Appendix L
Soil Management Plan
(On CD-ROM only)

Operation and Maintenance Manual

Volume 4

Soil Management Plan

Final (100%) Design Submittal for the Final Groundwater Remedy

PG&E Topock Compressor Station Needles, California

Prepared for

Pacific Gas & Electric Company

November 2015

CH2MHILL®
155 Grand Avenue
Suite 800
Oakland, CA 94612

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Acronyms and Abbreviations

AOC	Area of Concern
APE	Area of Potential Effects
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
BLM	U.S. Bureau of Land Management
BMP	Best Management Practice
BOR	U.S. Bureau of Reclamation
CCR	California Code of Regulations
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
DQO	Data Quality Objective
DOI	U.S. Department of the Interior
DOT	U.S. Department of Transportation
DTSC	California Department of Toxic Substances Control
EIR	environmental impact report
FMIT	Fort Mojave Indian Tribe
HAZWOPER	Hazardous Waste Operations and Emergency Response
HERO	California Department of Toxic Substances Control's Human and Ecological Risk Office
HSP	Health and Safety Plan
IM-3	Interim Measure No. 3
LDR	Land Disposal Restriction
mg/kg	milligrams per kilogram
O&M	operation and maintenance
OSHA	Occupational Health and Safety Administration
PAH	polycyclic aromatic hydrocarbon
PG&E	Pacific Gas and Electric Company
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RD/RA	Remedial Design/Remedial Action
RI	Remedial Investigation
SAP	Sampling and Analysis Plan

SMP	Soil Management Plan
STLC	soluble threshold limit concentration
SWMU	Solid Waste Management Unit
TC	toxicity characteristic
TCLP	toxicity characteristic leaching procedure
TTLC	total threshold limit concentration
UA	Undesignated Area
USEPA	United States Environmental Protection Agency
WET	Waste Extraction Test

SECTION 1

Introduction

Pacific Gas and Electric Company (PG&E) is implementing the selected groundwater remedy to address chromium contamination in groundwater at the Topock Compressor Station (Compressor Station) in San Bernardino County, Needles, California. In addition, after receipt of approval from the California Department of Toxic Substances Control (DTSC), with the U.S. Department of the Interior's (DOI's) concurrence, PG&E will decommission and remove the Interim Measure No. 3 (IM-3) Groundwater Extraction and Treatment System (referred to herein as the "IM-3 system"). The IM-3 Treatment Plant and MW-20 Bench Facility (a portion of which is part of the IM-3 system) areas have been identified as investigation areas (Areas of Concern [AOCs] 29 and AOC 30, respectively) in the concurrent Soil RCRA Facility Investigation/Remedial Investigation (RFI/RI) program.

The mitigation measure HAZ-2c set forth in the certified environmental impact report (EIR) (DTSC 2011) adopted by the DTSC for the groundwater remediation project requires that contaminated soil identified during ground disturbance activities be managed and disposed of in accordance with a project-specific Soil Management Plan (SMP) and Health and Safety Plan (HSP). If activities involve stockpiling of excavated hazardous soil, this would trigger the need for compliance with the California action-specific applicable or relevant and appropriate requirement (ARAR) #86: Waste piles for RCRA hazardous waste (22 CCR, Div 4.5, Ch. 14, Article 12) (DOI 2010), which is addressed in this SMP.

At the final design stage of the groundwater remediation project, proposed remedy infrastructure (excluding future provisional wells) is within 20 feet of or overlaps with twenty-four Soil Investigation Areas that are undergoing investigations as part of the Soil RFI/RI (see Figure 1.0-1 located at the end of this section). As shown in Figure 1.0-1, the overlap between the groundwater remediation project and ongoing soil investigations (or areas within 20 feet of these investigation areas) occurs in the following areas:

- Soil Investigation Areas inside the Compressor Station:
  - SWMU 5 – Sludge Drying Beds
  - SWMU 6 – Chromium Reduction Tank
  - SWMU 9 – Transfer Sump
  - AOC 7 – Hazardous Materials Storage Area
  - AOC 8 – Paint Locker
  - AOC 13 – Unpaved Areas within the Compressor Station
  - AOC 17 – Onsite Septic System
  - AOC 18 – Combined Hazardous Waste Transference Pipelines
  - AOC 21 – Round Area by Sludge Drying Beds
  - AOC 22 – Unidentified Three-sided Structure
  - AOC 33 – Potential Former Burn Area near AOC 17
  - Unit 4.3 – Oil/Water Holding Tank
- Soil Investigation Areas outside Compressor Station:
  - SWMU 1 – Former Percolation Bed
  - AOC 1 – Area Around Former Percolation Bed
  - AOC 4 - Debris Ravine
  - AOC 9 – Southeast Fence Line (Outside Visitor Parking Area)
  - AOC 10 – East Ravine
  - AOC 11 – Topographic Low Areas
  - AOC 12 – Fill Areas
  - AOC 27 – MW-24 Bench
  - AOC 28 – Pipeline Drip Legs
  - AOC 30 – MW 20 Bench

- Perimeter Area outside of but adjacent to the Compressor Station fence line
- Storm Drain System

In compliance with the aforementioned EIR mitigation measure and action-specific ARAR, this SMP includes procedures and protocols for the management and disposal of potentially contaminated and contaminated soil displaced during drilling, construction, operation and maintenance (O&M) of the groundwater remedy, and the decommissioning and removal of the IM-3 system. Potentially contaminated and contaminated soil is expected to be limited to within and near the boundaries of the Soil RFI/RI Investigation Areas. This SMP is Volume 4 of the O&M Manual, which is Appendix L of the Basis of Design Report for the final design. The HSP for O&M activities is Volume 5 of the O&M Manual. The HSP for groundwater remedy construction activities was submitted as part of the Construction/Remedial Action Work Plan (CH2M HILL 2015). Details of the decommissioning and removal of the IM-3 system are submitted as part of the IM-3 Decommissioning, Removal, and Restoration Work Plan. Soil and material originating in or near Soil RFI/RI Investigation Areas (areas of known or suspected soil contamination) that is displaced as part of the groundwater remediation project will be handled and managed in accordance with this SMP and the HSPs for construction and O&M activities. Displaced soil and material originating outside areas of known or suspected contamination will be pre-characterized prior to remedy construction to identify areas potentially impacted by nearby current and former roadways (polycyclic aromatic hydrocarbons [PAHs] and lead). Displaced soil from areas outside of known or suspected contamination areas that is impacted with PAHs and lead will be handled and managed in accordance with this SMP and the HSPs for construction and O&M activities. Uncontaminated soil will be reused as backfill into the same trench or excavation area, if practicable. Uncontaminated soil that cannot be immediately used as backfill may be reused in other areas within the Area of Potential Effects (APE), or stockpiled for future reuse within the APE. The stockpiled uncontaminated soil will be managed following the Construction and Operations Best Management Practices (BMPs) Plan for Soil Storage that is summarized in Section 3.1.2 of this SMP, the Construction/Remedial Action Work Plan (CH2M HILL 2015), and the Groundwater Remedy O&M Storm Water Pollution Prevention Plan (also called the Industrial SWPPP) (Appendix E of Volume 1 of the O&M Manual).

In addition, handling and management of displaced soil and material from Soil RFI/RI Investigation Areas, and soil displaced as part of the decommissioning and removal of the IM-3 system will be performed in accordance with this SMP and the IM-3 Decommissioning, Removal, and Restoration Work Plan. Soil generated from Soil RFI/RI work activities will follow the protocols for handling of soil specified in the Revised Final Soil RFI/RI Work Plan (CH2M HILL 2013).

1.1 Soil Management Plan Purpose and Objectives

The purpose and objectives of this SMP are as follows:

1. Ensure that soil is handled in a manner that complies with ARARs and the EIR mitigation measures.
2. Ensure that displaced soil from in and near Soil RFI/RI Investigation Areas that are generated during drilling, construction, decommissioning, removal, and O&M activities is handled in a manner that is protective of human health (including construction workers) and the environment within the framework of appropriate federal, state, and local requirements, and consistent with United States Environmental Protection Agency (USEPA) guidance.
3. Maximize onsite reuse of soil that was displaced during drilling, construction, decommissioning, removal, and O&M activities, following guidelines and protocols of the *Revised Management Protocol for Handling and Disposition of Displaced Site Material, Topock Remediation Project, Needles, California* (PG&E 2015) presented in Appendix B.
4. Minimize offsite transportation and disposal of soil that was displaced during drilling, construction, decommissioning, removal, and O&M.
5. Collect data to help guide future decision-making regarding the disposition of displaced soil and material.

1.2 Site Description, Soil Investigation History, and Findings

The Compressor Station is located adjacent to the Colorado River in eastern San Bernardino County, California, approximately 12 miles southeast of Needles, California, south of Interstate 40 (I-40), in the north end of the Chemehuevi Mountains. The APE for the Topock site is contained within what the Fort Mojave Indian Tribe (FMIT) and other Native American Tribes have identified as a larger area of traditional and cultural importance. The Tribes believe that the environmental, cultural, and spiritual resources may not be physically perceptible. DTSC has concluded within the January 2011 certified EIR that the 779.2-acre project site "appears to qualify as a historic resource under CEQA [California Environmental Quality Act] as an area that is significant in the social and cultural annals of California," and the U.S. Bureau of Land Management (BLM) also has determined that a traditional cultural property or property of traditional religious and cultural significance that is eligible for listing on the National Register of Historic Places exists in the area of the Topock project within the current APE, consisting of 1,600 acres of surface area and a section of the Colorado River (DTSC 2011).

In recognition of this, all remedial activities at the Compressor Station are planned in such a way as to minimize impact to this area. Specifically, impacts to cultural resources will be minimized by implementing the mitigation measures required by the EIR. In addition, mitigation measures will be implemented in accordance with the Programmatic Agreement (PA), the Cultural and Historic Properties Management Plan (CHPMP), and the Cultural Impact Mitigation Program (CIMP), and in consultation with the Tribes. The work will be conducted in a manner that recognizes and respects these resources and the spiritual values of the area.

Since 1996, there have been multiple phases of investigation at the Topock site to collect data to evaluate the nature and extent of contamination at the Solid Waste Management Units (SWMUs), AOCs, and Undesignated Areas (UAs). Results from the RFI/RI at the site are being documented in three volumes:

- **RFI/RI Volume 1**. The *Revised Final RCRA Facility Investigation and Remedial Investigation Report, Volume 1 – Site Background and History* (CH2M HILL 2007a) was completed in August 2007 and was approved by DTSC and DOI. Volume 1 of the RFI/RI identifies the 20 SWMUs, AOCs, and other UAs at the Topock Compressor Station to be carried forward in the Final RFI/RI. An Addendum to the RFI/RI Volume 1 (CH2M HILL 2014) was submitted and approved in May 2014. This Addendum summarizes the history and available data for 15 new units identified since the completion of the RFI/RI Volume 1.
- **RFI/RI Volume 2.** The Revised *Final RCRA Facility Investigation/Remedial Investigation, Volume 2— Hydrogeologic Characterization and Results of Groundwater and Surface Water Investigation Report* (CH2M HILL 2009a) was completed in February 2009 and approved by DTSC and DOI. Volume 2 of the RFI/RI contains the hydrogeologic characterization and results of groundwater and surface water investigations to address historical releases to groundwater from wastewater discharged at Bat Cave Wash and injection well PGE-8 at the Topock Compressor Station. The purpose of the Volume 2 RFI/RI is to complete the RFI/RI requirements for groundwater impacts associated with the past discharge of wastewater from Bat Cave Wash (SMWU 1/ AOC 1) and injection well PGE-8 (SWMU 2). An Addendum to the RFI/RI Volume 2 (CH2M HILL 2009b) was submitted in June 2009. This Addendum included select data and information collected between October 2007 and September 2008, after the data cutoff period for RFI/RI Volume 2.
- **RFI/RI Volume 3.** RFI/RI Volume 3 will include final characterization data to complete the RFI/RI requirements for remaining Topock Compressor Station operations, including results of soils investigations and the current East Ravine (AOC 10) and Compressor Station groundwater investigation. Also included in Volume 3 will be new or additional SWMUs and AOCs that have been identified in the Addendum to the RFI/RI Volume 1.

PG&E will continue to document and notify the Agencies of any new units discovered in the future. The SWMUs, AOCs, UAs, and other investigation areas still being characterized in support of the RFI/RI Volume 3 are presented in Exhibit 1.2-1 and shown on Figure 1.0-1.

Two draft work plans were initially prepared to describe collection of additional soil data to complete site characterization activities at the SWMUs, AOCs, and UAs identified in the Revised Final RFI/RI Volume 1 in support of RFI/RI Volume 3 preparation. Investigation areas outside the compressor station fence line were addressed in

the *Draft RCRA Facility Investigation/Remedial Investigation Soil Investigation Work Plan Part A, PG&E Topock Compressor Station, Needles, California* (Draft Soil Part A Work Plan) (CH2M HILL 2006). Investigation areas within the compressor station fence line were addressed in the *Draft RCRA Facility Investigation/Remedial Investigation Soil Investigation Work Plan Part B, PG&E Topock Compressor Station, Needles, California* (Draft Part B Work Plan) (CH2M HILL 2007b).

EXHIBIT 1.2-1
Soil RCRA Facility Investigation/Remedial Investigation Solid Waste Management Units, Areas of Concern, and Undesignated Areas
Groundwater Remedy Operation and Maintenance Manual
Volume 4: Soil Management Plan
PG&E Topock Compressor Station, Needles, California

Soil Investigation Areas		Overlaps or Is within 20 feet of Groundwater Remedy Infrastructure? (Y/N) — List type of infrastructure
Located Outside the Topock Compressor Station Fence Line		
SWMU 1	Former Percolation Bed	Yes - pipes
AOC 1	Area Around Former Percolation Bed	Yes – wells, pipes
AOC 4	Debris Ravine	Yes – pipes
AOC 9	Southeast Fence Line (Outside Visitor Parking Area)	Yes – pipes
AOC 10	East Ravine	Yes – pipes, wells
AOC 11	Topographic Low Areas	Yes – pipes, wells, building
AOC 12	Fill Area	Yes – pipe, wells
AOC 14	Railroad Debris Site	No
AOC 27	MW 24 Bench	Yes – well, pipe
AOC 28	Pipeline Drip legs	Yes – pipes, wells
AOC 29	IM-3 Treatment Plant	No
AOC 30	MW 20 Bench	Yes – pipes, wells, building, tanks
AOC 31	Former Teapot Dome Oil Pit	No
UA 1	Potential Pipe Disposal Area	No
UA 2	Former 300B Pipeline Liquids Tank	No
Located Inside the Topock Compressor Station Fence Line		
SWMU 5	Sludge-Drying Beds	Yes - pipes
SWMU 6	Chromate Reduction Tank	Yes - pipes
SWMU 8	Process Pump Tank	No
SWMU 9	Transfer Sump	Yes - pipes
SWMU 11	Former Sulfuric Acid Tanks	No
AOC 5	Cooling Tower A	No
AOC 6	Cooling Tower B	No
AOC 7	Hazardous Materials Storage Area	Yes – pipes, tanks
AOC 8	Paint Locker	Yes – pipes, tanks
AOC 13	Unpaved Areas within the Compressor Station	Yes – pipes, wells, buildings
AOC 15	Auxiliary Jacket Water Cooling Pumps	No
AOC 16	Sandblast Shelter	No
AOC 17	Onsite Septic System	Yes – pipes
AOC 18	Combined Hazardous Waste Transference Pipelines	Yes – pipes
AOC 19	Former Cooling Liquid Mixing Area and Former Hotwell	No
AOC 20	Industrial Floor Drains	No
AOC 21	Round Depression near Sludge Drying Bed	Yes - pipes

EXHIBIT 1.2-1
Soil RCRA Facility Investigation/Remedial Investigation Solid Waste Management Units, Areas of Concern, and Undesignated Areas
Groundwater Remedy Operation and Maintenance Manual
Volume 4: Soil Management Plan
PG&E Topock Compressor Station, Needles, California

Soil Investigation Areas		Overlaps or Is within 20 feet of Groundwater Remedy Infrastructure? (Y/N) — List type of infrastructure
AOC 22	Unidentified Three-sided Structure	Yes – pipes
AOC 23	Former Water Conditioning Building	No
AOC 24	Stained Area and Former American Petroleum Institute Oil/Water Separator	No
AOC 25	Compressor and Generator Engine Basements	No
AOC 26	Former Scrubber Oil Sump	No
AOC 32	Oil Storage Tanks and Waste Oil Sump	No
AOC 33	Potential Former Burn Area near AOC 17	Yes – pipes
Unit 4.3	Oil/Water Holding Tank	Yes - pipes
Unit 4.4	Oil Water Separator	No
Unit 4.5	Portable Waste Oil Storage Tank	No
Perimeter Area		Yes – pipes, wells
Storm Drain System		Yes – pipes

Subsequent to submitting the two draft work plans, the Part A and Part B work plans were combined into a single work plan: *Draft Soil RFI/RI Work Plan, PG&E Topock Compressor Station, Needles, California* (CH2M HILL 2011a). The Draft Soil RFI/RI Work Plan contains the Part A and B Data Quality Objectives (DQOs) process, data gaps analysis for each SWMU/AOC, and the proposed sampling plan for the next phase of investigation.

A Revised Final Soil RFI/RI Work Plan was prepared to incorporate comments received from Agencies and stakeholders on the Draft Work Plan, and was submitted to Agencies on January 14, 2013 (CH2M HILL 2013) for final review and approval. The Revised Final Soil RFI/RI Work Plan was approved by DTSC and DOI on August 24, 2015.

1.2.1 Soil Investigation History and Findings Outside the Compressor Station Fence Line

Ten investigation areas located outside of the Compressor Station fence line, one new investigation area (AOC 28 – Pipeline Drip Legs), Perimeter Area, and Storm Drains System located outside of the Compressor Station fence line require further investigation in order to satisfy the Part A DQOs. These investigation areas are:

- SWMU 1 – Former Percolation Bed
- AOC 1 – Area Around Former Percolation Bed
- AOC 4 – Debris Ravine
- AOC 9 – Southeast Fence Line (Outside Visitor Parking Area)
- AOC 10 – East Ravine
- AOC 11 – Topographic Low Areas, including the two new areas
- AOC 14 – Railroad Debris Area
- AOC 28 – Pipeline Drip Legs
- AOC 27 – MW-24 Bench Area
- UA-1 – Potential Pipeline Disposal Area
- AOC 31 – Former Teapot Dome Oil Pit
- Perimeter Area
- Storm Drains System

The proposed sampling plan for these units is described in the Revised Final Soil RFI/RI Work Plan (CH2M HILL 2013). Table 1.2-1 (tables are presented at the end of each section) provides a summary of historical activities at the Part A investigation areas, a list of constituents that exceeded interim screening levels, and the proposed analytical suites.

1.2.2 Soil Investigation History and Findings Inside the Compressor Station Fence Line

Twenty-four investigation areas located inside the compressor station fence line require further investigation in order to satisfy the Part B DQOs. These investigation areas are:

- SWMU 5 – Sludge-drying Beds
- SWMU 6 – Chromate Reduction Tank
- SWMU 8 – Process Pump Tank
- SWMU 9 – Transfer Sump
- SWMU 11 – Former Sulfuric Acid Tanks
- AOC 5 – Cooling Tower A
- AOC 6 – Cooling Tower B
- AOC 7– Hazardous Materials Storage Area
- AOC 8 – Paint Locker
- AOC 13 – Unpaved Areas within the Compressor Station
- AOC 15 – Auxiliary Jacket Cooling Water Pumps
- AOC 16 – Sandblast Shelter
- AOC 17 – Onsite Septic System
- AOC 18 – Combined Wastewater Transference Pipelines
- AOC 19 – Former Cooling Liquid Mixing Area and Former Hotwell
- AOC 20 – Industrial Floor Drains
- AOC 21 – Round Depression near Sludge Drying Bed
- AOC 22 – Three-sided Structure
- AOC 23 – Former Water Conditioning Building
- AOC 24 – Stained Area and Former American Petroleum Institute Oil/Water Separator
- AOC 26 – Former Scrubber Sump
- AOC 33 – Potential Former Burn Area Near AOC 17
- Unit 4.3 – Oily Water Holding Tank
- Unit 4.4 – Oil/Water Separator
- Unit 4.5 – Portable Waste Oil Holding Tank

The proposed sampling plan for these units was described in the Revised Final Soil RFI/RI Work Plan (CH2M HILL 2013). Table 1.2-2 provides a summary of historical activities at the Part B investigation areas, a list of constituents that exceeded interim screening levels, and the proposed analytical suites.

1.3 Report Organization

This SMP is organized into the following sections:

- Section 1.0 contains background information, objectives, a summary of the previous investigations conducted at the site, and a list of Soil RFI/RI Investigation Areas within 20 feet of or overlapping groundwater remedy infrastructure.
- Section 2.0 presents details related to soil management activities including identifying areas of potential/ known contamination in the vicinity of the groundwater remedy system and IM-3 system, and the process for soil characterization, soil screening and classification, handling, and storage of soil at the site.
- Section 3.0 describes storage methods, labeling requirements and inspection of soil storage areas.

- Section 4.0 summarizes the employee training required for waste soil management, hazardous waste profiling, transportation, and disposal of the various waste streams.
- Section 5.0 summarizes the records and documents that should be maintained at the site.
- Section 6.0 presents the process for updating the SMP.
- Section 7.0 presents a list of references used in the preparation of this SMP.

TABLE 1.2-1
Historical Activities Summary, Constituents Exceeding Interim Screening Levels for Soil RFI/RI Units Outside the Fence Line, Perimeter Area, and Storm Drains, and Associated Analytical Suites
Groundwater Remedy Operation and Maintenance Manual
Volume 4: Soil Management Plan
PG&E Topock Compressor Station, Needles, California

Units	Summary of Historical Activities	Constituents Exceeding Interim Screening Levels	Analytical Suites[1]	Overlaps or Is within 20 feet of Groundwater Remedy Infrastructure?
SWMU 1	SWMU 1 is located outside the facility fence line in the bed of Bat Cave Wash. During the 1950s, the facility discharged wastewater containing chromium (cooling tower blowdown) wastewater into Bat Cave Wash without any impoundment. From about 1964 to approximately 1971, the facility discharged wastewater containing chromium to a percolation bed and allowed water to percolate into the ground and/or evaporate. The chromium-containing wastewater was combined with a small quantity (approximately 5 percent) of treated water from the oily waste treatment system discharged from the station.	As, Ba, Ca, Total Cr, Cr^{+6}, Co, Cu, Pb, Mn, Mo, Ni, K, Se, V, Zn, Ca, Mg, Mn, K	Title 22 metals, hexavalent chromium, VOCs. SVOCs, PAHs, TPH, pH, pesticides, PCBs[2]	Yes
AOC 1	AOC 1 is located in the area surrounding SWMU 1, outside the fence line within Bat Cave Wash. This area comprises property owned by PG&E, Havasu National Wildlife Refuge, and the Bureau of Reclamation. As discussed for SWMU 1, the facility discharged wastewater containing chromium into the Bat Cave Wash until approximately 1964.	As, Ba, Total Cr, Cr^{+6}, Cu, Pb, Mo, Ni, Zn, Mn, Benzo (a) anthracene; Benzo (a) pyrene; Benzo (b) fluoranthene; PAH High Molecular weight; B(a)P Equivalent; Aroclor 1254; Total PCBs	Title 22 metals, hexavalent chromium, VOCs. SVOCs, PAHs, TPH, pH, pesticides, PCBs[2], dioxins and furans	Yes
AOC 4	AOC 4 is located south of the fence line, and is a narrow, steep ravine that drains into the Bat Cave Wash. This area comprises property owned by PG&E and the Havasu National Wildlife Refuge. Operation of the area is not well known, but trash burning has been identified on site. In 2009, a Removal Action and erosion control were conducted.	An, Ba, Cd, Total Cr, Cr^{+6}, Co, Cu, Pb, Hg, Ni, V, Zn, Benzo (a) anthracene; Benzo (a) pyrene; Benzo (b) fluoranthene; Benzo (k) fluoranthene; Indeno (1,2,3-cd) pyrene; PAH High Molecular weight; B(a)P Equivalent; Aroclor 1254; Aroclor 1260, Total PCBs	Title 22 metals, hexavalent chromium, VOCs, SVOCs, PAHs, TPH, pH, pesticides, PCBs, dioxins and furans	Yes
AOC 9	AOC 9 is located outside the fence line on the east side, south of the visitor parking lot on a steep slope. In 2000, a broken stormwater drainage pipe and stained soil were found in the area. The staining most likely originated from leaks near the Auxiliary Building. The stained soil was excavated, a new stormwater drainage pipe was installed, and the area was backfilled with 1 – 2 feet of clean soil. The exact location of the former storm drain line is uncertain, and the footprint of AOC 9 is sufficiently large to address both potential locations.	Total Cr, Cr^{+6}, Cu, Pb, Hg, Mo, Ni, Tl, Zn, Benzo (a) pyrene; B(a)P Equivalent; 4,4-DDE	Title 22 metals, hexavalent chromium, VOCs, SVOCs, PAHs, TPH, pH, asbestos, pesticides, PCBs	Yes

TABLE 1.2-1
Historical Activities Summary, Constituents Exceeding Interim Screening Levels for Soil RFI/RI Units Outside the Fence Line, Perimeter Area, and Storm Drains, and Associated Analytical Suites
Groundwater Remedy Operation and Maintenance Manual
Volume 4: Soil Management Plan
PG&E Topock Compressor Station, Needles, California

Units	Summary of Historical Activities	Constituents Exceeding Interim Screening Levels	Analytical Suites[1]	Overlaps or Is within 20 feet of Groundwater Remedy Infrastructure?
AOC 10	AOC 10 is the east ravine located on the southeast side, outside of the fence line. This AOC comprises property owned by PG&E and the Havasu National Wildlife Refuge. The ravine is bisected by three constructed berms built between 1916 and the 1950s. AOC 10 receives run-off from the eastern portion of the upper yard of the compressor station, and the station access road.	As, Ba, Total Cr, Cr^{+6}, Co, Cu, Pb, Mo, Ni, Se, V, Zn, Benzo (a) anthracene; Benzo (a) pyrene; Benzo (b) fluoranthene; Benzo (k) fluoranthene; Indeno (1,2,3-cd) pyrene; PAH High Molecular weight; B(a)P Equivalent	Title 22 metals, hexavalent chromium, VOCs, SVOCs, PAHs, TPH, general chemistry parameters, pesticides, PCBs, dioxins and furans (if burn material present)	Yes
AOC 11	AOC 11 consists of the topographic low areas on the northeast side of the Topock Compressor Station. AOC 11 is located on PG&E and Havasu National Wildlife Refuge property. Multiple storm drains may be discharging to this area, or have discharged to this area in the past. AOC 11 also includes the topographic low area north of the plant access road near the Old Route 66 sign. This area receives run-off from the station access road.	As, Ba, Total Cr, Cr^{+6}, Cu, Pb, Mo, Se, Zn, Al, Mn, K, Benzo (a) anthracene; Benzo (a) pyrene; Benzo (b) fluoranthene; Benzo (k) fluoranthene; PAH High Molecular weight; B(a)P Equivalent; Aroclor 1260; Total PCBs; 4,4-DDE; Dieldrin	Title 22 metals, hexavalent chromium, VOCs, SVOCs, PAHs, TPH, pH, PCBs, pesticides	Yes
AOC 12	AOC 12, known as the Fill Area, included three areas located near the Transwestern gas pipeline meter station, east of the compressor station. Portions of AOC 12 are located on PG&E and Havasu National Wildlife Refuge property. These areas were identified as locations that may contain buried construction-related debris, but no debris was found in the identified areas during the Soil Part A Phase investigation.	Co, Cu, Se, Zn, Di-N-butyl phthalate; Benzo (a) pyrene; B(a)P Equivalent	Title 22 metals, hexavalent chromium, VOCs, SVOCs, PAHs, TPH, pH, asbestos, pesticides, PCBs	Yes
AOC 14	AOC 14, the Railroad Debris Site, is located immediately north of I-40. It is bounded by Santa Fe railroad tracks to the north. The area sits approximately 100 feet above the bottom of the Bat Cave Wash. Aerial photos dated from 1947 to 1955 depicted materials and debris scattered in this area, and water softening (lime) sludge is also believed to have been disposed of in this area. An asbestos removal action was completed in 1999, and sampling detected no remaining asbestos. Field observations identified scattered debris and a potential burn layer (visible in the I-40 road cut) in this area.	Total Cr, Cr^{+6}, Cu, Pb, Hg, Mo, Se, Zn, Benzo (a) pyrene; PAH High Molecular weight; B(a)P Equivalent; 4,4-DDE; 4,4-DDT	Title 22 metals, hexavalent chromium, VOCs, SVOCs, PAHs, TPH, pH, asbestos, pesticides, PCBs, dioxins and furans (if burn material present)	No

TABLE 1.2-1
Historical Activities Summary, Constituents Exceeding Interim Screening Levels for Soil RFI/RI Units Outside the Fence Line, Perimeter Area, and Storm Drains, and Associated Analytical Suites
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Units	Summary of Historical Activities	Constituents Exceeding Interim Screening Levels	Analytical Suites[1]	Overlaps or Is within 20 feet of Groundwater Remedy Infrastructure?
AOC 27	AOC 27, known as the MW-24 Bench, is located north of the upper yard of the compressor station and south of I-40. During employee interviews conducted by PG&E, a former PG&E Topock Compressor Station employee indicated this area was also used as a potential waste disposal area. In January 2008, during trenching activities in the MW-24 bench area associated with installation of a control panel related to the upland *in-situ* pilot test, debris consisting mostly of treated wood, concrete, and scrap steel/tin (including a possible fragment of a storage tank) were encountered.	No data have been collected in this area.	Title 22 metals, hexavalent chromium, pesticides, PAHs, VOCs, SVOCs, PCBs, TPH, pH, dioxins and furans (if burn material present)	Yes
AOC 28	AOC 28, the Pipeline Drip Legs, consists of three drip legs associated with the 300A and 300B pipelines are located to the east of the compressor station and a drip leg for the 300B pipeline downstream of the compressor station in Bat Cave Wash. A drip leg collects pipeline liquids by gravity. It is connected to a valve used to drain the pipeline liquids to a fixed or portable tank.	No data have been collected in this area.	TPH, PAHs, and PCBs	Yes
AOC 29	AOC 29, the Interim Measure-3 Treatment Plant, is located north of Interstate-40. The Interim Measure-3 provides hydraulic control of the plume boundaries near the Colorado River to maintain a landward gradient. This facility was established and is operated under modern waste management laws, and will be closed pursuant to a decommissioning plan. Investigation of this AOC has been postponed until the plant is closed.	No data have been collected in this area.	Title 22 metals, hexavalent chromium, sodium, chloride	No
AOC 30	AOC 30, the MW 20 Bench, is located between the National Trails Highway and the Colorado River. This area is part of the floodplain reductive zone in-situ pilot test. This facility was established and is operated under modern waste management laws and will be closed in accordance with agency requirements; therefore, investigation of this AOC is postponed until this unit is closed.	No data have been collected in this area.	Title 22 metals, hexavalent chromium, sodium, chloride	Yes

TABLE 1.2-1
Historical Activities Summary, Constituents Exceeding Interim Screening Levels for Soil RFI/RI Units Outside the Fence Line, Perimeter Area, and Storm Drains, and Associated Analytical Suites
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Units	Summary of Historical Activities	Constituents Exceeding Interim Screening Levels	Analytical Suites[1]	Overlaps or Is within 20 feet of Groundwater Remedy Infrastructure?
AOC 31	AOC 31, the Teapot Dome oil pit, is located on the northeast side of the facility, just outside the compressor station fence line. It is located within and overlaps with the Perimeter Area investigation. Former employees indicated that they had been told that the Teapot Dome restaurant provided oil changes, and that oil from vehicles was dumped into a pit. Potential wastes in this area pre-date the construction of the compressor station.	No data have been collected in this area.	Title 22 metals, hexavalent chromium, TPH, SVOCs, PAHs, and PCBs	No
UA 1	UA 1 is located north of the gas pipeline road near the former evaporation ponds. During site investigations, a former employee identified this area as a possible burial for asbestos-covered metal pipes. In 2008, a geophysical survey did not reveal any presence of the buried pipes, only small metallic anomalies found underground. This area will be investigated further, but no historical data have been documented. UA-1 is located within an especially culturally sensitive area, and the Tribes have expressed their desire to avoid or greatly limit any further activity in this area.	No data have been collected in this area.	Asbestos	No
UA 2	UA 2, the former 300B Pipeline Drip Tank, is located southeast of the plant on a shelf in the hill next to old Route 66. In 1994, investigation found oil-stained soil in a small area underneath and adjacent to this tank. In 1996 the tank was removed, and a cleanup was implemented. Soil was excavated to a depth of 5.5 ft. No further characterization is recommended in this area.	As, Ba, Pb, Zn	Title 22 metals, hexavalent chromium, VOCs, SVOCs, PAHs, TPH, pH, pesticides, PCBs	No
Perimeter Area[3]	The Perimeter Area is the area extending from the facility fence line to the toe of the slope. The majority of the Perimeter Area is lower than the station, and these topographically lower areas could have received runoff and incidental spills from the station. The Perimeter Area excludes those portions of the slope that are already part of a designated unit (i.e., portions of SWMU 1, AOC 9, AOC 10, and AOC 11). There has been no previous investigations or sampling in this area.	No data have been collected in this area.	Title 22 metals, hexavalent chromium, TPH, SVOCs, PAHs, and PCBs	Yes

TABLE 1.2-1
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Units	Summary of Historical Activities	Constituents Exceeding Interim Screening Levels	Analytical Suites[1]	Overlaps or Is within 20 feet of Groundwater Remedy Infrastructure?
Storm Drains[3]	Fifteen storm drain outfalls have been visually identified outside the fence line, but little information is known regarding the exact locations of historic lines and drainage to these lines. Contaminants discharged to catch basins within the compressor station would most likely have entered the storm drains and been transported to the outfalls.	No data have been collected in this area.	Title 22 metals, hexavalent chromium, TPH, PAHs, and PCBs	Yes

Notes:

[1] Analytical suites as presented in the Revised Final Soil RFI/RI Work Plan (CH2M HILL 2013).

[2] PCB analysis only on soil collected between 0 and 2 feet below ground surface.

[3] The Perimeter Area and Storm Drains are being investigated separately from the areas outside (Part A) and within (Part B) the fence line; once the data from the Perimeter Area and Storm Drains investigations have been collected, they will be combined with the appropriate existing Part A or B unit(s) or identified as a hotspot if there is no apparent connection to an existing unit.

Metals: Antimony (An); Arsenic (As); Barium (Ba); Beryllium (Be), Cadmium (Cd); Hexavalent Chromium (Cr^{+6}); Total Chromium (Total Cr); Cobalt (Co); Copper (Cu); Lead (Pb); Mercury (Hg); Molybdenum (Mo); Nickel (Ni); Selenium (Se); Silver (Hg); Thallium (Tl); Vanadium (V); Zinc (Zn)

Inorganics: Aluminum (Al); Calcium (Ca); Iron (Fe); Magnesium (Mg); Manganese (Mn); Potassium (K); Sodium (Na); Cyanide (CN)

Semivolatile Organic Compounds (SVOCs): 4-Methylphenol; Bis (2-ethylhexyl) phthalate; Di-N-butyl phthalate

Volatile Organic Compounds (VOCs): Methyl acetate

Polycyclic Aromatic Hydrocarbons (PAHs): 1-Methyl naphthalene; 2-Methyl naphthalene; Acenaphthene, Anthracene; Benzo (a) anthracene; Benzo (a) pyrene; Benzo (b) fluoranthene; Benzo (ghi) perylene; Benzo (k) fluoranthene; Chrysene; Dibenzo (a,h) anthracene; Fluoranthene; Fluorene; Indeno (1,2,3-cd) pyrene, Naphthalene; Phenanthrene; Pyrene, PAH Low molecular weight; PAH High Molecular weight; B(a)P Equivalent

Polychlorinated biphenyls (PCBs): Aroclor-1016; Aroclor-1254; Aroclor-1260; Total PCBs

Pesticides: 1,1-dichloro-2.2-bis[p-chlorophenyl] ethylene (4,4-DDE); 1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane (4,4-DDT)

Total Petroleum Hydrocarbons (TPH): TPH as diesel; TPH as motor oil

TABLE 1.2-2
Historical Area Summary and Constituents Exceeding Background Threshold Value for Soil RFI/RI Units Inside the Fence Line and Associated Analytical Suites
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Units	Summary of Historical Activities	Constituents Exceeding Background Threshold Value	Analytical Suites[1]	Overlaps or Is within 20 feet of Groundwater Remedy Infrastructure?
SWMU 5	SWMU 5 is located inside the fence line and comprises the two former sludge-drying beds. Both of these beds were approximately 20 feet wide by 50 feet long. Bed 1, constructed in the early 1950s, was used to dehydrate lime sludge generated by the water softening process. From 1964 through 1969, it was used to treat chromium-bearing wastewater in the single-step chromate reduction process. A second bed was constructed in the late 1960s, and from 1969 through 1985, the two drying beds were used to dehydrate chromic hydroxide sludge. Use of these beds ceased in 1985. Closure of the drying beds was accomplished during Phase I of the Hazardous Waste Treatment System Closure, between 1988 and 1989.	Total Cr, Pb, Zn	Title 22 metals, hexavalent chromium, VOCs, TPH, SVOCs, and PAHs	Yes
SWMU 6	SWMU 6 was the chromate reduction tank located in the southern end of the lower yard. The tank was part of the two-step waste water treatment system installed in 1969 and was in operation through 1985. The tank was approximately 10 feet high and 5 feet in diameter, with a capacity of 1,500 gallons. Closure of this system was completed during Phase I Hazardous Waste Treatment System Closure.	Total Cr, Cr^{+6}, Zn	Title 22 metals, hexavalent chromium, VOCs, TPH, SVOCs, and PAHs	Yes
SWMU 8	SWMU 8 was located on the southern end of the lower yard in an area that is now covered by the new Fire Pump Building. SWMU 8 was the process pump tank that was part of the two-step waste water treatment system. The tank was approximately 8 feet high and 5.5 feet in diameter. The pump tank was used as a temporary holding tank for treated wastewater discharged from the precipitation tank, before it was pumped to the former percolation bed. In 1985, this unit was removed from service and closure was accomplished during Phase I.	Co, Cu, Ni	Title 22 metals, hexavalent chromium, VOCs, TPH, SVOCs, and PAHs	No
SWMU 9	SWMU 9, located in the southwestern portion of the lower yard, was the transfer sump that was part of a two-step wastewater treatment system. The sump was a pre-fabricated concrete septic tank that had the capacity of 1,500 gallons. The sump was 3 feet in diameter and 20 feet deep. From 1969 through 1985 effluent from the chromate reduction tank was routed through SWMU 9. In 1989, the transfer sump was removed during Phase 2 of the Hazardous Waste Treatment System Closure.	Be	Title 22 metals, hexavalent chromium, VOCs, TPH, SVOCs, and PAHs	Yes
SWMU 11	SWMU 11 consists of two 400-gallon sulfuric acid tanks, located in the cooling tower A (AOC 5) and cooling Tower B (AOC 6). These tanks were used to control pH to minimize scale, corrosion, and biological growth. The 1950s through 1984, sulfuric acid was delivered to the facility in drums and pumped directly into the basins. To date, no data have been collected to evaluate any potential concerns related to sulfuric acid tanks.	No data have been collected in this area.	Title 22 metals, hexavalent chromium, and pH	No

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Units	Summary of Historical Activities	Constituents Exceeding Background Threshold Value	Analytical Suites[1]	Overlaps or Is within 20 feet of Groundwater Remedy Infrastructure?
AOC 5	AOC 5 is the area surrounding original Cooling Tower A, and encompasses the cooling tower, former chemical shed, and SWMU 11. Most of the area is covered with gravel, but pavement bounds the surrounding area. From 1951 to 1985 chromium-based corrosion inhibitors were used to treat the cooling water, and stored within the chemical shed. Stained soils were observed within the shed during demolition of the shed in 2000. The stained soils were excavated.	Cr^{+6}, total Cr, Cu, Zn	Title 22 metals, hexavalent chromium, and pH	No
AOC 6	AOC 6 is the entire area surrounding Cooling Tower B, and encompasses the cooling tower, former chemical shed, and SWMU 11. Most of the area is covered with gravel, but pavement bounds the surrounding area. From 1951 to 1985 chromium-based corrosion inhibitors were used to treat the cooling water, and stored within the chemical shed. Stained soils were observed within the shed during demolition of the shed in 2000. The stained soils were excavated.	Cr^{+6}, total Cr, Cu, Ni, Zn	Title 22 metals, hexavalent chromium, and pH	No
AOC 7	AOC 7 consists of the hazardous materials storage area and loading dock, and the adjacent Carpenter Shop (former Chemical Storage Building). The current hazardous material storage area has been used since the mid-1980s to store chemical products used at the station. The former Chemical Storage Building was constructed in 1951 as part of the original station configuration.	No data have been collected in this area.	Title 22 metals, hexavalent chromium, VOCs, SVOCs, PAHs, PCBs, TPH, and pH	Yes
AOC 8	AOC 8 consists of a small storage locker used for paint storage. The locker is 5 feet wide by 5 feet long and is set back into southern retaining wall at the Compressor Station. The paint locker is constructed of steel with tight fitting doors, and located on pavement. No evidence of release is present.	No data have been collected in this area.	Title 22 metals, VOCs and TPH	Yes
AOC 13	AOC 13 consists of the current and former unpaved areas within the fence line. Many of the former unpaved areas are now paved and covered by buildings. Spills that have occurred at the facility and may have affected unpaved areas.	Be, Cd, Cr+6, Total Cr, Co, Cu, Pb, Mo, Ni, Se, Zn	Title 22 metals, hexavalent chromium, VOCs, TPH, SVOCs, PAHs, PCBs, and asbestos	Yes
AOC 15	AOC 15 consist of the auxiliary jacket cooling water pumps located north of the Auxiliary Building. AOC 15 is part of the closed-loop cooling system for the generator engines. From 1951 through 1985, chromium-based cooling water additives were used in the closed loop cooling systems. Leaks from valve seals and pumps may have affected the soil at AOC 15.	Cr^{+6}, total Cr, Cu, Pb, Mo, Ni, Zn	Title 22 metals, hexavalent chromium, and pH	No

TABLE 1.2-2
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Units	Summary of Historical Activities	Constituents Exceeding Background Threshold Value	Analytical Suites[1]	Overlaps or Is within 20 feet of Groundwater Remedy Infrastructure?
AOC 16	AOC 16 is the sand blast shelter located in the lower yard. The sandblast shelter was installed in the early 1990s, and used primarily for smaller items (fixed infrastructure and large items are typically sandblasted in place).	No data have been collected in this area.	Title 22 metals	No
AOC 17	AOC 17 is the onsite septic system that serves the Auxiliary Building and nearby buildings. It consists of the septic located northeast of the air dryer building, and the associated leachfield. Wastewater from the facility laboratory of the Auxiliary Building is routed to the septic system. According to informal station drawings, the leachfield consists of 3 100-foot-long lines spaced 6 feet apart. The onsite septic system is believed to have been installed as part of the original compressor station facilities.	No data have been collected in this area.	Title 22 metals, hexavalent chromium, VOCs, TPH, SVOCs, and PAHs	Yes
AOC 18	AOC 18 consists of the hazardous waste transference pipelines associated with the hazardous waste treatment system, as well as the pipelines conveying the cooling tower blowdown to the lower yard. In the 1980s, the pipelines were uncovered, pressure tested, and removed in accordance with the hazardous waste treatment system closure plan. Visually contaminated soil was removed, confirmation sampling was conducted, and supplemental soil excavation was conducted where needed. Not all sections of the piping could be removed, and active sections were not pressure tested.	Be, Cr^{+6}, Total Cr, Pb, Mo, Ni, Zn	Title 22 metals, hexavalent chromium, pH, VOCs, TPH, SVOCs, and PAHs	Yes
AOC 19	AOC 19 is the Former Cooling Liquid Mixing and Jacket Cooling Water Hot Well Area located east of the Compressor Building. Employee interviews indicated that the hot well periodically overflowed. The hotwell was replaced with surge tanks circa 1967. Remnants of the hotwell were discovered and removed during a construction project in the 1990s. The former cooling liquid mixing area consists of a small concrete pad. Green droplets were noticed on the concrete pad during a routine test of a nearby eyewash fountain/safety shower in 2006. Elevated level of chromium were found in the green water.	Cd, Cr^{+6}, total Cr, Cu, Pb, Mo, Se, Zn	Title 22 metals, hexavalent chromium, and pH	No
AOC 20	AOC 20 consists of the industrial floor drains within the compressor station building and other buildings within the upper yard, as well as the associated pipelines, and the pipelines conveying the drainage to the oily water holding tank in the lower yard. Historically, the pipes associate with AOC 20 were made from vitrified clay.	No data have been collected in this area.	Title 22 metals, hexavalent chromium, VOCs, TPH, PCBs, and PAHs	No

TABLE 1.2-2
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Units	Summary of Historical Activities	Constituents Exceeding Background Threshold Value	Analytical Suites[1]	Overlaps or Is within 20 feet of Groundwater Remedy Infrastructure?
AOC 21	AOC 21 is a former round structure found adjacent to Sludge Drying Bed No. 1. This round structure was filled with white material that was most likely water softener (lime) sludge. The material appears to be similar to the material found in Sludge Drying Bed No. 1. No information is available on the construction of this area, although it appears to be of earthen materials.	No data have been collected in this area.	Title 22 metals, hexavalent chromium, calcium, sodium, and pH	Yes
AOC 22	AOC 22 consists of a three-sided structure located in the upper yard, along the present compressor station fence line. A 1955 aerial photo appears to depict a drum that was near the structure. No further information about this structure is available.	No data have been collected in this area.	Title 22 metals, hexavalent chromium, pH, VOCs, TPH, SVOCs, PCBs, and PAHs	Yes
AOC 23	AOC 23 is the former water conditioning (water softening) building located in the southern part of the upper yard. Currently AOC 23 is used for storage of dry non-hazardous materials. Chemical feed tanks for the water softening process were located inside the building, and the precipitator for the water softening system was located outside the building.	No data have been collected in this area.	Title 22 metals, hexavalent chromium, VOCs, TPH, SVOCs, PAHs, PCBs, and pH	No
AOC 24	AOC 24 consists of the stained area near the API oil/water separator formerly located northeast of the northern scrubbers, as well as the footprint of the separator. The staining is apparent in 1955 aerial photographs and some plant photographs. The separator was later moved and reused as part of the old oily water treatment system adjacent to Sludge Drying Bed No. 1.	No data have been collected in this area.	Title 22 metals, hexavalent chromium, VOCs, TPH, SVOCs, PAHs, PCBs, and pH	No
AOC 25	AOC 25 consists of the compressor and generator engine basements. There are 10 compressor engines, 9 of which are still active, and four generators engines. Each of the engines is mounted on a concrete pedestal on a concrete foundation. The pedestal is surrounded by a concrete trench. The trench around the pedestal is known as the basement. Drips and leaks from the engines would discharge into the drains in the basements, and enter AOC 20. Surface and shallow subsurface site investigation and soil removal have been conducted in areas immediately adjacent to the auxiliary and compressor buildings.	No data have been collected in this area.	Title 22 metals, hexavalent chromium, VOCs, TPH, SVOCs, PAHs, PCBs, and asbestos	No

TABLE 1.2-2
Historical Area Summary and Constituents Exceeding Background Threshold Value for Soil RFI/RI Units Inside the Fence Line and Associated Analytical Suites
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Units	Summary of Historical Activities	Constituents Exceeding Background Threshold Value	Analytical Suites[1]	Overlaps or Is within 20 feet of Groundwater Remedy Infrastructure?
AOC 26	AOC 26 is the location of the former scrubber oil sump located in the lower yard south of the South Scrubbers. The sump received pipeline liquids of the natural gas scrubbers, as well as oil from the oil bath filters until the filters were taken out of service in the 1960s. The scrubber sump was removed in 1996 as part of an upgrade to the waste oil system. The area was investigated and contaminated soil was removed to the degree feasible (excavation was limited by the presence of infrastructure). Residual contamination is present below the maximum excavation depth (approximately 10 feet).	No data have been collected in this area.	Title 22 metals, hexavalent chromium, VOCs, TPH, SVOCs, PAHs, PCBs, and pH	No
AOC 32	AOC 32 is the oil storage area in the upper yard immediately west of the visitor parking lot. AOC 32 contains five 7,150-gallon capacity oil storage tanks, the steel-lined waste oil sump, and two 150-gallon capacity lubricating oil surge tanks. The tanks and oil sump are part of the original compressor station installation. The tanks and sump are located within a concrete containment structure. The sidewalls of the containment structure are apparent in a ca. 1956 station photograph; however, it is uncertain if the floor of the oil storage area has always been paved. Associated piping is also located within the containment. The containment structure appears to be in good repair; an inspection conducted in 1994 indicated that it was in good condition at the time. The dirty oil sump receives waste oil from the oil/water separator, and pipeline liquids collected from the scrubbers. It formerly received used oil from the scrubber sump.	No data have been collected in this area.	Title 22 metals, hexavalent chromium, VOCs, TPH, SVOCs, PAHs, and PCBs	No
AOC 33	AOC 33 is the potential burn area located near AOC 17. This area was identified when PG&E conducted additional interviews with current and former employees to collect new anecdotal information pertaining to historical compressor station practices. Several employees reported that PG&E may have conducted a yearly fire training exercise during which materials were set on fire and employees practiced extinguishing the fire. The employees indicated that these fire extinguishing drills took place in the early 1980s (and may have taken place prior to then) and continued into the 1990s.	No data have been collected in this area.	Title 22 metals, hexavalent chromium, VOCs, TPH, SVOCs, PAHs, PCBs, asbestos, and dioxin and furans	Yes
Unit 4.3	Unit 4.3 is the oil/water holding tank that was installed in 1970. It was a cylindrical steel tank 15 feet long by 5 feet in diameter that was used to collect oily water from the compressor floor drainage, engine and steam-cleaning operations, and other activities discharging to AOC 20.	None, sampled only for TPH.	Title 22 metals, hexavalent chromium, pH, VOCs, TPH, SVOCs, and PAHs	Yes

TABLE 1.2-2

Historical Area Summary and Constituents Exceeding Background Threshold Value for Soil RFI/RI Units Inside the Fence Line and Associated Analytical Suites

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Units	Summary of Historical Activities	Constituents Exceeding Background Threshold Value	Analytical Suites[1]	Overlaps or Is within 20 feet of Groundwater Remedy Infrastructure?
Unit 4.4	Unit 4.4 was the oil water separator located adjacent to Unit 4.3 (the API oil/water separator relocated from the area northeast of the north scrubbers. Unit 4.4 was equipped with an underflow weir to control discharge, and the floating oil was transferred by hose to a portable waste oil storage tank.	None, sampled only for TPH.	Title 22 metals, hexavalent chromium, pH, VOCs, TPH, SVOCs, and PAHs	No
Unit 4.5	Unit 4.5 was the portable waste oil storage tank adjacent to the Unit 4.3 and 4.4. Skimmed oil from Unit 4.4 was discharged into Unit 4.5. The portable tank was stationed on a concrete pad; when it was full it was transported to the east side of the facility, and pumped into the waste oil tank. Starting in 1975, the oil was either sold for reuse or transported to a recycling center.	None, sampled only for TPH.	Title 22 metals, hexavalent chromium, pH, VOCs, TPH, SVOCs, and PAHs	No

Notes:

[1] Analytical suites as presented in the Revised Final Soil RFI/RI Work Plan (CH2M HILL 2013).

Metals: Antimony (An); Arsenic (As); Barium (Ba); Beryllium (Be), Cadmium (Cd); Hexavalent Chromium (Cr^{+6}); Total Chromium (Total Cr); Cobalt (Co); Copper (Cu); Lead (Pb); Mercury (Hg); Molybdenum (Mo); Nickel (Ni); Selenium (Se); Silver (Hg); Thallium (Tl); Vanadium (V); Zinc (Zn)

Inorganics: Aluminum (Al); Calcium (Ca); Iron (Fe); Magnesium (Mg); Manganese (Mn); Potassium (K); Sodium (Na); Cyanide (CN)

Semivolatile Organic Compounds (SVOCs): 4-Methylphenol; Bis (2-ethylhexyl) phthalate; Di-N-butyl phthalate

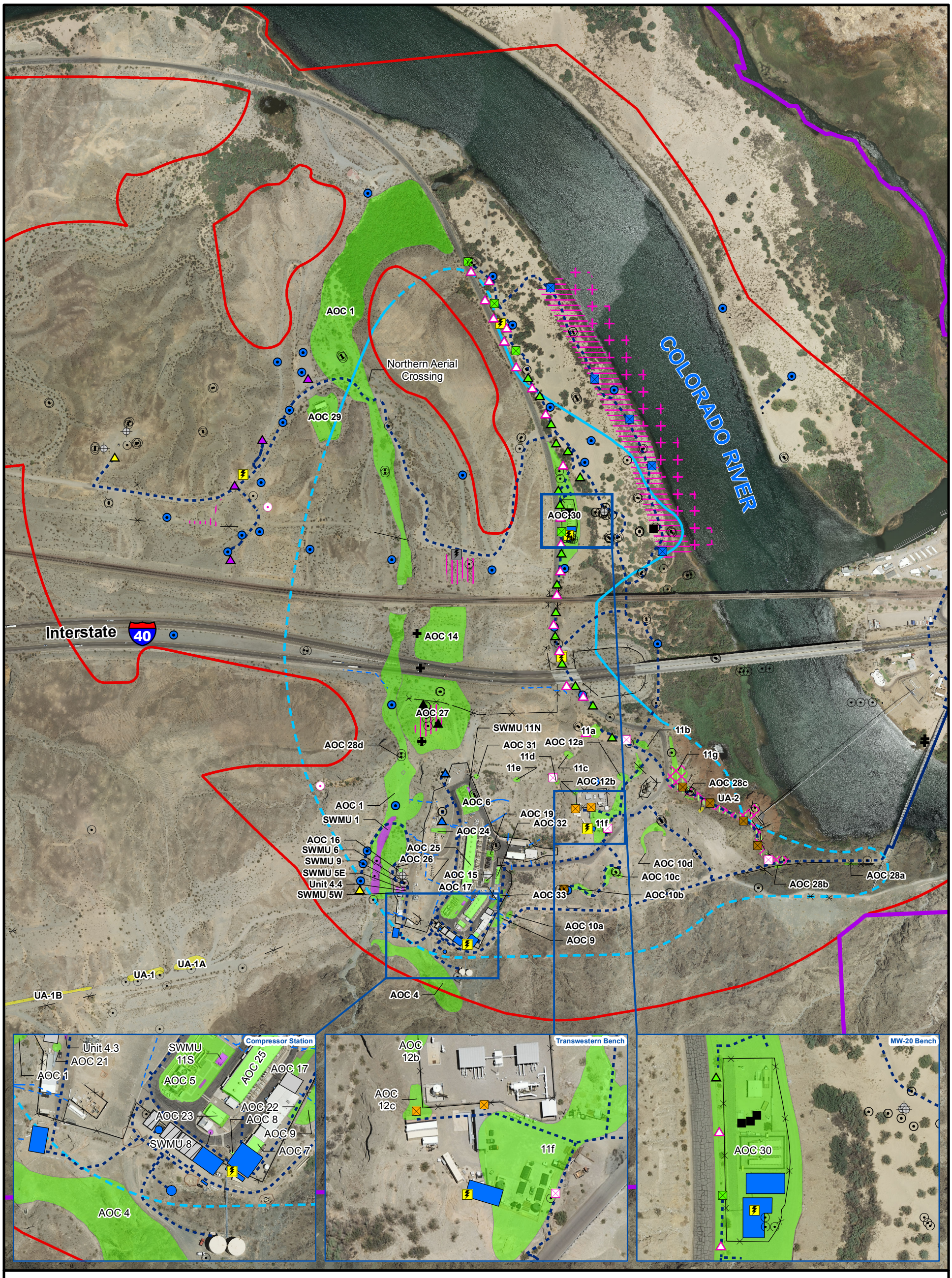
Volatile Organic Compounds (VOCs): Methyl acetate

Polycyclic Aromatic Hydrocarbons (PAHs): 1-Methyl naphthalene; 2-Methyl naphthalene; Acenaphthene, Anthracene; Benzo (a) anthracene; Benzo (a) pyrene; Benzo (b) fluoranthene; Benzo (ghi) perylene; Benzo (k) fluoranthene; Chrysene; Dibenzo (a,h) anthracene; Fluoranthene; Fluorene; Indeno (1,2,3-cd) pyrene, Naphthalene; Phenanthrene; Pyrene, PAH Low molecular weight; PAH High Molecular weight; B(a)P Equivalent

Polychlorinated biphenyls (PCBs): Aroclor-1016; Aroclor-1254; Aroclor-1260; Total PCBs

Pesticides: 1,1-dichloro-2.2-bis[p-chlorophenyl] ethylene (4,4-DDE); 1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane (4,4-DDT)

Total Petroleum Hydrocarbons (TPH): TPH as diesel; TPH as motor oil



LEGEND

Existing Wells:
- Extraction Well
- Injection Well
- Monitoring Well
- Water Supply Well

Provisional Wells:
- Extraction Well
- Injection Well
- Monitoring Well
- Area for East Ravine (ER) Wells (ER-7 to ER-11)
- Area for Potential Slant Well Screens
- Area for Inner Recirculation Loop (IRL) Wells
- Area for River Bank Extraction Wells

Planned Wells:
- Extraction, East Ravine
- Extraction, National Trails Highway (NTH) In-situ Reactive Zone (IRZ)
- Extraction, Riverbank
- Extraction, Transwestern Bench
- Injection, Freshwater
- Injection, Inner Recirculation Loop
- Injection, NTH IRZ
- Injection, Topock Compressor Station
- Remedy Monitoring Well
- Recirculation Well
- Area for Monitoring Well MW-T

Transformers
- Planned Transformer
- Future Provisional Transformer

- Site Fence Boundary
- Stormwater Piping Below Ground
- Stormwater Piping Above Ground

Pipeline Corridor for Remedy
- Aboveground Pipe
- Underground Pipe/Conduit
- Area of Potential Effects (APE)
- EIR Project Area

Work Areas
- Solid Waste Management Unit (SWMU)
- Area of Concern (AOC)
- Other

Remedy Facilities
- Proposed Remedy Structure
- Contingent Freshwater Pre-injection Treatment System

Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth in groundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

Notes:
1. All wells and remedy structure locations are approximate.
2. AOC 13 consists of the current and former unpaved areas within the fence line.AOC 18 consists of the hazardous waste transference pipelines and cooling tower blowdown pipelines.

N

0 550
Feet

FIGURE 1.0-1
GROUNDWATER REMEDY FEATURES, SOLID WASTE MANAGEMENT UNITS, AND AREAS OF CONCERN
GROUNDWATER REMEDY IMPLEMENTATION -
SOIL MANAGEMENT PLAN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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SECTION 2

Soil Management

Soil that may be displaced in the vicinity of the groundwater remedy system during drilling, construction, and O&M activities that are part of the groundwater remediation project or decommissioning and removal of the IM-3 system will be managed according to the processes described in this SMP. This section identifies Soil RFI/RI Investigation Areas in the vicinity of the groundwater remedy system and IM-3 system, and describes the processes for soil characterization, soil screening and classification, handling, short-term storage, and longer storage of displaced soil.

The process presented herein for determining whether displaced soil (including drill cuttings) is hazardous waste, is in compliance with California action-specific ARAR #74 (22 CCR Section 66262.11), Requirements for Waste Determination (DOI 2010). Once determined to be a hazardous waste, the waste will be managed in compliance with California action-specific ARARs #75 through #80, and #84 through #86 (DOI 2010):

- ARAR #75 (22 CCR 66262.12): USEPA identification number
- ARAR #76 (22 CCR, Div 4.5, Ch 14, Article 2): General requirements for hazardous waste facilities
- ARAR #77 (22 CCR 66262.20 and 66262.22): Use of hazardous waste manifest
- ARAR #78 (22 CCR 66262.30, 66262.31, 66262.32 and 66262.33): Packaging, marking, labeling, and placarding hazardous waste shipments
- ARAR #79 (22 CCR 66262.34): Accumulation requirements for hazardous waste
- ARAR #80 (22 CCR 66262.40 and 66262.41): Recordkeeping
- ARAR #84 (22 CCR, Div 4.5, Ch 14, Article 9): Use and management of containers
- ARAR #85 (22 CCR, Div 4.5, Ch 14, Article 10): Tank systems
- ARAR #86 (22 CCR, Div 4.5, Ch 14, Article 12): Waste piles for RCRA hazardous waste

In addition, to maximize onsite reuse of displaced soil and minimize offsite transportation and disposal of site soil, characterization, screening, handling, and storage processes were developed following guidelines in the *Revised Management Protocol for Handling and Disposition of Displaced Site Material, Topock Remediation Project, Needles, California* (Appendix B).

2.1 Soil RFI/RI Investigation Areas Intersected by the Groundwater Remedy Project

At the final design stage, proposed remedy pipeline/conduit alignments (includes direct burial pipelines/conduits, pipeline trenches, and remediation wells [i.e., injection and extraction wells] that are connected to those pipelines), remedy structures, and new monitoring well will intersect twenty-four Soil RFI/RI Investigation Areas. These areas are listed below and shown on Figure 1.0-1:

- SWMU 1 – Former Percolation Bed
- SWMU 5 – Sludge-Drying Beds
- SWMU 6 – Chromium Reduction Tank
- SWMU 9 – Transfer Sump
- AOC 1 – Area Around Former Percolation Bed
- AOC 4 – Debris Ravine
- AOC 7 – Hazardous Materials Storage Area
- AOC 8 – Paint Locker

- AOC 9 – Southeast Fence Line (Outside Visitor Parking Area)
- AOC 10 – East Ravine
- AOC 11 – Topographic Low Areas
- AOC 12 – Fill Areas
- AOC 13 – Unpaved Areas within the Compressor Station
- AOC 17 – Onsite Septic System
- AOC 18 – Combined Hazardous Waste Transference Pipelines
- AOC-21 – Round Area by Sludge Drying Beds
- AOC 22 – Unidentified Three-sided Structure
- AOC 27 – MW-24 Bench
- AOC 28 – Pipeline Drip Legs
- AOC 30 – MW 20 Bench
- AOC 33 – Potential Former Burn Area near AOC 17
- Unit 4.3 – Oil/Water Holding Tank
- Perimeter Area outside of but adjacent to the Compressor Station fence line
- Storm Drain System

The decommissioning and removal of the IM-3 system will affect two AOCs – AOC 29 (IM-3 Treatment Plant) and AOC 30 (MW 20 Bench).

These Soil RFI/RI Investigation Areas are currently being investigated under the Soil RFI/RI program. Tables 1.2-1 and 1.2-2 provide a summary of historical activities at each of these investigation areas, a list of constituents that exceeded interim screening levels, and the proposed analytical suites as presented in the revised Soil FRI/RI Work Plan. Existing soil data collected from within AOCs will be used to assess required protection of workers for health and safety purposes. Personnel engaged in field activities within known AOC areas will have completed the Occupational Safety Health Administration 40-hour health and safety training that meet the requirements of Title 29 CFR Section 1910.120 and Title 8 CCR Section 5192. All personnel will read applicable project-specific health and safety plans.

2.2 Soil and Waste Characterization Process

Soil in the vicinity of the groundwater remedy system expected to be displaced will be pre-characterized following the Groundwater Remedy Implementation—Baseline Soil Sampling and Analysis Plan (Baseline SAP), included as Appendix A of this document. The baseline soil sampling results will be screened following the process described below in Section 2.3 to classify the displaced soil for handling, storage, and/or disposal purposes. Soil generated during 1) post-construction O&M in or near Soil RFI/RI Investigation Areas that has not been pre-characterized and 2) the decommissioning and removal of the IM-3 system infrastructure used for the groundwater remedy, will be stockpiled or placed in lined roll-off bins at the work site, if practicable, or onsite in a temporary storage area designated by PG&E until they have been characterized.

Field segregation of soil will be a key step in the process of management of displaced soil for any ground disturbance activities that occur during remedy construction. As soil is displaced, any soil with odors or visual evidence of contamination will be segregated, characterized, and handled following procedures outlined in this SMP.

Representative sample profile results, existing soil sample results, and knowledge of the area history will be used to assess waste classification for displaced soil that has not been pre-characterized. Additional characterization of displaced soil from or near Soil RFI/RI Investigation Areas will be performed as needed. In general, characterization will entail collection of composite samples from roll-off bins and stockpiles. One four-point composite sample will be taken from each roll-off bin. For stockpiles, one four-point composite sample will be collected per 250 cubic yards.

The waste characterization soil samples collected within or near Soil RFI/RI Investigation Areas will be analyzed for the applicable Soil RFI/RI Investigation Area analytical suite presented in Tables 1.2-1 and 1.2-2. The samples

collected outside areas of known or suspected contamination will be analyzed for PAHs and lead. Analytical results will be screened according to the procedure listed in Section 2.3 to classify the soil for handling, storage, and disposal purposes. It is imperative to coordinate with the waste hauler and disposal facility to ensure proper completion of the profile.

Soil at 1 foot below ground surface (bgs) from each new monitoring, extraction, and injection well locations will be characterized per Section 2.3 as part of the Baseline SAP. Drill cuttings from installation of new monitoring, extraction, and injection wells will be containerized in 55-gallon U.S. Department of Transportation (DOT) drums or lined roll-off bins and characterized as described below. Drill cuttings from RFI/RI Investigation Areas will be segregated from those not within Investigation Areas to prevent comingling. The drill cuttings drums/bins will be stored onsite in a temporary storage area designated by PG&E until they have been characterized. Drum and roll-off bin storage are described in Section 3.1.

Characterization of drilling cuttings will be performed by collection of samples as follows:

- For one drum, one discrete sample will be collected from the drum. The sample will be collected from the center of the drum from at least 12-inches below the surface of the soil.
- For 2 to 10 drums, one discrete sample will be collected from each drum and composited into a single composite sample.
- For more than 10 drums, one composite sample will be collected for every 10 drums.
- For each roll-off bin, one four-point composite sample will be taken from the roll-off bin.

The samples will be analyzed for applicable Soil RFI/RI Investigation Area analytical suite presented in Tables 1.2-1 and 1.2-2. Analytical results will be screened according to the procedure listed in Section 2.3 to classify the soil for handling, storage, and disposal purposes.

2.3 Screening and Classification of Soil

The following process for screening and classification of displaced soil in compliance with California action-specific ARAR #74 (22 CCR 66262.11) is based on the *Revised Management Protocol for Handling and Disposition of Displaced Site Material, Topock Remediation Project, Needles, California* (PG&E 2015) (see Appendix B).

Analytical results from the baseline soil sampling or other characterization of soil samples (i.e., drum or roll-off bins, or areas not pre-characterized) will be used to assess whether displaced soil is suitable for retention onsite for eventual return, reuse, or replacement, or if the soil must be removed from the site for disposal in accordance with applicable state and federal laws and regulations. Analytes detected in the baseline soil sampling or other characterization of soil samples above laboratory detection limits will be screened against the screening values included on Tables 2.4-1 and 2.4-2. These screening values include the following:

- **Interim Screening Levels (Table 2.4-1)** – The screening levels for metals are predominantly Topock-specific soil background values. However, if a background value is not available then the lesser of the DTSC Residential Screening Level (*Human Health Risk Assessment Note 3 – DTSC-Modified Screening Levels* [HERO 2015]) or the ecological comparison value is used. If a DTSC Residential Screening Level is not available, then the lesser of the USEPA residential regional screening level or the ecological comparison value is used (the source document for the ecological comparison values is included in Appendix D of this SMP). These levels are the most conservative, and it is assumed that the project-specific soil cleanup goal will be equal to or greater than these levels. Once established, the project-specific cleanup goals will replace the interim screening levels.
- **Hazardous Waste Toxicity Characteristic Levels (Table 2.4-2)** – These values will be used to assess if the soil should be classified as a non-hazardous waste, a state (non-RCRA California) hazardous waste, or a federal (RCRA) hazardous waste. Specifically, total constituent concentrations expressed in milligrams per kilogram (mg/kg) will be compared to the hazardous waste characteristic levels in Table 2.4-2, and will be evaluated as follows:

- Step 1 – If the total constituent concentration exceeds the total threshold limit concentration (TTLC), the soil represented by the sample will be classified as a non-RCRA hazardous waste. Additional evaluation of the soluble threshold limit concentration (STLC), as described in Step 3 below, will not be performed.
- Step 2 – If the total constituent concentration exceeds the numeric value of the RCRA toxicity characteristic (TC) level by about 20 times or more, the toxicity characteristic leaching procedure (TCLP) will be performed. If the constituent concentration in the TCLP leachate exceeds the TC level, the soil represented by the sample will be classified as a RCRA hazardous waste. Additional evaluation of the STLC, as described in Step 3 below, will not be performed.
- Step 3 – If the sample has not been classified as hazardous waste in Steps 1 or 2, the total constituent concentration will be compared to the STLC. If the total constituent concentration exceeds the numeric value of the STLC by 10 times or more, the California Waste Extraction Test (WET) will be performed. If the constituent concentration in the WET exceeds the STLC, the soil represented by the sample will be classified as a non-RCRA hazardous waste.
- Step 4 – If the sample has not been classified as a hazardous waste in Steps 1, 2, or 3, the soil represented by the sample will be not be classified or managed as hazardous waste.

Subsequent to screening, soil that may be displaced in the vicinity of the groundwater remedy system will be classified into four categories and will be managed as follows:

- RCRA hazardous waste—The waste will be removed from the site within 90 days of generation and disposed of offsite in accordance with applicable laws and regulations (California action-specific ARARs #78 and #79) and the Remedial Design/Remedial Action Consent Decree (CD) (DOI 2013). It is imperative to coordinate with the waste hauler and disposal facility to ensure proper completion of the waste profile and to avoid unnecessary delays in acceptance of a waste to a specific facility (as discussed in Section 4.0).
- Non-RCRA hazardous waste – Same as management of the RCRA hazardous waste.
- Non-hazardous soil for offsite disposal — Soil that is not classified as a hazardous waste, and is greater than the interim screening level or project-specific cleanup goal (once established), will be disposed of offsite (as discussed in Section 2.5).
- Clean soil—Soil that is not classified as a hazardous waste, and is equal to or below the interim screening level, is suitable for immediate return, reuse, or replacement onsite (as discussed in Section 2.4).

2.4 Handling and Storage of Clean Soil

Non-hazardous clean displaced soil (i.e., soil below interim screening levels or project-specific cleanup goals [once established]) will be stockpiled at the work site, if practicable, and recorded in an inventory as described in Section 5.0. Clean soil that was removed from trenches or excavations will be reused as backfill into the same trench or excavation area, if practicable. Clean soil that cannot be immediately used as backfill may be reused in other areas within the APE, or stockpiled for future reuse within the APE. Displaced soil that is stockpiled for future use will be managed following the BMPs described in Section 3.1.2 below, the BMPs Plan presented in Appendix C, the Construction/Remedial Action Work Plan, and the Groundwater Remedy Industrial SWPPP (Appendix E of Volume 1 of this O&M Manual).

Consistent with the special handling procedures requested by the Hualapai Department of Cultural Resources for displaced material generated from clay beds (this does not include clay-containing sediment mixtures, only clay beds), if clay bed(s) are encountered during construction, the clay material will be set aside on 100% cotton muslin (dye free) for future disposition following discussions with the Tribes. For the purposes of this project the identification of a “clay bed,” and therefore the application of this special handling procedure, will be based on the practicability for the clay material to be separated from other excavated soils or drill cuttings. For example, when trenching with a backhoe it may be possible to identify relatively thin beds of clay material (e.g., less than a foot) and separate it from the rest of the excavated soil, but when drilling with a method that doesn’t retrieve

cores that can be closely observed and precisely separated (e.g., hollow-stem auger), a relatively thin clay bed might not be identified or the clay material might become mixed with the rest of the cuttings to the point where it cannot be practicably separated. PG&E will notify the Agencies and Tribes in the event clay material is encountered and separated for storage. Further, salvage of topsoil during installation of trenches will be done where the proposed excavation will occur in areas where undisturbed topsoil may be present. In such areas, the upper 4 inches of soil will be carefully removed and placed near the excavation. The remaining subsurface-soil will then be excavated and stored separately from the topsoil. Following the installation of piping/conduits and backfilling of the trench, the topsoil will be replaced over the trench. Therefore, there will be no need for long-term storage of undisturbed topsoil. The rest of the excavated soil that is not undisturbed topsoil consists of desert soils that are generally low in nutrients and organic matter. Desert soil that has been subject to disturbance typically loses a large percentage of the available nutrient supply and important soil biota. Therefore, salvage of soil from disturbed areas will not occur and there will be no specific actions related to protecting biological integrity while these soils are being stored.

Additional segregation or sorting of material by size may occur, e.g., separating oversize rocks and gravel that are excavated during trenching but are not considered suitable for backfill. Oversize rocks may be used as erosion control (riprap) or processed (crushed) to provide aggregates in concrete, pavements or road surfacing. An onsite segregation unit for screening/crushing may be used to process material for onsite use.

The estimated volume of clean soil (generated from construction of the groundwater remedy) needing storage is approximately 11,000 cubic yards. This volume is based on the total net volume of soil excavated from trenches and building foundations located outside of Soil RFI/RI Investigation Areas that cannot be immediately used as backfill. During the 60% design comment resolution process (September 2013 through March 2014), potential locations for soil storage were evaluated by PG&E and Tribes and discussed with Agencies and landowners/managers (BLM/BOR). As a result of these discussions, PG&E proposed to use an area (located on federal land) in Moabi Regional Park for storage of non-hazardous clean soil (see Figure 2.4-1 at the end of this section). The estimated storage capacity in the identified area is 11,700 cubic yards. It is anticipated that clean soil will be stored in stockpiles and managed per the BMPs presented in the BMPs Plan (Appendix C) and summarized in Section 3.1.2 below, the Construction/Remedial Action Work Plan, and the Groundwater Remedy Industrial SWPPP (Appendix E of Volume 1 of this O&M Manual).

The volume and classification of clean displaced soil from the decommissioning and removal of the IM-3 system requiring storage will not be known until after the system has been decommissioned and removed, which will not occur until after the start of implementation of the groundwater remedy. Since the amount of displaced soil from the decommissioning and removal of the IM-3 system is expected to be minimal and characterization of this displaced soil will not occur until after the SMP has been revised to include the baseline soil sampling results, this displaced soil will be stored and managed following the same process as the soil displaced during the groundwater remedy installation and O&M provided in the revised SMP.

2.5 Handling and Off-site Disposal of Non-Hazardous Soil

The SMP and the revised management protocol for handling and disposition of displaced site material (Appendix B) exclude storage of soil that is non-hazardous but unsuitable for final disposition onsite because contaminants are present above the interim screening level or project-specific cleanup goal (once established).

The estimated volume of non-hazardous soil (from construction of the groundwater remedy) (i.e., soil above interim screening levels) needing disposal is approximately 4,000 cubic yards. This volume is based on the total net volume of soil excavated from trenches and building foundations located within Soil RFI/RI investigation areas. It is anticipated that this soil will be stored initially in roll-off bins and managed per the BMPs described in Section 3.1.3.

It is anticipated that project-specific cleanup goals will be established by the time of the decommissioning and removal of the IM-3 system. Displaced soils (from the decommissioning activities) that are above the clean-up goals will be disposed of offsite as described in the Revised Management Protocol (Appendix B). The volume and

classification of this soil will not be known until after the system has been decommissioned and removed, which will be after the start of implementation of the groundwater remedy. The amount of displaced soil from the decommissioning and removal of the IM-3 system is expected to be minimal.

TABLE 2.4-1
Reference List of Potentially Applicable Analytes and Associated Screening Levels (rev. July 2015)
Management Protocol for Handling and Disposition of Displaced Material
PG&E Topock Compressor Station, Needles, California

Group	Analyte	Interim Screening Level		Interim Screening Level Source	Hazardous Waste Disposal Criteria
Dioxins and Furans (ng/kg)					
	1,2,3,4,6,7,8-HpCDD	NE		Not Established	NE
	1,2,3,4,6,7,8-HpCDF	NE		Not Established	NE
	1,2,3,4,7,8,9-HpCDF	NE		Not Established	NE
	1,2,3,4,7,8-HxCDD	NE		Not Established	NE
	1,2,3,4,7,8-HxCDF	NE		Not Established	NE
	1,2,3,6,7,8-HxCDD	NE		Not Established	NE
	1,2,3,6,7,8-HxCDF	NE		Not Established	NE
	1,2,3,7,8,9-HxCDD	NE		Not Established	NE
	1,2,3,7,8,9-HxCDF	NE		Not Established	NE
	1,2,3,7,8-PeCDD	4.8		EPA Residential RSL	NE
	1,2,3,7,8-PeCDF	NE		Not Established	NE
	2,3,4,6,7,8-HxCDF	NE		Not Established	NE
	2,3,4,7,8-PeCDF	NE		Not Established	NE
	2,3,7,8-TCDD	4.8		EPA Residential RSL	See Table 2
	2,3,7,8-TCDF	NE		Not Established	NE
	OCDD	NE		Not Established	NE
	OCDF	NE		Not Established	NE
	TEQ Avian	16		Soil Ecological Comparison Value (ECV)	NE
	TEQ Human	50		DTSC HHRA Note 2	NE
	TEQ Mammals	1.6		Soil Ecological Comparison Value (ECV)	NE
Metals (mg/kg)					
	Aluminum	16,400		Background Level	NE
	Antimony	0.285		Soil Ecological Comparison Value (ECV)	See Table 2
	Arsenic	11	*	Background Level	See Table 2
	Barium	410	*	Background Level	See Table 2
	Beryllium	0.672		Background Level	See Table 2
	Cadmium	1.1	*	Background Level	See Table 2
	Calcium	66,500		Background Level	NE
	Chromium, Hexavalent	0.83	*	Background Level	See Table 2
	Chromium, total	39.8	*	Background Level	See Table 2
	Cobalt	12.7	*	Background Level	See Table 2
	Copper	16.8		Background Level	See Table 2
	Cyanide	0.9		Soil Ecological Comparison Value (ECV)	NE
	Iron	55,000		EPA Residential RSL	NE
	Lead	8.39	*	Background Level	See Table 2
	Magnesium	12,100		Background Level	NE
	Manganese	402	*	Background Level	NE
	Mercury	0.0125		Soil Ecological Comparison Value (ECV)	See Table 2
	Molybdenum	1.37	*	Background Level	See Table 2
	Nickel	27.3	*	Background Level	See Table 2
	Potassium	4,400		Background Level	NE
	Selenium	1.47	*	Background Level	See Table 2
	Silver	5.15		Soil Ecological Comparison Value (ECV)	See Table 2
	Sodium	2,070		Background Level	NE
	Thallium	0.78		EPA Residential RSL	See Table 2
	Vanadium	52.2	*	Background Level	See Table 2
	Zinc	58	*	Background Level	See Table 2

TABLE 2.4-1
Reference List of Potentially Applicable Analytes and Associated Screening Levels (rev. July 2015)
Management Protocol for Handling and Disposition of Displaced Material
PG&E Topock Compressor Station, Needles, California

Group	Analyte	Interim Screening Level	Interim Screening Level Source	Hazardous Waste Disposal Criteria
Pesticides (µg/kg)				
	4,4-DDD	2.1	Soil Ecological Comparison Value (ECV)	See Table 2
	4,4-DDE	2	EPA Residential RSL	See Table 2
	4,4-DDT	1.9	EPA Residential RSL	See Table 2
	Aldrin	39	EPA Residential RSL	See Table 2
	alpha-BHC	86	EPA Residential RSL	NE
	alpha-Chlordane	470	Soil Ecological Comparison Value (ECV)	See Table 2
	beta-BHC	300	EPA Residential RSL	NE
	delta-BHC	300	EPA Residential RSL	NE
	Dieldrin	5	Soil Ecological Comparison Value (ECV)	See Table 2
	Endo sulfan I	470,000	EPA Residential RSL	NE
	Endo sulfan II	470,000	EPA Residential RSL	NE
	Endosulfan sulfate	470,000	EPA Residential RSL	NE
	Endrin	19,000	EPA Residential RSL	See Table 2
	Endrin aldehyde	19,000	EPA Residential RSL	NE
	Endrin ketone	19,000	EPA Residential RSL	NE
	gamma-BHC (Lindane)	570	EPA Residential RSL	See Table 2
	gamma-Chlordane	0.43	DTSC-Residential SLs	See Table 2
	Heptachlor	130	EPA Residential RSL	See Table 2
	Heptachlor Epoxide	70	EPA Residential RSL	See Table 2
	Methoxychlor	320,000	EPA Residential RSL	See Table 2
	Toxaphene	490	EPA Residential RSL	See Table 2
Polyaromatic Hydrocarbons (µg/kg)				
	1-Methyl naphthalene	18,000	EPA Residential RSL	NE
	2-Methyl naphthalene	240,000	EPA Residential RSL	NE
	Acenaphthene	3,600,000	EPA Residential RSL	NE
	Acenaphthylene	3,600,000	EPA Residential RSL	NE
	Anthracene	18,000,000	EPA Residential RSL	NE
	B(a)P Equivalent	16	EPA Residential RSL	NE
	Benzo (a) anthracene	160	EPA Residential RSL	NE
	Benzo (a) pyrene	16	EPA Residential RSL	NE
	Benzo (b) fluoranthene	160	EPA Residential RSL	NE
	Benzo (ghi) perylene	1,800,000	EPA Residential RSL	NE
	Benzo (k) fluoranthene	0.39	DTSC-Residential SLs	NE
	Chrysene	3.9	DTSC-Residential SLs	NE
	Dibenzo (a,h) anthracene	16	EPA Residential RSL	NE
	Fluoranthene	2,400,000	EPA Residential RSL	NE
	Fluorene	2,400,000	EPA Residential RSL	NE
	Indeno (1,2,3-cd) pyrene	160	EPA Residential RSL	NE
	Naphthalene	3,800	EPA Residential RSL	NE
	PAH High molecular weight	1,160	Soil Ecological Comparison Value (ECV)	NE
	PAH Low molecular weight	10,000	Soil Ecological Comparison Value (ECV)	NE
	Phenanthrene	1,800,000	EPA Residential RSL	NE
	Pyrene	1,800,000	EPA Residential RSL	NE
Polychlorinated Biphenyls (µg/kg)				
	Aroclor 1016	0.23	DTSC-Residential SLs	See Table 2
	Aroclor 1221	170	EPA Residential RSL	See Table 2

TABLE 2.4-1
Reference List of Potentially Applicable Analytes and Associated Screening Levels (rev. July 2015)
Management Protocol for Handling and Disposition of Displaced Material
PG&E Topock Compressor Station, Needles, California

Group	Analyte	Interim Screening Level	Interim Screening Level Source	Hazardous Waste Disposal Criteria
Polychlorinated Biphenyls (µg/kg)				
	Aroclor 1232	170	EPA Residential RSL	See Table 2
	Aroclor 1242	230	EPA Residential RSL	See Table 2
	Aroclor 1248	230	EPA Residential RSL	See Table 2
	Aroclor 1254	240	EPA Residential RSL	See Table 2
	Aroclor 1260	240	EPA Residential RSL	See Table 2
	Aroclor 1262	240	EPA Residential RSL	See Table 2
	Aroclor 1268	240	EPA Residential RSL	See Table 2
	Total PCBs	204	Soil Ecological Comparison Value (ECV)	See Table 2
Semivolatile Organic Compounds (µg/kg)				
	1,1´-Biphenyl	47,000	EPA Residential RSL	NE
	1,2,4,5-Tetrachlorobenzene	23,000	EPA Residential RSL	NE
	1,4-Dioxane	5,300	EPA Residential RSL	NE
	2,3,4,6-Tetrachlorophenol	1,900,000	EPA Residential RSL	NE
	2,4,5-Trichlorophenol	6,300,000	EPA Residential RSL	See Table 2
	2,4,6-Trichlorophenol	7.5	DTSC-Residential SLs	See Table 2
	2,4-Dichlorophenol	190,000	EPA Residential RSL	NE
	2,4-Dimethylphenol	1,300,000	EPA Residential RSL	NE
	2,4-Dinitrophenol	130,000	EPA Residential RSL	NE
	2,4-Dinitrotoluene	1,700	EPA Residential RSL	See Table 2
	2,6-Dinitrotoluene	360	EPA Residential RSL	NE
	2-Chloro naphthalene	4,800,000	EPA Residential RSL	NE
	2-Chlorophenol	390,000	EPA Residential RSL	NE
	2-Methylphenol (o-Cresol)	3,200,000	EPA Residential RSL	See Table 2
	2-Nitroaniline	630,000	EPA Residential RSL	NE
	3,3-Dichlorobenzidene	1,200	EPA Residential RSL	NE
	3-Nitroaniline	630,000	EPA Residential RSL	NE
	4,6-Dinitro-2-methylphenol	5,100	EPA Residential RSL	NE
	4-Chloro-3-methylphenol	6,300,000	EPA Residential RSL	NE
	4-Chloroaniline	2,700	EPA Residential RSL	NE
	4-Methylphenol (p-Cresol)	500	Soil Ecological Comparison Value (ECV)	See Table 2
	4-Nitroaniline	27,000	EPA Residential RSL	NE
	Acetophenone	7,800,000	EPA Residential RSL	NE
	Atrazine	2,400	EPA Residential RSL	NE
	Benzaldehyde	7,800,000	EPA Residential RSL	NE
	Benzoic acid	250,000,000	EPA Residential RSL	NE
	Benzyl alcohol	6,300,000	EPA Residential RSL	NE
	Bis (2-chloroethoxy) methane	190,000	EPA Residential RSL	NE
	Bis (2-ethylhexyl) phthalate	2,870	Soil Ecological Comparison Value (ECV)	NE
	Butyl benzyl phthalate	290,000	EPA Residential RSL	NE
	Caprolactam	31,000,000	EPA Residential RSL	NE
	Carbazole	1,600,000	EPA Residential RSL	NE
	Dibenzofuran	73,000	EPA Residential RSL	NE
	Diethyl phthalate	51,000,000	EPA Residential RSL	NE
	Dimethyl phthalate	51,000,000	EPA Residential RSL	NE
	Di-N-butyl phthalate	46.9	Soil Ecological Comparison Value (ECV)	NE
	Di-N-octyl phthalate	630,000	EPA Residential RSL	NE
	Hexachlorobenzene	210	EPA Residential RSL	See Table 2

TABLE 2.4-1
Reference List of Potentially Applicable Analytes and Associated Screening Levels (rev. July 2015)
Management Protocol for Handling and Disposition of Displaced Material
PG&E Topock Compressor Station, Needles, California

Group	Analyte	Interim Screening Level	Interim Screening Level Source	Hazardous Waste Disposal Criteria
Semivolatile Organic Compounds (µg/kg)				
	Hexachloroethane	1,800	EPA Residential RSL	See Table 2
	N-Nitroso-di-n-propylamine	78	EPA Residential RSL	NE
	N-nitrosodiphenylamine	110,000	EPA Residential RSL	NE
	Pentachlorophenol	1,000	EPA Residential RSL	See Table 2
	Phenol	19,000,000	EPA Residential RSL	NE
Total Petroleum Hydrocarbons (mg/kg)				
	TPH as diesel	240	SF RWQCB ESL for direct exposure (2013)	NE
	TPH as gasoline	770	SF RWQCB ESL for direct exposure (2013)	NE
	TPH as motor oil	10,000	SF RWQCB ESL for direct exposure (2013)	NE
Volatile Organic Compounds (µg/kg)				
	1,1,1,2-Tetrachloroethane	550	DTSC-Residential SLs	NE
	1,1,1-Trichloroethane	1,700	DTSC-Residential SLs	NE
	1,1,2,2-Tetrachloroethane	600	EPA Residential RSL	NE
	1,1,2-Trichloroethane	1,100	EPA Residential RSL	NE
	1,1,2-Trichlorotrifluoroethane (Freon 113)	40,000,000	EPA Residential RSL	NE
	1,1-Dichloroethane	1,600	DTSC-Residential SLs	NE
	1,1-Dichloroethene	230,000	EPA Residential RSL	See Table 2
	1,1-Dichloropropene	1,800	EPA Residential RSL	NE
	1,2,3-Trichlorobenzene	63,000	EPA Residential RSL	NE
	1,2,3-Trichloropropane	5.1	EPA Residential RSL	NE
	1,2,4-Trichlorobenzene	24,000	EPA Residential RSL	NE
	1,2,4-Trimethylbenzene	58,000	EPA Residential RSL	NE
	1,2-Dibromo-3-chloropropane	5.3	EPA Residential RSL	NE
	1,2-Dibromoethane	7.2	DTSC-Residential SLs	NE
	1,2-Dichlorobenzene	1,800,000	EPA Residential RSL	NE
	1,2-Dichloroethane	460	EPA Residential RSL	See Table 2
	1,2-Dichloropropane	1,000	EPA Residential RSL	NE
	1,3,5-Trimethylbenzene	210	DTSC-Residential SLs	NE
	1,3-Dichlorobenzene	1,800,000	EPA Residential RSL	NE
	1,3-Dichloropropane	420	DTSC-Residential SLs	NE
	1,4-Dichlorobenzene	2,600	EPA Residential RSL	See Table 2
	2,2-Dichloropropane	1,600,000	EPA Residential RSL	NE
	2-Chlorotoluene	480	DTSC-Residential SLs	NE
	2-Hexanone	200,000	EPA Residential RSL	NE
	4-Isopropyltoluene	1,900,000	EPA Residential RSL	NE
	Acetone	61,000,000	EPA Residential RSL	NE
	Acrolein	140	EPA Residential RSL	NE
	Acrylonitrile	0.068	DTSC-Residential SLs	NE
	Benzene	0.33	DTSC-Residential SLs	See Table 2
	Bis (2-chloroethyl) ether	230	EPA Residential RSL	NE
	Bis (2-chloroisopropyl) ether	4,900	EPA Residential RSL	NE
	Bromobenzene	290,000	EPA Residential RSL	NE
	Bromochloromethane	150,000	EPA Residential RSL	NE
	Bromodichloromethane	280	DTSC-Residential SLs	NE
	Bromoform	19,000	EPA Residential RSL	NE
	Bromomethane	6,800	EPA Residential RSL	NE

TABLE 2.4-1
Reference List of Potentially Applicable Analytes and Associated Screening Levels (rev. July 2015)
Management Protocol for Handling and Disposition of Displaced Material
PG&E Topock Compressor Station, Needles, California

Group	Analyte	Interim Screening Level	Interim Screening Level Source	Hazardous Waste Disposal Criteria
Volatile Organic Compounds (µg/kg)				
	Carbon disulfide	770,000	EPA Residential RSL	NE
	Carbon tetrachloride	0.099	DTSC-Residential SLs	See Table 2
	Chlorobenzene	280,000	EPA Residential RSL	See Table 2
	Chloroethane	3.1	DTSC-Residential SLs	NE
	Chloroform	320	EPA Residential RSL	See Table 2
	Chloromethane	110,000	EPA Residential RSL	NE
	cis-1,2-Dichloroethene	19	DTSC-Residential SLs	NE
	cis-1,3-Dichloropropene	1,800	EPA Residential RSL	NE
	Cyclohexane	6,500,000	EPA Residential RSL	NE
	Dibromochloromethane	750	EPA Residential RSL	NE
	Dibromomethane	23,000	EPA Residential RSL	NE
	Dichlorodifluoromethane	87,000	EPA Residential RSL	NE
	Ethylbenzene	5,800	EPA Residential RSL	NE
	Hexachlorobutadiene	1,200	EPA Residential RSL	See Table 2
	Hexachlorocyclopentadiene	1,800	EPA Residential RSL	NE
	Isophorone	570,000	EPA Residential RSL	NE
	Isopropylbenzene	1,900,000	EPA Residential RSL	NE
	m,p-Xylenes	550,000	EPA Residential RSL	NE
	Methyl acetate	24,000	DTSC-Residential SLs	NE
	Methyl ethyl ketone	27,000,000	EPA Residential RSL	See Table 2
	Methyl isobutyl ketone	5,300,000	EPA Residential RSL	NE
	Methyl tert-butyl ether (MTBE)	47,000	EPA Residential RSL	NE
	Methylcyclohexane	6,500,000	EPA Residential RSL	NE
	Methylene chloride	5.5	DTSC-Residential SLs	NE
	N-Butylbenzene	1,200	DTSC-Residential SLs	NE
	Nitrobenzene	5,100	EPA Residential RSL	See Table 2
	N-Propylbenzene	3,800,000	EPA Residential RSL	NE
	o-Xylene	650,000	EPA Residential RSL	NE
	p-Chlorotoluene	440	DTSC-Residential SLs	NE
	sec-Butylbenzene	2,200	DTSC-Residential SLs	NE
	Styrene	6,000,000	EPA Residential RSL	NE
	tert-Butylbenzene	2,200	DTSC-Residential SLs	NE
	Tetrachloroethene	0.6	DTSC-Residential SLs	See Table 2
	Toluene	1,100	DTSC-Residential SLs	NE
	trans-1,2-Dichloroethene	190	DTSC-Residential SLs	NE
	trans-1,3-Dichloropropene	1,800	EPA Residential RSL	NE
	Trichloroethene	940	EPA Residential RSL	See Table 2
	Trichlorofluoromethane (Freon 11)	730,000	EPA Residential RSL	NE
	Vinyl chloride	59	EPA Residential RSL	See Table 2
	Xylenes, total	650,000	EPA Residential RSL	NE

Notes:

This table presents a reference list of analytes and associated screening levels that may be applicable for making decisions related to disposition of displaced site materials. The specific analytes and screening levels applicable for characterization of displaced material will be determined based on the origin of the material and potential disposition locations.

Interim screening level is background value. If background value is not available then the lesser of the DTSC HHRA Note 3 Residential Screening Levels (DTSC Residential SL) or the ecological comparison value is used. If a DTSC Residential SL is not available, it is the lesser of the USEPA residential regional screening level or the ecological comparison value.

Background	"Final Soil Background Investigation at Pacific Gas and Electric Company Topock Compressor Station, Needles, California" (CH2M HIll 2009c)
DTSC-Residential SLs	Human Health Risk Assessment Note 3 – DTSC-Modified Screening Levels, May 2015.
EPA Residential RSL	United States Environmental Protection Agency Residential Soil Regional Screening Level (THQ=1.0), June 2015.
ECV	Ecological Comparison Values; ECV were calculated as needed for constituents detected during the Part A Phase I sampling (Arcadis 2008)
HHRA Note 2	DTSC Human Health Risk Assessment (HHRA) Note 2: Remedial Goals for Dioxins and Dioxin-like Compounds for Consideration at California Hazardous Waste Sites – Interim (May 2009).
SF RWQCB ESL	San Francisco Bay Regional Water Quality Control Board Environmental Screening Levels for residential direct exposure (2013)
*	One or more screening levels (EPA Residential RSL, DTSC-Residential SLs, ECV, or Soil SL) have values lower than the background level.
NE	not established
mg/kg	milligrams per kilogram
ng/kg	nanograms per kilogram
µg/kg	micrograms per kilogram

TABLE 2.4-2

Hazardous Waste Toxicity Characteristic Levels

Groundwater Remedy Operation and Maintenance Manual (Volume 4: Soil Management Plan)

PG&E Topock Compressor Station, Needles, California

Group	Analyte	TTLC [a, i]	STLC [b] Screen	RCRA TC [c] Screen	STLC [d, i] (from WET)	RCRA TC [e] (from TCLP)	EPA HW [f]
		mg/kg	mg/kg	mg/kg	mg/L	mg/L	
Asbetos							
	Asbestos	1%	NE	NE	NE	NE	NE
Dioxins and Furans							
	2,3,7,8-TCDD	0.01	0.01	NE	0.001	NE	NE
Metals							
	Antimony	500	150	NE	15	NE	NE
	Arsenic	500	50	100	5	5	D004
[j]	Barium	10,000	1,000	2,000	100	100	D005
	Beryllium	75	7.5	NE	0.75	NE	NE
	Cadmium	100	10	20	1	1	D006
	Chromium, Hexavalent	500	50	NE	5	NE	NE
[k]	Chromium, total	2,500	50	100	5	5	D007
	Cobalt	8,000	800	NE	80	NE	NE
	Copper	2,500	250	NE	25	NE	NE
	Lead	1,000	50	100	5	5	D008
	Mercury	20	2	4	0.2	0.2	D009
[l]	Molybdenum	3,500	3,500	NE	350	NE	NE
	Nickel	2,000	200	NE	20	NE	NE
	Selenium	100	10	20	1	1	D010
	Silver	500	50	100	5	5	D011
	Thallium	700	70	NE	7	NE	NE
	Vanadium	2,400	240	NE	24	NE	NE
	Zinc	5,000	2,500	NE	250	NE	NE
Pesticides							
	4,4-DDD	1	1	NE	0.1	NE	NE
	4,4-DDE	1	1	NE	0.1	NE	NE
	4,4-DDT	1	1	NE	0.1	NE	NE
	Aldrin	1.4	1.4	NE	0.14	NE	NE
	alpha-Chlordane	2.5	2.5	0.6	0.25	0.03	D020
	Dieldrin	8	8	NE	0.8	NE	NE
	Endrin	0.2	0.2	0.4	0.02	0.02	D012
	gamma-BHC (Lindane)	4	4	8	0.4	0.4	D013
	gamma-Chlordane	2.5	2.5	0.6	0.25	0.03	D020
	Heptachlor	4.7	4.7	0.16	0.47	0.008	D031
	Heptachlor Epoxide	4.7	4.7	0.16	0.47	0.008	D031
	Methoxychlor	100	100	200	10	10	D014
	Toxaphene	5	5	10	0.5	0.5	D015
Polychlorinated Biphenyls							
	Aroclor 1016	50	50	NE	5	NE	NE
	Aroclor 1221	50	50	NE	5	NE	NE
	Aroclor 1232	50	50	NE	5	NE	NE
	Aroclor 1242	50	50	NE	5	NE	NE
	Aroclor 1248	50	50	NE	5	NE	NE
	Aroclor 1254	50	50	NE	5	NE	NE
	Aroclor 1260	50	50	NE	5	NE	NE
	Aroclor 1262	50	50	NE	5	NE	NE
	Aroclor 1268	50	50	NE	5	NE	NE
	Total PCBs	50	50	NE	5	NE	NE

TABLE 2.4-2

Hazardous Waste Toxicity Characteristic Levels

Groundwater Remedy Operation and Maintenance Manual (Volume 4: Soil Management Plan)

PG&E Topock Compressor Station, Needles, California

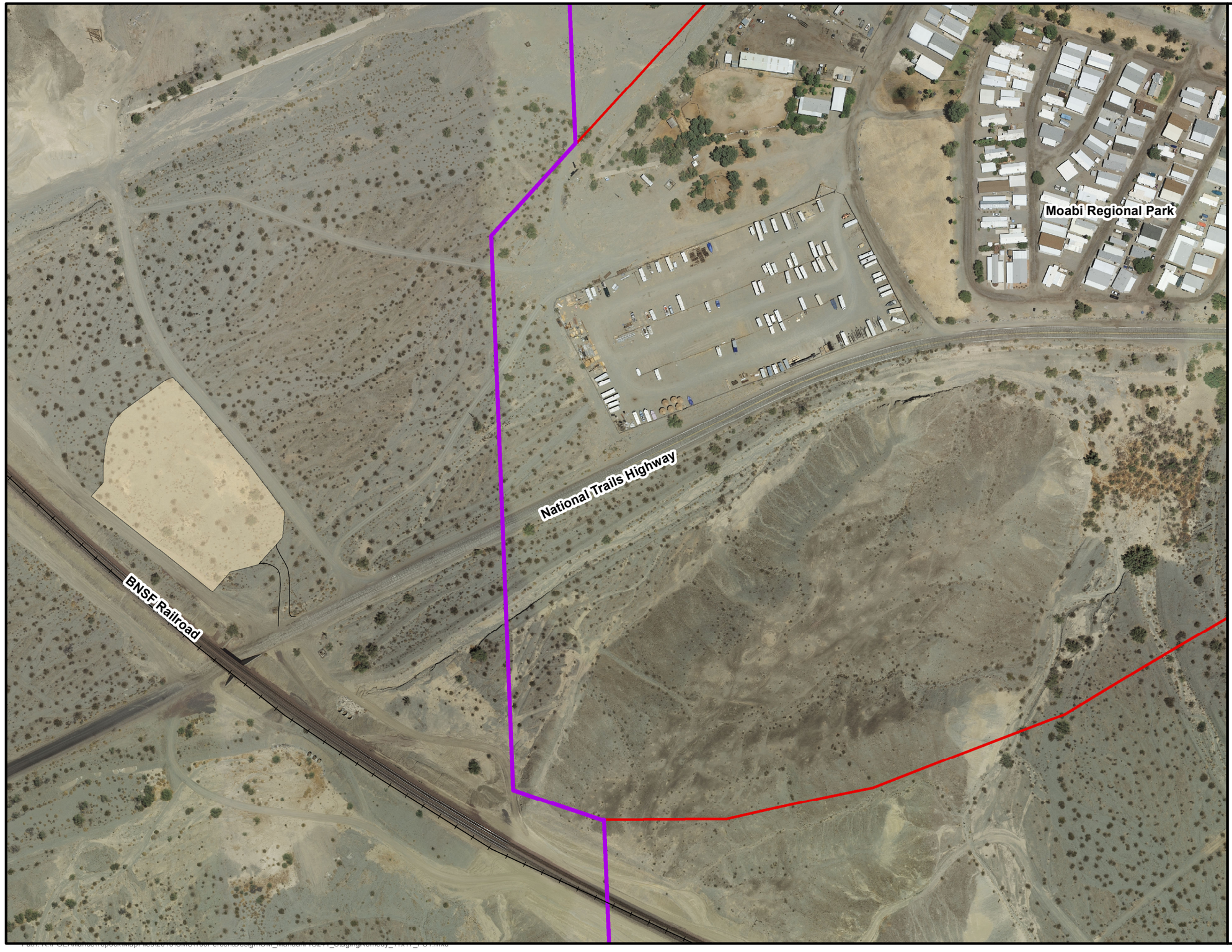
Group	Analyte	TTLC [a, i]	STLC [b] Screen	RCRA TC [c] Screen	STLC [d, i] (from WET)	RCRA TC [e] (from TCLP)	EPA HW [f]
		mg/kg	mg/kg	mg/kg	mg/L	mg/L	
Polychlorinated Biphenyls							
Semivolatile Organic Compounds							
	2,4-Dinitrotoluene	NE	NE	2.6	NE	0.13	D030
g	2-Methylphenol (o-Cresol)	NE	NE	4,000	NE	200	D023
g	3-Methylphenol (m-Cresol)	NE	NE	4,000	NE	200	D024
g	4-Methylphenol (p-Cresol)	NE	NE	4,000	NE	200	D025
	Hexachlorobenzene	NE	NE	2.6	NE	0.13	D032
	Hexachloroethane	NE	NE	60	NE	3	D034
	Pentachlorophenol	17	17	2,000	1.7	100	D037
Volatile Organic Compounds							
	1,1-Dichloroethene	NE	NE	14	NE	0.7	D029
	1,2-Dichloroethane	NE	NE	10	NE	0.5	D028
	1,4-Dichlorobenzene	NE	NE	150	NE	7.5	D027
	2,4,5-Trichlorophenol	NE	NE	8,000	NE	400	D041
	2,4,6-Trichlorophenol	NE	NE	40	NE	2	D042
	Benzene	NE	NE	10	NE	0.5	D018
	Carbon tetrachloride	NE	NE	10	NE	0.5	D019
	Chlorobenzene	NE	NE	2,000	NE	100	D021
	Chloroform	NE	NE	120	NE	6	D022
	Hexachlorobutadiene	NE	NE	10	NE	0.5	D033
	Methyl ethyl ketone	NE	NE	4,000	NE	200	D035
	Nitrobenzene	NE	NE	40	NE	2	D036
	Tetrachloroethene	NE	NE	14	NE	0.7	D039
	Trichloroethene	2,040	2,040	10	204	0.5	D040
	Vinyl chloride	NE	NE	4	NE	0.2	D043

Notes:

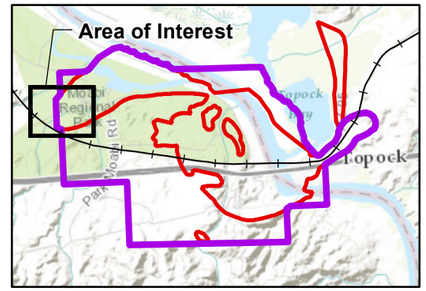
NE	not established
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
EPA HW	Environmental Protection Agency Hazardous Waste Code
TC	Toxicity Characteristic
TTLC	Total Threshold Limit Concentration
STLC	Soluble Threshold Limit Concentration
RCRA	Resource Conservation and Recovery Act
TCLP	Toxicity Characteristic Leaching Procedure
WET	California Waste Extraction Test

Hazardous waste critiera exist for kepone, 2,4-D, mirex, pyridine, and 2,45-TP (Silvex); however, since they are not contaminants of potential concern at the Topock site, they are excluded from this table.

a	Total Threshold Limit Concentration (TTLC) from 22 CCR 66261.24(a)(2). Calculated based on the concentration of the elements, not the compounds.
b	Screening level is 10x Soluble Threshold Limit Concentraction (STLC). If screening level is exceeded in total analysis, California Waste Extraction Test (WET) should be run to evaluate whether STLC is exceeded.
c	Screening level is 20x RCRA Toxicity Characteristic (TC). If screening level is exceeded in total analysis, Toxicity Characteristic Leaching Procedure (TCLP) should be run to evaluate whether RCRA TC is exceeded.
d	Soluble threshold limit concentration from 22 CCR 66261.24(a)(2), measured using the WET. Calculated based on the concentration of the elements, not the compounds.
e	RCRA TC level from 22 CCR 66261.24(a)(1), measured using the TCLP.
f	A waste is assigned a RCRA waste code for each constituent where the results of the TCLP equal or exceed the RCRA TC level.
g	If o-, m- and p-Cresol concentrations cannot be differentiated, the total cresol (D026) concentration is used. The regulatory level of total cresol is 200 mg/L.
i	In the case of asbestos and elemental metals, the specified concentration limits apply only if the substances are in a friable, powdered or finely divided state. Asbestos includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite.
j	TTLC and STLC exclude barite. TTLC excludes barium sulfate.
k	For STLC, if the waste does not exceed the RCRA TC or exhibit another RCRA hazardous characteristic, the STLC is 560 mg/L, not 5 mg/L.
l	For TTLC, excludes molybdenum disulfide.
h	Quantitation limit is greater than the calculated regulatory level. The quantitation limit therefore becomes the regulatory level.



VICINITY MAP



LEGEND

- Clean Soil Storage Area (2.56 Acres Approximate)
- Area of Potential Effects (APE)
- EIR Project Area

N

0 90 180 360 Feet

Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS

FIGURE 2.4-1
CLEAN SOIL STORAGE AREA
GROUNDWATER REMEDY IMPLEMENTATION - SOIL MANAGEMENT PLAN
PG&E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

CH2MHILL

SECTION 3

Soil Storage

This section describes the storage procedures for soil displaced in the vicinity of the groundwater remedy system during drilling, construction, decommissioning, removal, and O&M activities at the site. Displaced soil will be segregated into the following streams:

- RCRA hazardous waste
- Non-RCRA hazardous waste
- Non-hazardous soil above interim screening levels or project-specific cleanup goals (once established)
- Clean soil

Soil that is classified as clean soil that is suitable for final deposition onsite will be managed following the BMPs described in Section 3.1.2 below, the PG&E Program Quality Assurance Project Plan (Appendix C of the Construction/Remedial Action Work Plan), and the Groundwater Remedy Industrial SWPPP (Appendix E of Volume 1 of this O&M Manual).

The procedures for accumulation of hazardous waste onsite will be in compliance with California action-specific ARAR #79 (22 CCR 66262.34). In addition, containerization of hazardous waste will be in compliance with ARAR #84 (22 CCR, Div 4.5, Ch 14, Article 9), ARAR #85 (22 CCR, Div 4.5, Ch 14, Article 10) and for RCRA hazardous waste, ARAR #86 (22 CCR Div 4.5, Ch 14, Article 12).

3.1 Methods to Store Soil

Soil will be stored in 55-gallon drums/small containers, roll-off bins, and/or stockpiles. Soil that is classified as hazardous waste and placed in containers must comply with Title 22 CCR Div. 4.5, Chapter 15, Article 9 (container management), Article 27, Article 28 and Article 28.5 (air emission standards) as required by ARAR #79, and with 22 CCR Div. 4.5, Chapter 14, Article 9 (container management) as required by ARAR #84. A BMPs Plan for soil storage is included in Appendix C of this SMP, and is summarized in the subsections below. PG&E does not anticipate utilizing any remote locations for storage of hazardous waste. If hazardous waste is encountered, it will likely be stored at the Compressor Station and/or the Transwestern Bench.

3.1.1 Drums/Small Containers

Drums containing soils which are hazardous waste will be stored in a hazardous waste storage area at the Compressor Station and/or Transwestern Bench and disposed of within 90 days of generation. If needed, drums/small containers that contain soil that may be displaced in the vicinity of the groundwater remedy system that is non-hazardous, but unsuitable for final disposition onsite because contaminants are present above the interim screening level, will be staged for offsite transportation following these BMPs:

- Only DOT-specification containers will be used for soil accumulation.
- Empty drums will be inspected and inventoried upon arrival onsite for signs of contamination and/or deterioration.
- Drums and small containers will be transported to the temporary accumulation areas on wood pallets and will be secured together with non-metallic banding.
- Drums will be placed within a bermed and lined area or otherwise will be provided with secondary containment.
- Adequate aisle space (e.g., 36 inches) will be provided for containers such as 55-gallon drums to allow the unobstructed movement of personnel and equipment for inspection purposes. Drums will be placed with no more than two drums per row. The column length must fit within the lined, bermed area.
- Each drum will be provided with its own label, and labels will be visible for inspection purposes.

- Drums will remain closed except when removing or adding soil to the drum. Closed means that the lid and securing ring must be on and securely tightened.
- Drums containing hazardous waste will not be reused.

3.1.2 Stockpiles

Stockpile management procedures and practices will be implemented to reduce or eliminate pollution to the air and stormwater from materials that are stockpiled. Stockpile protection is required year-round. Any stockpiles will be stored in the staging area and outside of the roadway right-of-way. Stockpiles will be located a minimum of 50 feet away from any concentrated flow of stormwater, drainage courses, and inlets. During the rainy season, stockpiles will be covered and anchored down with gravel bags and/or sand bags.

RCRA and non-RCRA Hazardous Soil. Stockpiling of RCRA and non-RCRA hazardous waste/soil is not planned. It is anticipated that all soil that is above soil screening levels or project-specific cleanup goals (once established) will be placed in roll-off bins or similar containers.

If it is necessary to temporarily stockpile soil classified as RCRA or non-RCRA hazardous waste for up to 90 days to facilitate characterization or staging for offsite transportation, the liner will consist of a single sheet of material, or multiple sheets with seams that are sealed together. Hazardous waste stockpiles will use a minimum 20-mil liner if constructed on a foundation (e.g., pavement or compacted soil) or a 60-mil liner if constructed in a location without a foundation (e.g., unpaved, uncompacted soil). Stockpiled soil will not contain free liquids.

Stockpiles will be inspected by a California-registered professional engineer to verify conformance with these requirements. Temporary staging for up to 90 days prior to offsite transportation will not trigger compliance with ARAR #86 (requirements for waste piles that are applicable to RCRA hazardous waste). The contents of the stockpile, including the words “Hazardous Waste” and the accumulation start date, will be posted on a sign next to the stockpile, and the contents and accumulation start date will be entered in the field logbook. Stockpiles will be inspected on a weekly basis to verify that controls to prevent run-on, runoff, and windblown dispersal of soil are in place and effective. Security and emergency response equipment will be provided as described in Section 3.5. After the final volume of stockpiled soil has been removed, the area will be inspected for visual contamination due to stockpiling activities, and any remaining residual contaminated material will be removed.

Non-Hazardous Soil Above Interim Screening Levels or Project-Specific Cleanup Goals (once established). It is anticipated that all soil that is above soil screening levels or project-specific cleanup goals will not be stockpiled and will be placed in roll-off bins or similar containers. If it is necessary to temporarily stockpile displaced soil that is non-hazardous, but unsuitable for final disposition onsite because contaminants are present above the interim screening level, the following BMPs will be implemented:

- Stockpiles will be constructed with liner and perimeter berm to prevent release or infiltration of liquids. Minimum 20-mil polyethylene sheeting or equivalent will be used for liners.
- Wind erosion will be prevented by use of a cover, applying Soiltac® or a similar soil stabilization product, or other suitable means. If a cover is employed it will be minimum 6-mil polyethylene sheeting or equivalent.
- The perimeter berm will be constructed of clean materials (such as hay bales or straw wattle under the liner).
- If a cover is employed, it will extend over the outer edges of the perimeter berm and liner so that rainfall is prevented from entering the stockpile.
- Covers and perimeter berms will be secured in place when not in use and at the end of each workday and as necessary to prevent wind dispersion or run-off from precipitation events.
- Liquids that accumulate inside the berm will be pumped from the stockpile to a container or tank for characterization and disposal.
- If the stockpile is outside of a secured area, the stockpile will be demarcated with barricades, orange cones, and/or caution tape until the stockpiles are removed from the site.

- Erosion control measures will be employed to prevent stockpiled soil from contributing to surface runoff and wind-generated particulate matter as shown on Figure C-1.
- After the final volume of stockpiled soil has been removed, the area will be inspected for visual contamination due to stockpiling activities, and any remaining residual contaminated material will be removed.

Clean Soil. Stockpiles of displaced soil outside of Soil RFI/RI Investigation Areas that is non-hazardous, clean, and suitable for immediate reuse will be stored following these BMPs:

- Stockpiles will be constructed with liner and perimeter berm to prevent release or infiltration of liquids. Minimum 20-mil polyethylene sheeting or equivalent will be used for liners.
- Wind erosion will be prevented by use of a cover, applying Soiltac® or a similar soil stabilization product, or other suitable means. If a cover is employed it will be minimum 6-mil polyethylene sheeting or equivalent.
- The perimeter berm will be constructed of clean materials (such as hay bales or straw wattle under the liner).
- If a cover is employed, it will extend over the outer edges of the perimeter berm and liner so that rainfall is prevented from entering the stockpile.
- Covers and perimeter berms will be secured in place when not in use and at the end of each workday and as necessary to prevent wind dispersion or run-off from precipitation events.
- If the stockpile is outside of a secured area, the stockpile will be demarcated with barricades, orange cones, and/or caution tape until it is removed from the site.
- Erosion control measures will be employed to prevent stockpiled soil from contributing to surface runoff and wind-generated particulate matter as shown on Figure C-1.
- After the stockpile has been removed, all residual material will be removed from the underlying and surrounding areas.

3.1.3 Roll-off Bins

- All empty roll-off bins will be inspected upon arrival onsite. Any roll-off containers arriving with contents, residual contamination, or deterioration will be rejected. Existing damage (dings, significant paint scratches, broken wheels, etc.), if not significant enough to result in rejection, will be documented upon arrival of the bin using photos and written documentation.
- Roll-off bins will be provided with covers and disposable liners.
- Covers will be properly secured, except when adding or removing soil.
- Old labels will be removed, and each bin will be provided with its own label. Labels will be visible.
- Roll-off bins containing soils that are hazardous waste will be stored in a hazardous waste storage area and disposed of within 90 days of generation.
- Roll-off bins containing clean soil can be stored anywhere on PG&E property or at other properties that have granted permission to PG&E.
- Roll-off bins that contain displaced soil that is non-hazardous, but unsuitable for final disposition onsite because contaminants are present above the interim screening level will be stored at designated locations. The bins will be covered and inspected at a specified frequency (see Section 3.4 for inspection frequencies).

3.2 Hazardous Waste Soil Storage Time Limit

In compliance with 22 CCR 66262.34 (California action-specific ARAR #79), non-RCRA and RCRA hazardous wastes will be removed from the site within 90 days from date of generation. The date of generation is the day that a waste is first placed in a container (drum or roll-off bin) or stockpile. Accumulation start date for containers is

documented on the hazardous waste label. A log or other record will be used to document the accumulation start date for stockpiles.

3.3 Labeling

This section describes the labeling of waste containers.

3.3.1 Hazardous Waste Soil

Labeling for hazardous waste soil and soil pending characterization that could potentially be classified as hazardous will be in accordance with 22 CCR, Division 4.5, Chapter 12 (California action-specific ARAR #78) and 49 Code of Federal Regulations (CFR) 172, 173, and 178. Labels will include the type of waste, location from which the waste was generated, and accumulation start date. "Remediation Waste" will be written on the container with a paint pen, or on a blank label on the side of the container. Containers and roll-off bins used to store/accumulate hazardous waste will be labeled with a pre-printed "Hazardous Waste" label specific to California, with the following information:

- Accumulation start date
- Generator name, address, and phone number
- USEPA ID number
- Waste codes
- Description of waste, including hazardous properties and physical state
- DOT shipping description

Prior to transport, the manifest number will be added to each label. Soil pending characterization that could potentially be classified as hazardous will be labeled with the hazardous waste label described above, except that the waste codes and DOT shipping description will not be entered until the analytical results are received. An "Analysis Pending" or "Waste Material" label, which is a temporary or handwritten label, will be placed next to the hazardous waste label until analytical results are received and reviewed. This label will include generator information, type and location of waste, and the accumulation start date. The waste codes and DOT shipping description must be entered on the Hazardous Waste label, and the Analysis Pending label must be removed, within 10 days of receipt of the analytical results.

The appropriate DOT hazard class label will also be placed on the container prior to loading onto the transport vehicle.

3.3.2 Clean Soil/Non-Hazardous Soil

Containers and roll-off bins used to store/accumulate non-hazardous soil will be labeled as follows:

- Place a "Clean Soil" label on containers/roll-off bins containing soil determined to be suitable for onsite reuse. This is a handwritten label with the following information:
  - Material origin – Specific location of the site
  - Material description (e.g., soil, rock, etc.)
  - Date(s) of displacement or accumulation
  - Generating activity (e.g., drilling, excavation, etc.)
- Place a "Non-hazardous Soil for Offsite Disposal" label on containers/roll-off bins containing soil identified for off-site disposal. This is a handwritten label with the following information:
  - Material origin – Specific location of the site
  - Material description (e.g., soil, rock, etc.)
  - Date(s) of displacement or accumulation
  - Generating activity (e.g., drilling, excavation, etc.)
- Different color labels will be used to distinguish between "Non-Hazardous Clean Soil" and "Non-Hazardous Soil for Offsite Disposal."

3.4 Inspections

In compliance with 22 CCR 66264.15 (California action-specific ARAR #76), soil accumulation or storage areas for hazardous waste will be inspected at a frequency specified in the BMPs Plan (Appendix C) for malfunctions, deterioration, discharges, and leaks that could result in a release.

- Containers and roll-off containers will be inspected for proper closure, leaks, signs of corrosion, or signs of general deterioration, proper labeling, and accumulation time.
- Stockpiles will be inspected for liner, cover, and berm integrity and to check that controls for windborne dispersion and run-on and run-off control are functioning properly.
- Secondary containment structures will be inspected for integrity and accumulation of liquids.
- All areas will be inspected to ensure that good housekeeping practices are maintained.

Any deficiencies observed during inspection will be corrected upon discovery, and corrective measures will be documented. The employee inspecting the storage areas will be responsible for documenting the deficiency and implementing its remedy.

Appropriate measures may include transfer of waste from leaking container to new container, replacement of liner or cover, or repair of containment berm. Copies of inspection reports and corrective measures will be maintained onsite and will be available for review.

As part of BMPs, soil storage areas for displaced soil that has been classified as non-hazardous clean soil will be inspected on a monthly basis as specified in the BMPs Plan (Appendix C).

3.5 Security/Emergency Response

In compliance with 22 CCR 66264.14 (California action-specific ARAR #76), a barrier, such as temporary fencing, will be provided for hazardous waste accumulation areas. PG&E does not anticipate utilizing any remote locations for storage of hazardous waste. If hazardous waste is encountered, it will likely be stored at the Compressor Station and/or the Transwestern Bench.

Hazardous waste soil accumulation areas will also have signs that provide 24-hour emergency contacts and telephone numbers. Hazardous waste accumulation areas will contain emergency response equipment appropriate to applicable waste hazards. The project-specific HSPs will identify the project emergency response procedures and equipment, including emergency response contacts and phone numbers.

In addition to the project-specific HSP procedures, hazardous waste accumulation areas will be provided with fire extinguishers, decontamination equipment including an eye wash station, and an alarm system (if radio equipment is not available to all staff working in accumulation area).

SECTION 4

Waste Training, Profiling, Transportation, and Disposal

This section describes guidelines for waste management training, waste profiling, transportation for offsite disposal, and disposal of displaced soil that is classified as a hazardous or non-hazardous waste soil. The previously established practice at the site is that transportation within the plume boundary is considered to be onsite transportation. Consistent with this practice, transportation of soil within the project's APE is considered to be onsite transportation for purposes of complying with hazardous waste requirements.

4.1 Employee Training for Waste Soil Management

In compliance with 22 CCR 66264.16 (California action-specific ARAR #76), field personnel that will manage hazardous or potentially hazardous waste will obtain:

- Hazardous waste management training that meets the requirements of 22 CCR 66265.16, and that will address how to implement applicable provisions of the hazardous waste contingency plan and how to perform job duties related to hazardous waste management in a manner that complies with hazardous waste regulatory requirements. Each employer working at the site is responsible for providing this training to their employees. The specific content of this training will vary by employer and by job function.
- On-the-job training (as applicable to the job description), including:
  - Project-specific HSP review that requires each site worker and guests to review and sign the plan
  - Activity hazard analysis and daily "tailgate" meetings
  - Project-specific Work Plan review (e.g., this SMP)
  - DOT hazardous material training (49 CFR 172.704)

Training documentation will be maintained and will include the job title for each position involving hazardous waste soil management and the name of the person filling the job, written job description including skills and required qualifications, description of type and amount of continuing training given, and records that document training or job experience.

4.2 Hazardous Waste Profiling

As discussed in Section 2, displaced soil from in and near Soil RFI/RI Investigation Areas will be screened to assess whether it is hazardous using prior knowledge of the soil and sample analytical results. However, in some cases, offsite disposal facilities may require additional analyses to evaluate the soil waste stream prior to acceptance. The purpose of pre-disposal profiling of the hazardous waste soil identified for offsite disposal is to characterize the appropriate disposal method and location.

Ultimately, the profile of the waste must meet the acceptance criteria of the disposal facility and be in compliance with all pertinent federal, state, and local regulations. Characterization will be documented on a waste profile form provided by the offsite treatment or disposal facility as part of the waste acceptance process. An approved copy of the waste profile will be received prior to offsite transportation of the material.

4.3 Manifests/Shipping Documentation

In compliance with 22 CCR 66262.20 and 66262.22 (California action-specific ARAR #77), each load of soil classified as hazardous waste will be manifested prior to leaving the site. The hazardous waste manifest (USEPA Form 8700-22) is the shipping document for tracking shipments of hazardous waste from the site to the final disposal facility. Note that each load of non-hazardous waste will be accompanied by a properly completed non-hazardous waste manifest form or bill of lading.

Additionally, each shipment of waste soil will also have a haul ticket. If the signed hazardous waste manifest from the designated offsite facility is not received within 35 days, PG&E will contact the transporter or the designated facility to determine the status of the waste. All communications will be documented. If the signed hazardous waste manifest has not been received within 45 days, PG&E will prepare an Exception Report and submit it to the State of California, as required under 22 CCR 66262.42.

4.4 Department of Transportation (DOT) Requirements

Requirements under 49 CFR 171-178 (DOT) and 22 CCR 66262.30 through 66262.33 (California action-specific ARAR #78) and the CD (DOI 2013) will apply to all offsite shipments of soil that is classified as hazardous waste. These requirements do not apply to shipments of non-hazardous waste. The information contained in this section is provided as a general guide. Requirements specific to each hazardous waste will be determined in the field. It is the responsibility of a DOT-trained individual to ensure that the requirements of 49 CFR 171-178 are met.

4.4.1 Shipping Name

Each shipment will be properly classified using the Hazardous Materials Table in 49 CFR 172.101. All determinations will be made by DOT-trained personnel.

4.4.2 Packaging, Marking, and Labeling

The shipping name, hazard class, identification number, technical names (if applicable), USEPA markings and waste code numbers, and consignee/consignor designations will be marked on packages for shipment (49 CFR 172.301). Once a waste is characterized, reference will be made to the Hazardous Materials Table in 49 CFR 172.101 to determine the appropriate label.

4.4.3 Placards

Appropriate placards will be determined by DOT-trained personnel. Specific placard descriptions are found starting at 49 CFR 172.521. If a placard is required, it will be affixed on each side and each end of the vehicle. It is the shipper's responsibility to provide the proper placards for their shipment if the transporter does not have them.

4.5 California and Arizona Transportation Requirements

California hazardous waste regulations (22 CCR Division 4.5, Chapter 13) require that anyone engaged in the transportation of hazardous waste within California must possess a valid hazardous waste hauler registration issued by DTSC. Transporters operating in Arizona must also be registered with the Arizona Department of Environmental Quality. Transporters operating in Nevada must also hold a permit and certificate of registration issued by the Nevada Department of Environmental Protection.

4.6 Transporter Requirements

Each transportation vehicle and load of hazardous waste will be inspected before leaving the site and will be documented. A PG&E representative will verify that the driver has the appropriate class of driver's license with appropriate endorsements for the class of vehicle being driven before loading hazardous waste onto the vehicle. The quantities of hazardous waste leaving the site will be recorded on a transportation and disposal log. The transporter must be registered with DTSC as a hazardous waste hauler, have a USEPA Identification number, and must comply with transportation requirements outlined in 49 CFR 171-179 (DOT) and 22 CCR 66262.33 (California action-specific ARAR #78).

The transporter will be responsible for ensuring that loaded trucks comply with all applicable weight limits. For each load of material, weight measurements will be obtained for each full and empty container and dump truck. Disposal quantities will be based on the difference of weight measurements between the full and empty container or dump truck. Weights will be recorded on the waste manifest and weight ticket by the disposal facility.

The transporter will observe the following practices when hauling and transporting hazardous waste (and non-hazardous waste) offsite:

- Minimize impacts to general public traffic.
- Trucks/trailers and roll-off bins used for hauling hazardous or regulated waste will be lined and covered with a tarp or ridged closure before transport to comply with EIR mitigation measure HAZ-2f and to prevent spills or releases.
- Decontaminate exterior of vehicle using dry methods as necessary prior to leaving the site.
- Wastes or materials from other projects may not be combined with wastes generated during this project.
- All personnel involved in offsite disposal activities will follow safety and spill response procedures outlined in project-specific HSPs.

4.7 Spill Reporting

In the event of a spill or release of hazardous (or non-hazardous) waste, the transporter must immediately notify a PG&E representative**.** The following information about the spill will be reported and recorded:

- Type of material (for example, soil) and contaminant
- Location
- Estimated volume
- Media affected (for example, spilled on concrete pad or soil)
- Time of spill/release
- Final disposition of spilled material

The transporter will also report any spill or release of hazardous waste, as required by 49 CFR 171.15, to the National Response Center at 800/424-8802 or 202/426-2675. The transporter will also report, in writing, as required by 49 CFR 171.16, to the Director, Office of Hazardous Materials Regulations, Materials Transportation Bureau, Department of Transportation, Washington D.C. 20590.

4.8 Spill Response

The transporter will clean up any spill or release of hazardous (or non-hazardous) waste (including soil) that occurs during transportation or will take such action as may be required or approved by federal, state, or local officials. Spilled waste will be immediately cleaned up, including soils on the outside of the trucks, the truck and/or container, or road surface. Where appropriate, the spilled material will be returned to the original waste container. Regardless, the spilled material will be properly contained and disposed.

4.9 Waste Disposal

Soil classified as RCRA or non-RCRA hazardous waste, and non-hazardous soil will be disposed of at an appropriately permitted facility. In accordance with the requirements of the CD (DOI 2013), prior to the first shipment of waste material offsite, and annually thereafter, PG&E will demonstrate to DOI's satisfaction that USEPA has determined that the proposed receiving facility is operating in compliance with 42 U.S.C. § 9621(d)(3) and 40 CFR § 300.440. If PG&E knows or has reason to know the facility no longer meets the criteria of 40 CFR § 300.440(b), PG&E will inform DOI, propose an alternate receiving facility prior to any subsequent shipments, and demonstrate to DOI's satisfaction that USEPA has determined that the alternate receiving facility is operating in compliance with 42 U.S.C. § 9621(d)(3) and 40 CFR § 300.440. The waste material will be stored onsite in accordance with this waste management plan until approval is received and the waste material is transported offsite. If the waste management facility is out-of-state, prior to the first shipment of waste material, PG&E will provide written notice for disposal of waste material at the listed facilities to the appropriate state environmental official in each receiving facility's state and the DOI Project Manager, and will comply with state law with regard to providing any further notifications. Additionally, PG&E will notify the state environmental official referenced

above and the DOI Project Manager of any major changes in the shipment plan, such as a decision to ship the waste material to a different out-of-state facility.

SECTION 5

Recordkeeping

California action-specific ARAR #80 (22 CCR 66262.40) requires that hazardous waste manifests, biennial reports, exception reports, and waste analysis and waste determination records be retained for three years. Further, 22 CCR 66262.41 requires large quantity generators of RCRA hazardous waste to submit a biennial report to USEPA by March 1 of each even-numbered year that describes hazardous waste generated in the previous odd-numbered year. In addition, the CD (DOI 2013) requires that project-related records be retained until 10 years after receipt of the Certificate of Completion. The following records and documents will be maintained for the hazardous waste:

- Transportation and offsite disposal records, including:
  - Profiles and associated characterization data
  - Manifests, Land Disposal Restriction (LDR) notifications/certifications, bills of lading, and weight tickets
  - Offsite facility waste receipts, certificates of disposal/destruction/recycle
  - Trucking logs
- Training records
- Inspection records

In addition, in accordance with the *Revised Management Protocol for Handling and Disposition of Displaced Site Material* (Appendix B), PG&E will maintain a Displaced Material Inventory for all displaced soil, which will include:

- Material origin – Specific location of the site.
- Material description (e.g., soil, rock, etc.).
- Date(s) of displacement or accumulation.
- Generating activity (e.g., drilling, excavation, etc.).
- Approximate volume of material stored.
- Short-term storage mode and location – Type of storage (including container identification number, as applicable) and location of short-term storage pending soil characterization. In some cases, this information may need to be updated as containers are moved between areas of the site.
- Characterization status – Characterization sample information (e.g., date of submittal and laboratory used), date of receipt of results, and the contamination assessment based on comparison to screening criteria (as discussed in Section 2.3).
- Storage mode and location – Type of storage (including container identification number, as applicable) and location of storage pending decision regarding final disposition. This information may need to be updated as containers are moved between areas of the site.
- Final disposition information – Indication of the onsite or offsite final disposition action identified through discussion with the Tribe(s), Agencies, and the affected land owner(s), as appropriate, based on review of material type and the contamination assessment.

SECTION 6

Soil Management Plan Updates

PG&E developed this SMP based on the final design for the groundwater remedy, current understanding of historical site activities, and available soil data. This final SMP is submitted with the final design documents. An addendum to the SMP will be prepared to update the screening levels for non-hazardous soil after the project specific cleanup goals are established and during future O&M activities, as warranted. A data report will be prepared after the implementation of the baseline soil sampling to document sampling results and refine soil classification volumes.

In addition, as the soil RFI/RI program advances through the RCRA/CERCLA processes, PG&E will also obtain a better understanding of existing soil conditions across the site by collecting additional analytical data, performing a risk assessment, and (if necessary) developing a Corrective Measures Study/Feasibility Study (CMS/FS) for soil. The CMS/FS will develop project-specific goals and propose appropriate soil remedy(ies). In addition, screening levels included in Tables 2.4-1 and 2.4-2 will be updated as regulations change and project-specific decisions are made. PG&E will review all such new relevant information as it becomes available, incorporate it into future addendum to this SMP as appropriate, and submit the addendum to the regulatory agencies for review and approval.

SECTION 7

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Appendix A
Groundwater Remedy Implementation—
Baseline Soil Sampling and Analysis Plan

Groundwater Remedy Implementation—Baseline Soil Sampling and Analysis Plan, Pacific Gas and Electric Company, Topock Compressor Station, Needles, California

1.0 Introduction

Pacific Gas and Electric Company (PG&E) is implementing the selected groundwater remedy of chromium at the Topock Compressor Station (Compressor Station) in Needles, San Bernardino County, California. The selected remedy consists of the following five primary components:

- In-Situ Reactive Zone (IRZ)
- Inner Recirculation Loop
- Freshwater Injection System
- Institutional Controls (ICs)
- Monitored Natural Attenuation (MNA)

Three components for the groundwater remedy system—IRZ, Inner Recirculation Loop, and Freshwater Injection System—involve construction and installation of infrastructure such as pipelines, pipe trenches, buildings, tanks, electrical equipment, and remediation/monitoring wells, and are the focus of this Sampling and Analysis Plan (SAP).

To document baseline soil conditions prior to groundwater remedy implementation, this SAP has been developed to provide the approach and methods to collect and analyze soil samples in the areas used by the groundwater remedy. In addition, the SAP also includes the collection of data to assist with the management of materials displaced during construction activities, in accordance with the *Revised Management Protocol for Handling and Disposition of Displaced Site Material, Topock Remediation Project, Needles, California* (PG&E 2015) (Appendix B of the Soil Management Plan [SMP]) that was developed by a subgroup consisting of representatives from PG&E, Agencies, Interested Tribes, and other stakeholders. As discussed in Section 2.5 of the Soil Management Plan, the management protocol excludes the provision for long-term storage of soil above the interim screening levels. The process for assessing the baseline data for management of displaced materials is described in the main text of the SMP.

In areas where groundwater remedy infrastructure is within 20 feet of or overlaps with Soil Investigation Areas, the approach presented in this SAP has been fully coordinated with the current RCRA Facility Investigation/ Remedial Investigation (RFI/RI) (CH2M HILL 2013) planning activities to minimize the total number of soil samples to be collected and associated ground disturbances, as well as to ensure consistency between the groundwater and soil programs at Topock. Figures A-1, A-1A, A-2, and A-3 show these overlapping areas (or areas within 20 feet) (tables and figures are presented at the end of this appendix). As shown, remedy infrastructure proposed at the final design stage (i.e., excluding future provisional wells) is within 20 feet of or overlaps with the following twenty-four Soil Investigation Areas:

- SWMU 1 – Former Percolation Bed
- SWMU 5 – Sludge Drying Beds
- SWMU 6 – Chromium Reduction Tank
- SWMU 9 – Transfer Sump
- AOC 1 – Area Around Former Percolation Bed
- AOC 4 - Debris Ravine
- AOC 7 – Hazardous Materials Storage Area
- AOC 8 – Paint Locker
- AOC 9 – Southeast Fence Line (Outside Visitor Parking Area)
- AOC 10 – East Ravine

- AOC 11 – Topographic Low Areas
- AOC 12 – Fill Areas
- AOC 13 – Unpaved Areas within the Compressor Station
- AOC 17 – Onsite Septic System
- AOC 18 – Combined Hazardous Waste Transference Pipelines
- AOC 21 – Round Area by Sludge Drying Beds
- AOC 22 – Unidentified Three-sided Structure
- AOC 27 – MW-24 Bench
- AOC 28 – Pipeline Drip Legs
- AOC 30 – MW 20 Bench
- AOC 33 – Potential Former Burn Area near AOC 17
- Unit 4.3 – Oil/Water Holding Tank
- Perimeter Area outside of but adjacent to the Compressor Station fence line
- Storm Drain System

The following sections discuss the sampling and analytical approach (Section 2); sampling methods, sample management, and shipping (Section 3); procedures for waste management and decontamination (Section 4); data management and reporting (Section 5); references (Section 6); and certification (Section 7). The final SAP has a professional stamp by Keith Sheets, CH2M HILL's supervising California-registered Professional Geologist.

2.0 Sampling and Analytical Approach

Baseline soil samples will be collected along the remedy pipelines/conduits alignments, which include direct burial pipelines/conduits, pipeline trenches, and the remediation wells (i.e., injection and extraction wells) that are connected to those pipelines, as well as at the new remedy monitoring well locations. The exception is that baseline soil sampling will not occur along the alignment of the freshwater pipeline in Arizona, and on the California side, leading to the Compressor Station. The freshwater pipeline will contain groundwater pumped from water supply well(s) installed on the Havasu National Wildlife Refuge (HNWR) in Arizona, near the Topock Marsh. Because inorganic compounds are present in the fresh water at such low concentrations, soil underlying the pipeline would not be adversely impacted by inorganic compounds from incidental releases, spills or leaks from the pipeline. All other remedy pipeline alignments will be part of the baseline sampling plan and will follow the sampling guidelines provided below and presented in Figure A-4 .

Baseline soil samples will also be collected at locations of remedy structures/buildings following the sampling guidelines below and presented in Figure A-5.

Where practicable, proposed sample locations are located near existing roads or in other disturbed areas to minimize the potential for impacts to sensitive resources (cultural, historical, and/or biological). Access routes used to collect baseline soil samples are expected to be the same routes used to construct and install the remedy infrastructure. Qualified biologists and cultural resource consultants will be consulted during the selection of final sampling locations.

2.1 Pipeline Alignment (including Connecting Remediation Wells)

The remedy pipeline/conduit alignments will be installed both above and below ground. To assess baseline conditions along the pipeline/conduit alignments, soil samples will be collected approximately every 500 linear feet along the proposed pipeline/conduit runs. If pipelines/conduits are aboveground, baseline soil samples will be collected at 0.5 foot below ground surface (bgs). If pipelines/conduits alignments are underground, then soil samples will be collected at the bottom of the trench if the pipelines/conduit alignments are outside Soil RFI/RI Investigation areas. Except as noted below, if the pipelines/conduit alignments are in or within 20 feet of Soil RFI/RI Investigation Areas, a soil sample will be collected at 1 foot bgs and at the bottom of the trench to assess conditions for management of disturbed soil.

Proposed remedy pipelines/conduits alignments intersect twenty-four Soil RFI/RI Investigation Areas as shown on Figures A-1 and A-1A. These investigation areas are currently undergoing investigations under the Soil RFI/RI program:

- SWMU 1 – Former Percolation Bed
- SWMU 5 – Sludge Drying Beds
- SWMU 6 – Chromium Reduction Tank
- SWMU 9 – Transfer Sump
- AOC 1 – Area Around Former Percolation Bed
- AOC 4 – Debris Ravine
- AOC 7 – Hazardous Materials Storage Area
- AOC 8 – Paint Locker
- AOC 9 – Southeast Fence Line (Outside Visitor Parking Area)
- AOC 10 – East Ravine
- AOC 11 – Topographic Low Areas, including the two new areas
- AOC 12 – Fill Areas
- AOC 13 – Unpaved Areas within the Compressor Station
- AOC 17 – Onsite Septic System
- AOC 18 – Combined Hazardous Waste Transference Pipelines
- AOC 21 – Round Area by Sludge Drying Beds
- AOC 22 – Unidentified Three-sided Structure (in upper yard)
- AOC 27 – MW-24 Bench
- AOC 28 –Pipeline Drip Legs
- AOC 30 – MW 20 Bench
- AOC 33 – Burn Area near AOC 17
- Unit 4.3 – Oil/Water Holding Tank
- Perimeter Area
- Storm Drain System

As part of the Soil RFI/RI, soil samples will be collected from several samples locations within these seventeen areas. To minimize disturbance and potential impacts to sensitive resources, baseline soil samples will not be collected along a pipeline segment if soil RFI/RI Investigation proposed sample locations and/or existing soil data locations are located within 20 feet of the pipeline/conduit run and meet the criteria of the baseline sample program. Proposed Soil RFI/RI sample locations and existing soil data locations pertinent to this baseline sampling plan are shown in Figures A-1 and A-1A. Figure A-4 shows the decision process that will be used to collect baseline soil samples along the pipelines/conduits.

Baseline soil samples will be analyzed for PAHs, sodium, and Title 22 metals in order to assess potential affects to soil associated with the operation of the groundwater remedy and to provide pre-characterization information prior to remedy construction. Title 22 metals is standard testing methodology for assessment of metals, and includes certain metals that are generally of concern at the Topock Compressor Station. If a baseline soil sample location is within 20 feet of a Soil RFI/RI Investigation Area, the sample will also be analyzed for the Soil RFI/RI Investigation Area analytical suite as presented in Table A-1.

2.2 Remedy Structures

A number of remedy structures are proposed to be constructed to support the groundwater remedy system. A majority of the proposed structures will be within the Compressor Station fence line, the Transwestern Bench, and the MW-20 Bench as shown in Figures A-1 and A-1A. There are a few miscellaneous structures that will also require baseline sampling, including well vaults and soil storage areas as well as the satellite maintenance and storage yard at Moabi Regional Park. The following is a list of key remedy structures; these structures are also shown in Figures A-1, A-1A, and A-2:

- **Structures Located Inside the Compressor Station**
  - Remedy-Produced Water Conditioning Plant
  - Conditioned Water Storage Tanks and Secondary Containment
  - Influent Water Storage Tanks and Secondary Containment
  - Freshwater Storage Tank
  - Decontamination Pad (occupies the same footprint as the Contingent Freshwater Pre-injection Treatment Building)
  - Contingent Storage Tanks associated with the Contingent Freshwater Pre-injection Treatment System
- **Structures Located at the Transwestern Bench**
  - Operation Building
- **Structures Located at the MW-20 Bench**
  - Carbon Amendment Building
  - Carbon Storage Tank
- **Other Remedy Structures**
  - Well Vaults
  - Soil Storage/Processing at Moabi Regional Park
  - Long term remedy support area at Moabi Regional Park (this area will also be used as the main construction yard during remedy construction)

To assess baseline conditions in areas where remedy structures will be constructed, soil samples will be collected on a 50-foot grid, or a minimum of one sample location within each remedy structure footprint. Soil samples will be collected at 0.5 foot below the proposed remedy structure. If the remedy structure is being constructed over an existing structure footprint, baseline soil samples will be collected only if the former structure's foundation is being removed and exposing underlying soil. Surface soil samples (0.5 foot below the ground surface) will be collected on a 100-foot grid in the soil storage areas and the satellite maintenance and storage yard at Moabi Regional Park.

The currently proposed remedy structures are located within 20 feet of or overlap six Soil RFI/RI Investigation Areas. These Soil RFI/RI Investigation Areas and their associated analytical suites are included in Table A-1 and are currently undergoing investigations under the Soil RFI/RI program:

- AOC 7 – Hazardous Materials Storage Area
- AOC 8 – Paint Locker
- AOC 11 – Topographic Low Areas, including the two new areas
- AOC 13 – Unpaved Areas within the Compressor Station
- AOC 17 – Onsite Septic System
- AOC 30 – MW 20 Bench

As part of the Soil RFI/RI, soil samples will be collected from several sample locations within these six Soil RFI/RI areas. To minimize disturbance and impacts to sensitive resources, baseline soil samples will not be collected within the remedy structure footprint if soil RFI/RI Investigation proposed sample locations and/or existing soil data points are located within the proposed structure footprint or within 20 feet of the footprint and meet the criteria of the baseline sample program. Figure A-5 shows the decision process that will be used to collect baseline soil samples within remedy structure footprints.

Baseline soil samples will be analyzed for Title 22 metals, PAHs, and sodium. Except as noted below, if the baseline soil sample location is within 20 feet of or overlaps a Soil RFI/RI Investigation Area, the sample will also be analyzed for the same analytical suite for that Soil RFI/RI Investigation Area as presented in Table A-1.

In addition, select baseline sample locations will be used to collect geotechnical data to support the groundwater remedy design. The areas where geotechnical samples will be collected have been identified and are included in the Final Basis of Design Report, Appendix C.

2.3 New Monitoring Well Locations

A number of new monitoring wells are proposed to be installed to support the groundwater remedy system. To assess baseline conditions in areas where the monitoring wells will be installed, one soil sample will be collected at each new monitoring well location at 1.0 feet bgs. Baseline soil samples will be analyzed for Title 22 metals and sodium. If the baseline soil sample location is within 20 feet of or overlaps a Soil RFI/RI Investigation Area, the sample will also be analyzed for the same analytical suite for that Soil RFI/RI Investigation Area as presented in Table A-1.

The new monitoring well locations intersect nine Soil RFI/RI Investigation Areas:

- AOC 1 – Area Around Former Percolation Bed
- AOC 10 – East Ravine
- AOC 11 – Topographic Low Areas, including the two new areas
- AOC 12 – Fill Areas
- AOC 13 – Unpaved Areas within the Compressor Station
- AOC 27 – MW-24 Bench
- AOC 28 – Pipeline Drip Legs
- AOC 30 – MW 20 Bench
- Perimeter Area

3.0 Sampling Methods, Sample Management, and Shipping

For consistency between the groundwater remedy and the Soil RFI/RI program, soil sample collection and handling activities will follow the standard operating procedures (SOPs) included in the Revised Final Soil RFI/RI Work Plan. Those SOPs are also included in Attachment 1 of this SAP. Sample containers, preservation, and hold times are summarized in Table A-1A.

3.1 Sample Management and Storage

Samples will be placed immediately into field coolers with ice; VOC and TPH-gasoline containers will be arranged in the sample cooler standing upright. The field coolers will be taken to the sample management area, where the samples will be transferred into a refrigerator and/or freezer. If transport of a sample to the laboratory is scheduled for a pickup more than 24 hours after sampling, samples will be stored in the freezer.

3.2 Shipping

Samples collected for chemical analysis will be transported to the laboratory via courier, generally daily. Chains-of-custody will accompany all samples to the laboratory.

4.0 Waste Management and Decontamination

The approach for investigation-derived waste (IDW) management and equipment decontamination is presented in the following subsections.

4.1 Equipment Decontamination

If used for sample collected, the downhole drilling tools, tracks on track rigs, and the back ends of the drilling rigs will be decontaminated prior to arrival at the site and will be cleaned between investigation areas as determined necessary by the field team leader. In addition, a visual inspection will be conducted between boring locations to determine if decontamination is necessary. Decontamination will be accomplished by steam-cleaning or pressure washing the core barrel, drill stem, drive casing, and back of the drilling rig. Equipment may also be cleaned using dry methods prior to leaving an excavation area to prevent the tracking of material out of the area. The backs of drill rigs and down-hole drilling tools will be decontaminated before arrival at the site.

Steam-cleaning or pressure washing will be conducted on the decontamination pad located at the Transwestern Bench. Rinseate from the decontamination operation will be collected on the containment pad and will be transferred to the cuttings bin/drum or portable storage tank. Rinseate will be processed at the IM-3 treatment

plant, the new remedy-produced water conditioning plant, or transported to a PG&E-contracted offsite disposal facility.

4.2 Investigation-derived Waste Management

Several types of waste materials will be generated during the drilling and sampling of soil borings, excavation of potholes, and hand excavation for utility clearance. IDW materials that will be generated include drill cuttings, incidental trash, equipment decontamination water, and possibly small quantities of soil from pothole or hand excavation areas. The IDW will be handled in accordance with the *Revised Management Protocol for Handling and Disposition of Displaced Site Material, Topock Remediation Project, Needles, California* (Soil Management Plan Appendix B).

Drill cuttings include fragments of rock and soil that are removed to create the borehole. The cuttings will be contained in drums or lined roll-off bins at staging areas during drilling and sampling activities. After sampling and characterization, drums and bins will be removed from the staging areas. If cuttings or soil are free from contaminants (below interim screening levels presented in Table A-2), material will be designated appropriate for reuse on site. Cuttings and any soil from excavation areas that exceed the hazardous waste characteristic levels presented in Table A-3 will be considered contaminated and transported to a permitted offsite disposal facility. Cuttings and any soil from excavation areas that are below hazardous waste characteristic levels, but above interim screening levels, will be managed following protocols prescribed in this Soil Management Plan.

Water generated during equipment decontamination will be collected in bins or portable storage tanks temporarily located in staging areas near the drilling sites or at the Compressor Station as needed. Secondary containment will be set up at the drilling area for the portable storage tanks or bins. Rinseate will be processed at the IM No. 3 treatment plant, the new remedy-produced water conditioning plant, or transported to a PG&E-contracted offsite disposal facility.

Incidental trash will be collected at the end of each drilling shift and will be disposed of properly.

5.0 Data Management and Reporting

The electronic data will be used to generate validation reports, data summary tables, and figures. Management of data generated from baseline soil sampling will be conducted in a manner that is consistent with the Soil RFI/RI program.

5.1 Data Validation

Data validation will be carried out when the data packages are received from the laboratory. It will be performed on an analytical batch basis using the summary results of calibration and laboratory quality control, as well as those of the associated field samples. Data packages will be reviewed for all analytes. Raw data will be reviewed when deemed necessary. Data validation procedures will include:

- Review of the data package for completeness.
- Review of chain-of-custody records for discrepancies that might degrade data quality.
- Review for compliance with holding time and quality control frequency requirements.
- Evaluation of all calibration and quality control summary results against the project requirements.
- Verification of analyte identification and calculations for at least 10 percent of the data.
- Qualification of the data using appropriate qualifier flags, as necessary, to reflect data usability limitations.
- Initiation of corrective actions, as necessary, based on the data review findings.

Data validation procedures follow the United States Environmental Protection Agency (USEPA) *Contract Laboratory National Functional Guidelines for Inorganic Data Review* (USEPA 2002) and *Contract Laboratory National Functional Guidelines for Organic Data Review* (USEPA 1999), substituting the qualifiers, the calibration and quality control requirements specified in the *PG&E Program Quality Assurance Project Plan, Revision 2* (CH2M HILL 2012), the Addendum to the QAPP, Revision 2 (CH2M HILL 2015), and the *PG&E Program Quality Assurance Project Plan for Dioxins and Furans* (CH2M HILL 2010).

5.2 Reporting

PG&E will present the results of the baseline soil sampling in a data report, summarizing the sampling event and analysis results. The data report will consist of a discussion of the sampling, laboratory analytical results, a discussion of uncertainties in the data, and a discussion of the implications on management of displaced soil, especially storage of soil. Field documentation, summary tables of laboratory results, and laboratory analytical data sheets will be included as attachments or appendices to the report.

6.0 References

California Department of Toxic Substances Control's Human and Ecological Office (HERO). 2015. *Human Health Risk Note 3–DTSC-Modified Screening Levels*. May.

CH2M HILL. 2005. *Sampling, Analysis, and Field Procedures Manual, PG&E Topock Program*. March 31.

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_____. 2015. *Addendum to PG&E Program Quality Assurance Plan, Revision 2, for the RCRA Facility Investigation/Remedial Investigation, Topock Compressor Station, Needles, California*. November.

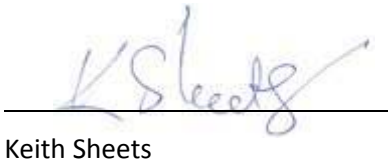
Pacific Gas and Electric Company (PG&E). 2015. *Revised Management Protocol for Handling and Disposition of Displaced Site Material, Topock Remediation Project, Needles, California*. Presented as Appendix B of the Soil Management Plan. November

United States Environmental Protection Agency (USEPA). 1999. *Contract Laboratory National Functional Guidelines for Organic Data Review*.

_____. 2002. *Contract Laboratory National Functional Guidelines for Inorganic Data Review.*

7.0 Certification

This report was prepared by CH2M HILL under the supervision of the professional whose seal and signature appears herein, in accordance with currently accepted professional practices; no warranty, expressed or implied, is made.



Keith Sheets
California Professional Geologist, PG No. 6888

Tables

TABLE A-1

List of RFI/RI Investigation Areas within 20 feet of or that Overlap with Groundwater Remedy Infrastructure and Proposed Analyte Suite

Groundwater Remedy Implementation - Baseline Soil Sampling and Analysis Plan
Pacific Gas and Electric Company, Topock Compressor Station, Needles, California

Soil RFI/RI Investigation Area	Analytical Suite[1]
SWMU 1 – Former Percolation Bed	Title 22 metals, hexavalent chromium, VOCs. SVOCs, PAHs, TPH, pH, pesticides, PCBs[2]
SWMU 5 – Sludge Drying Beds	Title 22 metals, hexavalent chromium, VOCs, TPH, SVOCs, and PAHs
SWMU 6 – Chromium Reduction Tank	Title 22 metals, hexavalent chromium, VOCs, TPH, SVOCs, and PAHs
SWMU 9 – Transfer Sump	Title 22 metals, hexavalent chromium, VOCs, TPH, SVOCs, and PAHs
AOC 1 - Area Around Former Percolation Bed	Title 22 metals, hexavalent chromium, PAHs, pH, PCBs[2], and dioxins and furans
AOC 4 – Debris Ravine	Title 22 metals, PAHs, PCBs, and dioxins/furans
AOC 7 - Hazardous Materials Storage Area	Title 22 metals, hexavalent chromium, VOCs, SVOCs, PAHs, PCBs, TPH, and pH
AOC 8 – Paint Locker	Title 22 metals, VOCs, and TPH
AOC 10 – East Ravine	Title 22 metals, hexavalent chromium, PAHs, Asbestos, dioxins and furans
AOC 9 – Southeast Fence Line (Outside Visitor Parking Area)	Hexavalent chromium, Title 22, PAHs, PCBs, and pesticides
AOC 11 - Topographic Low Areas	Title 22 metals, hexavalent chromium, TPH, SVOCs, PAHs, and PCBs
AOC 12 - Fill Areas	Title 22 metals, hexavalent chromium, VOCs, TPH, PAHs, pH, asbestos, pesticides, and PCBs
AOC 13 - Unpaved Areas within the Compressor Station	Title 22 metals, hexavalent chromium, VOCs, TPH, SVOCs, PAHs, PCBs, and asbestos
AOC 17 - Onsite Septic System	Title 22 metals, hexavalent chromium, VOCs, TPH, SVOCs, and PAHs
AOC 18 – Combined Hazardous Waste Transference Pipelines	Title 22 metals, hexavalent chromium, pH, VOCs, TPH, SVOCs, PCBs, and PAHs
AOC 21 – Round Area by Sludge Drying Beds	Title 22 metals, hexavalent chromium, calcium, sodium, and pH
AOC 22 - Unidentified Three-sided Structure	Title 22 metals, hexavalent chromium, pH, VOCs, TPH, SVOCs, PCBs, and PAHs
AOC 27 – MW-24 Bench	Title 22 metals, hexavalent chromium, pH, VOCs, TPH, SVOCs, PCBs, pesticides, PAHs, and dioxins and furans
AOC 28 - Pipeline Drip Leg	TPH, PAHs, and PCBs
AOC 30 - MW 20 Bench	Title 22 metals, hexavalent chromium, sodium, and chloride
AOC 33 – Former Potential Burn Area Near AOC 17	Title 22 metals, hexavalent chromium, VOCs, TPH, SVOCs, PAHs, PCBs, asbestos, and dioxin and furans
Unit 4.3 – Oil/Water Holding Tank	Title 22 metals, hexavalent chromium, pH, VOCs, TPH, SVOCs, and PAHs
Perimeter Area	Title 22 metals, hexavalent chromium, TPH, SVOCs, PAHs, and PCBs
Storm Drain System	Title 22 metals, hexavalent chromium, TPH, PAHs, and PCBs

Notes:

[1] Analytical suites as presented in the Revised Final Soil RFI/RI Work Plan.(CH2M HILL 2013)
[2] PCB analysis only on soil collected between 0 and 2 feet below ground surface
AOC - Area of Concern
PAHs - polynuclear aromatic hydrocarbons
PCBs - polychlorinated biphenyls
SVOCs - semivolatile organic compounds
TPH - total petroleum hydrocarbons
VOCs - volatile organic compounds

TABLE A-1A

Sample Containers, Preservation, and Holding Times

Groundwater Remedy Implementation – Baseline Soil Sampling and Analysis Plan
PG&E Topock Compressor Station, Needles, California

Analyte	Method	Container and Minimum Quantity		Preservation	Holding Time
		Water	Soil/Sediment		
Metals (except hexavalent chromium)	SW6010B or C, SW6020A, EPA200.7, EPA200.8, SM3120B, EPA245.1, SW7000 series methods	1-liter P or G	8-oz/P, G, or T	Water: Add HNO_3 to pH<2; soil/sediment: None	28 days for mercury; 180 days for all others
Hexavalent Chromium	SW7199	Not applicable	4-oz/P, G, or T	Soil/sediment: Chill to 4°C (±2°C)	Soil: 30 days to extraction, 7 days to analysis

TABLE A-1A

Sample Containers, Preservation, and Holding Times

Groundwater Remedy Implementation – Baseline Soil Sampling and Analysis Plan
PG&E Topock Compressor Station, Needles, California

Analyte	Method	Container and Minimum Quantity		Preservation	Holding Time
		Water	Soil/Sediment		
Pesticides	SW8081A or B	Two 1-liter Amber G	8-oz/ G or T	Chill to 4°C (±2°C)	Water: 7 days to extraction; 40 days to analysis Soil: 14 days to extraction; 40 days to analysis
PCBs	SW8082 or SW8082A	Two 1-liter Amber G	8-oz/ G or T	Chill to 4°C (±2°C)	Water: 7 days to extraction; 40 days to analysis Soil: 14 days to extraction; 40 days to analysis

TABLE A-1A

Sample Containers, Preservation, and Holding Times

Groundwater Remedy Implementation – Baseline Soil Sampling and Analysis Plan
PG&E Topock Compressor Station, Needles, California

Analyte	Method	Container and Minimum Quantity		Preservation	Holding Time
		Water	Soil/Sediment		
Asbestos	Water – EPA 100.1/100.2-TEM Soil- PLM/BULK (present/absent); CARB435/PLM; TEM	1-liter sonicated P	4-oz G	Chill to 4°C (±2°C)	Water: 48 hour holding time Soil: 1 year
Multiple (California WET)	STLC Extraction Analysis by methods listed above	See specific method above for container	8-oz G	Chill to 4°C (±2°C)	See specific matrix and method above for holding time
Multiple (RCRA TCLP)	TCLP Extraction Analysis by methods listed above	See specific method above for container	8-oz G	Chill to 4°C (±2°C)	See specific matrix and method above for holding time

Notes:

< = less than
≤ = less than or equal to
°C = degrees centigrade
G = glass
HCl = hydrochloric acid
HNO_3 = nitric acid
mL = milliliters
NH_4OH = ammonium hydroxide
$(NH_4)_2SO_4$ = ammonium sulfate
oz = ounce
P = polyethylene
PCBs = polychlorinated biphenyls
PAHs = polynuclear aromatic hydrocarbons
RCRA = Resource Conservation and Recovery Act
SIM = selected ion monitoring
SVOCs = semivolatile organic compounds
T = brass sleeves in the sample barrel (sometimes called California brass)
TCLP = Toxicity Characteristic Leaching Procedure
TLC = Teflon lined closure
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds
WET = Waste Extraction Test

TABLE A-2
Reference List of Potentially Applicable Analytes and Associated Screening Levels (rev. July 2015)
Groundwater Remedy Implementation - Baseline Soil Sampling and Analysis Plan
PG&E Topock Compressor Station, Needles, California

Group	Analyte	Interim Screening Level		Interim Screening Level Source	Hazardous Waste Disposal Criteria
Dioxins and Furans (ng/kg)					
	1,2,3,4,6,7,8-HpCDD	NE		Not Established	NE
	1,2,3,4,6,7,8-HpCDF	NE		Not Established	NE
	1,2,3,4,7,8,9-HpCDF	NE		Not Established	NE
	1,2,3,4,7,8-HxCDD	NE		Not Established	NE
	1,2,3,4,7,8-HxCDF	NE		Not Established	NE
	1,2,3,6,7,8-HxCDD	NE		Not Established	NE
	1,2,3,6,7,8-HxCDF	NE		Not Established	NE
	1,2,3,7,8,9-HxCDD	NE		Not Established	NE
	1,2,3,7,8,9-HxCDF	NE		Not Established	NE
	1,2,3,7,8-PeCDD	4.8		EPA Residential RSL	NE
	1,2,3,7,8-PeCDF	NE		Not Established	NE
	2,3,4,6,7,8-HxCDF	NE		Not Established	NE
	2,3,4,7,8-PeCDF	NE		Not Established	NE
	2,3,7,8-TCDD	4.8		EPA Residential RSL	See Table A-3
	2,3,7,8-TCDF	NE		Not Established	NE
	OCDD	NE		Not Established	NE
	OCDF	NE		Not Established	NE
	TEQ Avian	16		Soil Ecological Comparison Value (ECV)	NE
	TEQ Human	50		DTSC HHRA Note 2	NE
	TEQ Mammals	1.6		Soil Ecological Comparison Value (ECV)	NE
Metals (mg/kg)					
	Aluminum	16,400		Background Level	NE
	Antimony	0.285		Soil Ecological Comparison Value (ECV)	See Table A-3
	Arsenic	11	*	Background Level	See Table A-3
	Barium	410	*	Background Level	See Table A-3
	Beryllium	0.672		Background Level	See Table A-3
	Cadmium	1.1	*	Background Level	See Table A-3
	Calcium	66,500		Background Level	NE
	Chromium, Hexavalent	0.83	*	Background Level	See Table A-3
	Chromium, total	39.8	*	Background Level	See Table A-3
	Cobalt	12.7	*	Background Level	See Table A-3
	Copper	16.8		Background Level	See Table A-3
	Cyanide	0.9		Soil Ecological Comparison Value (ECV)	NE
	Iron	55,000		EPA Residential RSL	NE
	Lead	8.39	*	Background Level	See Table A-3
	Magnesium	12,100		Background Level	NE
	Manganese	402	*	Background Level	NE
	Mercury	0.0125		Soil Ecological Comparison Value (ECV)	See Table A-3
	Molybdenum	1.37	*	Background Level	See Table A-3
	Nickel	27.3	*	Background Level	See Table A-3
	Potassium	4,400		Background Level	NE
	Selenium	1.47	*	Background Level	See Table A-3
	Silver	5.15		Soil Ecological Comparison Value (ECV)	See Table A-3
	Sodium	2,070		Background Level	NE
	Thallium	0.78		EPA Residential RSL	See Table A-3
	Vanadium	52.2	*	Background Level	See Table A-3
	Zinc	58	*	Background Level	See Table A-3

TABLE A-2
Reference List of Potentially Applicable Analytes and Associated Screening Levels (rev. July 2015)
Groundwater Remedy Implementation - Baseline Soil Sampling and Analysis Plan
PG&E Topock Compressor Station, Needles, California

Group	Analyte	Interim Screening Level	Interim Screening Level Source	Hazardous Waste Disposal Criteria
Pesticides (µg/kg)				
	4,4-DDD	2.1	Soil Ecological Comparison Value (ECV)	See Table A-3
	4,4-DDE	2	EPA Residential RSL	See Table A-3
	4,4-DDT	1.9	EPA Residential RSL	See Table A-3
	Aldrin	39	EPA Residential RSL	See Table A-3
	alpha-BHC	86	EPA Residential RSL	NE
	alpha-Chlordane	470	Soil Ecological Comparison Value (ECV)	See Table A-3
	beta-BHC	300	EPA Residential RSL	NE
	delta-BHC	300	EPA Residential RSL	NE
	Dieldrin	5	Soil Ecological Comparison Value (ECV)	See Table A-3
	Endo sulfan I	470,000	EPA Residential RSL	NE
	Endo sulfan II	470,000	EPA Residential RSL	NE
	Endosulfan sulfate	470,000	EPA Residential RSL	NE
	Endrin	19,000	EPA Residential RSL	See Table A-3
	Endrin aldehyde	19,000	EPA Residential RSL	NE
	Endrin ketone	19,000	EPA Residential RSL	NE
	gamma-BHC (Lindane)	570	EPA Residential RSL	See Table A-3
	gamma-Chlordane	0.43	DTSC-Residential SLs	See Table A-3
	Heptachlor	130	EPA Residential RSL	See Table A-3
	Heptachlor Epoxide	70	EPA Residential RSL	See Table A-3
	Methoxychlor	320,000	EPA Residential RSL	See Table A-3
	Toxaphene	490	EPA Residential RSL	See Table A-3
Polyaromatic Hydrocarbons (µg/kg)				
	1-Methyl naphthalene	18,000	EPA Residential RSL	NE
	2-Methyl naphthalene	240,000	EPA Residential RSL	NE
	Acenaphthene	3,600,000	EPA Residential RSL	NE
	Acenaphthylene	3,600,000	EPA Residential RSL	NE
	Anthracene	18,000,000	EPA Residential RSL	NE
	B(a)P Equivalent	16	EPA Residential RSL	NE
	Benzo (a) anthracene	160	EPA Residential RSL	NE
	Benzo (a) pyrene	16	EPA Residential RSL	NE
	Benzo (b) fluoranthene	160	EPA Residential RSL	NE
	Benzo (ghi) perylene	1,800,000	EPA Residential RSL	NE
	Benzo (k) fluoranthene	0.39	DTSC-Residential SLs	NE
	Chrysene	3.9	DTSC-Residential SLs	NE
	Dibenzo (a,h) anthracene	16	EPA Residential RSL	NE
	Fluoranthene	2,400,000	EPA Residential RSL	NE
	Fluorene	2,400,000	EPA Residential RSL	NE
	Indeno (1,2,3-cd) pyrene	160	EPA Residential RSL	NE
	Naphthalene	3,800	EPA Residential RSL	NE
	PAH High molecular weight	1,160	Soil Ecological Comparison Value (ECV)	NE
	PAH Low molecular weight	10,000	Soil Ecological Comparison Value (ECV)	NE
	Phenanthrene	1,800,000	EPA Residential RSL	NE
	Pyrene	1,800,000	EPA Residential RSL	NE
Polychlorinated Biphenyls (µg/kg)				
	Aroclor 1016	0.23	DTSC-Residential SLs	See Table A-3
	Aroclor 1221	170	EPA Residential RSL	See Table A-3

TABLE A-2
Reference List of Potentially Applicable Analytes and Associated Screening Levels (rev. July 2015)
Groundwater Remedy Implementation - Baseline Soil Sampling and Analysis Plan
PG&E Topock Compressor Station, Needles, California

Group	Analyte	Interim Screening Level	Interim Screening Level Source	Hazardous Waste Disposal Criteria
Polychlorinated Biphenyls (µg/kg)				
	Aroclor 1232	170	EPA Residential RSL	See Table A-3
	Aroclor 1242	230	EPA Residential RSL	See Table A-3
	Aroclor 1248	230	EPA Residential RSL	See Table A-3
	Aroclor 1254	240	EPA Residential RSL	See Table A-3
	Aroclor 1260	240	EPA Residential RSL	See Table A-3
	Aroclor 1262	240	EPA Residential RSL	See Table A-3
	Aroclor 1268	240	EPA Residential RSL	See Table A-3
	Total PCBs	204	Soil Ecological Comparison Value (ECV)	See Table A-3
Semivolatile Organic Compounds (µg/kg)				
	1,1´-Biphenyl	47,000	EPA Residential RSL	NE
	1,2,4,5-Tetrachlorobenzene	23,000	EPA Residential RSL	NE
	1,4-Dioxane	5,300	EPA Residential RSL	NE
	2,3,4,6-Tetrachlorophenol	1,900,000	EPA Residential RSL	NE
	2,4,5-Trichlorophenol	6,300,000	EPA Residential RSL	See Table A-3
	2,4,6-Trichlorophenol	7.5	DTSC-Residential SLs	See Table A-3
	2,4-Dichlorophenol	190,000	EPA Residential RSL	NE
	2,4-Dimethylphenol	1,300,000	EPA Residential RSL	NE
	2,4-Dinitrophenol	130,000	EPA Residential RSL	NE
	2,4-Dinitrotoluene	1,700	EPA Residential RSL	See Table A-3
	2,6-Dinitrotoluene	360	EPA Residential RSL	NE
	2-Chloro naphthalene	4,800,000	EPA Residential RSL	NE
	2-Chlorophenol	390,000	EPA Residential RSL	NE
	2-Methylphenol (o-Cresol)	3,200,000	EPA Residential RSL	See Table A-3
	2-Nitroaniline	630,000	EPA Residential RSL	NE
	3,3-Dichlorobenzidene	1,200	EPA Residential RSL	NE
	3-Nitroaniline	630,000	EPA Residential RSL	NE
	4,6-Dinitro-2-methylphenol	5,100	EPA Residential RSL	NE
	4-Chloro-3-methylphenol	6,300,000	EPA Residential RSL	NE
	4-Chloroaniline	2,700	EPA Residential RSL	NE
	4-Methylphenol (p-Cresol)	500	Soil Ecological Comparison Value (ECV)	See Table A-3
	4-Nitroaniline	27,000	EPA Residential RSL	NE
	Acetophenone	7,800,000	EPA Residential RSL	NE
	Atrazine	2,400	EPA Residential RSL	NE
	Benzaldehyde	7,800,000	EPA Residential RSL	NE
	Benzoic acid	250,000,000	EPA Residential RSL	NE
	Benzyl alcohol	6,300,000	EPA Residential RSL	NE
	Bis (2-chloroethoxy) methane	190,000	EPA Residential RSL	NE
	Bis (2-ethylhexyl) phthalate	2,870	Soil Ecological Comparison Value (ECV)	NE
	Butyl benzyl phthalate	290,000	EPA Residential RSL	NE
	Caprolactam	31,000,000	EPA Residential RSL	NE
	Carbazole	1,600,000	EPA Residential RSL	NE
	Dibenzofuran	73,000	EPA Residential RSL	NE
	Diethyl phthalate	51,000,000	EPA Residential RSL	NE
	Dimethyl phthalate	51,000,000	EPA Residential RSL	NE
	Di-N-butyl phthalate	46.9	Soil Ecological Comparison Value (ECV)	NE
	Di-N-octyl phthalate	630,000	EPA Residential RSL	NE
	Hexachlorobenzene	210	EPA Residential RSL	See Table A-3

TABLE A-2
Reference List of Potentially Applicable Analytes and Associated Screening Levels (rev. July 2015)
Groundwater Remedy Implementation - Baseline Soil Sampling and Analysis Plan
PG&E Topock Compressor Station, Needles, California

Group	Analyte	Interim Screening Level	Interim Screening Level Source	Hazardous Waste Disposal Criteria
Semivolatile Organic Compounds (µg/kg)				
	Hexachloroethane	1,800	EPA Residential RSL	See Table A-3
	N-Nitroso-di-n-propylamine	78	EPA Residential RSL	NE
	N-nitrosodiphenylamine	110,000	EPA Residential RSL	NE
	Pentachlorophenol	1,000	EPA Residential RSL	See Table A-3
	Phenol	19,000,000	EPA Residential RSL	NE
Total Petroleum Hydrocarbons (mg/kg)				
	TPH as diesel	240	SF RWQCB ESL for direct exposure (2013)	NE
	TPH as gasoline	770	SF RWQCB ESL for direct exposure (2013)	NE
	TPH as motor oil	10,000	SF RWQCB ESL for direct exposure (2013)	NE
Volatile Organic Compounds (µg/kg)				
	1,1,1,2-Tetrachloroethane	550	DTSC-Residential SLs	NE
	1,1,1-Trichloroethane	1,700	DTSC-Residential SLs	NE
	1,1,2,2-Tetrachloroethane	600	EPA Residential RSL	NE
	1,1,2-Trichloroethane	1,100	EPA Residential RSL	NE
	1,1,2-Trichlorotrifluoroethane (Freon 113)	40,000,000	EPA Residential RSL	NE
	1,1-Dichloroethane	1,600	DTSC-Residential SLs	NE
	1,1-Dichloroethene	230,000	EPA Residential RSL	See Table A-3
	1,1-Dichloropropene	1,800	EPA Residential RSL	NE
	1,2,3-Trichlorobenzene	63,000	EPA Residential RSL	NE
	1,2,3-Trichloropropane	5.1	EPA Residential RSL	NE
	1,2,4-Trichlorobenzene	24,000	EPA Residential RSL	NE
	1,2,4-Trimethylbenzene	58,000	EPA Residential RSL	NE
	1,2-Dibromo-3-chloropropane	5.3	EPA Residential RSL	NE
	1,2-Dibromoethane	7.2	DTSC-Residential SLs	NE
	1,2-Dichlorobenzene	1,800,000	EPA Residential RSL	NE
	1,2-Dichloroethane	460	EPA Residential RSL	See Table A-3
	1,2-Dichloropropane	1,000	EPA Residential RSL	NE
	1,3,5-Trimethylbenzene	210	DTSC-Residential SLs	NE
	1,3-Dichlorobenzene	1,800,000	EPA Residential RSL	NE
	1,3-Dichloropropane	420	DTSC-Residential SLs	NE
	1,4-Dichlorobenzene	2,600	EPA Residential RSL	See Table A-3
	2,2-Dichloropropane	1,600,000	EPA Residential RSL	NE
	2-Chlorotoluene	480	DTSC-Residential SLs	NE
	2-Hexanone	200,000	EPA Residential RSL	NE
	4-Isopropyltoluene	1,900,000	EPA Residential RSL	NE
	Acetone	61,000,000	EPA Residential RSL	NE
	Acrolein	140	EPA Residential RSL	NE
	Acrylonitrile	0.068	DTSC-Residential SLs	NE
	Benzene	0.33	DTSC-Residential SLs	See Table A-3
	Bis (2-chloroethyl) ether	230	EPA Residential RSL	NE
	Bis (2-chloroisopropyl) ether	4,900	EPA Residential RSL	NE
	Bromobenzene	290,000	EPA Residential RSL	NE
	Bromochloromethane	150,000	EPA Residential RSL	NE
	Bromodichloromethane	280	DTSC-Residential SLs	NE
	Bromoform	19,000	EPA Residential RSL	NE
	Bromomethane	6,800	EPA Residential RSL	NE

TABLE A-2
Reference List of Potentially Applicable Analytes and Associated Screening Levels (rev. July 2015)
Groundwater Remedy Implementation - Baseline Soil Sampling and Analysis Plan
PG&E Topock Compressor Station, Needles, California

Group	Analyte	Interim Screening Level	Interim Screening Level Source	Hazardous Waste Disposal Criteria
Volatile Organic Compounds (µg/kg)				
	Carbon disulfide	770,000	EPA Residential RSL	NE
	Carbon tetrachloride	0.099	DTSC-Residential SLs	See Table A-3
	Chlorobenzene	280,000	EPA Residential RSL	See Table A-3
	Chloroethane	3.1	DTSC-Residential SLs	NE
	Chloroform	320	EPA Residential RSL	See Table A-3
	Chloromethane	110,000	EPA Residential RSL	NE
	cis-1,2-Dichloroethene	19	DTSC-Residential SLs	NE
	cis-1,3-Dichloropropene	1,800	EPA Residential RSL	NE
	Cyclohexane	6,500,000	EPA Residential RSL	NE
	Dibromochloromethane	750	EPA Residential RSL	NE
	Dibromomethane	23,000	EPA Residential RSL	NE
	Dichlorodifluoromethane	87,000	EPA Residential RSL	NE
	Ethylbenzene	5,800	EPA Residential RSL	NE
	Hexachlorobutadiene	1,200	EPA Residential RSL	See Table A-3
	Hexachlorocyclopentadiene	1,800	EPA Residential RSL	NE
	Isophorone	570,000	EPA Residential RSL	NE
	Isopropylbenzene	1,900,000	EPA Residential RSL	NE
	m,p-Xylenes	550,000	EPA Residential RSL	NE
	Methyl acetate	24,000	DTSC-Residential SLs	NE
	Methyl ethyl ketone	27,000,000	EPA Residential RSL	See Table A-3
	Methyl isobutyl ketone	5,300,000	EPA Residential RSL	NE
	Methyl tert-butyl ether (MTBE)	47,000	EPA Residential RSL	NE
	Methylcyclohexane	6,500,000	EPA Residential RSL	NE
	Methylene chloride	5.5	DTSC-Residential SLs	NE
	N-Butylbenzene	1,200	DTSC-Residential SLs	NE
	Nitrobenzene	5,100	EPA Residential RSL	See Table A-3
	N-Propylbenzene	3,800,000	EPA Residential RSL	NE
	o-Xylene	650,000	EPA Residential RSL	NE
	p-Chlorotoluene	440	DTSC-Residential SLs	NE
	sec-Butylbenzene	2,200	DTSC-Residential SLs	NE
	Styrene	6,000,000	EPA Residential RSL	NE
	tert-Butylbenzene	2,200	DTSC-Residential SLs	NE
	Tetrachloroethene	0.6	DTSC-Residential SLs	See Table A-3
	Toluene	1,100	DTSC-Residential SLs	NE
	trans-1,2-Dichloroethene	190	DTSC-Residential SLs	NE
	trans-1,3-Dichloropropene	1,800	EPA Residential RSL	NE
	Trichloroethene	940	EPA Residential RSL	See Table A-3
	Trichlorofluoromethane (Freon 11)	730,000	EPA Residential RSL	NE
	Vinyl chloride	59	EPA Residential RSL	See Table A-3
	Xylenes, total	650,000	EPA Residential RSL	NE

Notes:

This table presents a reference list of analytes and associated screening levels that may be applicable for making decisions related to disposition of displaced site materials. The specific analytes and screening levels applicable for characterization of displaced material will be determined based on the origin of the material and potential disposition locations.

Interim screening level is background value. If background value is not available then the lesser of the DTSC HHRA Note 3 Residential Screening Levels (DTSC Residential SL) or the ecological comparison value is used. If a DTSC Residential SL is not available, it is the lesser of the USEPA residential regional screening level or the ecological comparison value.

Background	"Final Soil Background Investigation at Pacific Gas and Electric Company Topock Compressor Station, Needles, California" (CH2M HIll 2009c)
DTSC-Residential SLs	Human Health Risk Assessment Note 3 – DTSC-Modified Screening Levels, May 2015.
EPA Residential RSL	United States Environmental Protection Agency Residential Soil Regional Screening Level (THQ=1.0), June 2015.
ECV	Ecological Comparison Values; ECV were calculated as needed for constituents detected during the Part A Phase I sampling (Arcadis 2008)
HHRA Note 2	DTSC Human Health Risk Assessment (HHRA) Note 2: Remedial Goals for Dioxins and Dioxin-like Compounds for Consideration at California Hazardous Waste Sites – Interim (May 2009).
SF RWQCB ESL	San Francisco Bay Regional Water Quality Control Board Environmental Screening Levels for residential direct exposure (2013)
*	One or more screening levels (EPA Residential RSL, DTSC-Residential SLs, ECV, or Soil SL) have values lower than the background level.
NE	not established
mg/kg	milligrams per kilogram
ng/kg	nanograms per kilogram
µg/kg	micrograms per kilogram

TABLE A-3
Hazardous Waste Toxicity Characteristic Levels
Groundwater Remedy Implementation - Baseline Soil Sampling and Analysis Plan
PG&E Topock Compressor Station, Needles, California

Group	Analyte	TTLC [a, i]	STLC [b] Screen	RCRA TC [c] Screen	STLC [d, i] (from WET)	RCRA TC [e] (from TCLP)	EPA HW [f]
		mg/kg	mg/kg	mg/kg	mg/L	mg/L	
Asbetos							
	Asbestos	1%	NE	NE	NE	NE	NE
Dioxins and Furans							
	2,3,7,8-TCDD	0.01	0.01	NE	0.001	NE	NE
Metals							
	Antimony	500	150	NE	15	NE	NE
	Arsenic	500	50	100	5	5	D004
j	Barium	10,000	1,000	2,000	100	100	D005
	Beryllium	75	7.5	NE	0.75	NE	NE
	Cadmium	100	10	20	1	1	D006
	Chromium, Hexavalent	500	50	NE	5	NE	NE
k	Chromium, total	2,500	50	100	5	5	D007
	Cobalt	8,000	800	NE	80	NE	NE
	Copper	2,500	250	NE	25	NE	NE
	Lead	1,000	50	100	5	5	D008
	Mercury	20	2	4	0.2	0.2	D009
l	Molybdenum	3,500	3,500	NE	350	NE	NE
	Nickel	2,000	200	NE	20	NE	NE
	Selenium	100	10	20	1	1	D010
	Silver	500	50	100	5	5	D011
	Thallium	700	70	NE	7	NE	NE
	Vanadium	2,400	240	NE	24	NE	NE
	Zinc	5,000	2,500	NE	250	NE	NE
Pesticides							
	4,4-DDD	1	1	NE	0.1	NE	NE
	4,4-DDE	1	1	NE	0.1	NE	NE
	4,4-DDT	1	1	NE	0.1	NE	NE
	Aldrin	1.4	1.4	NE	0.14	NE	NE
	alpha-Chlordane	2.5	2.5	0.6	0.25	0.03	D020
	Dieldrin	8	8	NE	0.8	NE	NE
	Endrin	0.2	0.2	0.4	0.02	0.02	D012
	gamma-BHC (Lindane)	4	4	8	0.4	0.4	D013
	gamma-Chlordane	2.5	2.5	0.6	0.25	0.03	D020
	Heptachlor	4.7	4.7	0.16	0.47	0.008	D031
	Heptachlor Epoxide	4.7	4.7	0.16	0.47	0.008	D031
	Methoxychlor	100	100	200	10	10	D014
	Toxaphene	5	5	10	0.5	0.5	D015
Polychlorinated Biphenyls							
	Aroclor 1016	50	50	NE	5	NE	NE
	Aroclor 1221	50	50	NE	5	NE	NE
	Aroclor 1232	50	50	NE	5	NE	NE
	Aroclor 1242	50	50	NE	5	NE	NE
	Aroclor 1248	50	50	NE	5	NE	NE
	Aroclor 1254	50	50	NE	5	NE	NE
	Aroclor 1260	50	50	NE	5	NE	NE
	Aroclor 1262	50	50	NE	5	NE	NE
	Aroclor 1268	50	50	NE	5	NE	NE
	Total PCBs	50	50	NE	5	NE	NE

TABLE A-3
Hazardous Waste Toxicity Characteristic Levels
Groundwater Remedy Implementation - Baseline Soil Sampling and Analysis Plan
PG&E Topock Compressor Station, Needles, California

Group	Analyte	TTLC [a, i]	STLC [b] Screen	RCRA TC [c] Screen	STLC [d, i] (from WET)	RCRA TC [e] (from TCLP)	EPA HW [f]
		mg/kg	mg/kg	mg/kg	mg/L	mg/L	
Polychlorinated Biphenyls							
Semivolatile Organic Compounds							
	2,4-Dinitrotoluene	NE	NE	2.6	NE	0.13	D030
g	2-Methylphenol (o-Cresol)	NE	NE	4,000	NE	200	D023
g	3-Methylphenol (m-Cresol)	NE	NE	4,000	NE	200	D024
g	4-Methylphenol (p-Cresol)	NE	NE	4,000	NE	200	D025
	Hexachlorobenzene	NE	NE	2.6	NE	0.13	D032
	Hexachloroethane	NE	NE	60	NE	3	D034
	Pentachlorophenol	17	17	2,000	1.7	100	D037
Volatile Organic Compounds							
	1,1-Dichloroethene	NE	NE	14	NE	0.7	D029
	1,2-Dichloroethane	NE	NE	10	NE	0.5	D028
	1,4-Dichlorobenzene	NE	NE	150	NE	7.5	D027
	2,4,5-Trichlorophenol	NE	NE	8,000	NE	400	D041
	2,4,6-Trichlorophenol	NE	NE	40	NE	2	D042
	Benzene	NE	NE	10	NE	0.5	D018
	Carbon tetrachloride	NE	NE	10	NE	0.5	D019
	Chlorobenzene	NE	NE	2,000	NE	100	D021
	Chloroform	NE	NE	120	NE	6	D022
	Hexachlorobutadiene	NE	NE	10	NE	0.5	D033
	Methyl ethyl ketone	NE	NE	4,000	NE	200	D035
	Nitrobenzene	NE	NE	40	NE	2	D036
	Tetrachloroethene	NE	NE	14	NE	0.7	D039
	Trichloroethene	2,040	2,040	10	204	0.5	D040
	Vinyl chloride	NE	NE	4	NE	0.2	D043

Notes:

NE	not established
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
EPA HW	Environmental Protection Agency Hazardous Waste Code
TC	Toxicity Characteristic
TTLC	Total Threshold Limit Concentration
STLC	Soluble Threshold Limit Concentration
RCRA	Resource Conservation and Recovery Act
TCLP	Toxicity Characteristic Leaching Procedure
WET	California Waste Extraction Test

Hazardous waste critiera exist for kepone, 2,4-D, mirex, pyridine, and 2,45-TP (Silvex); however, since they are not contaminants of potential concern at the Topock site, they are excluded from this table.

a	Total Threshold Limit Concentration (TTLC) from 22 CCR 66261.24(a)(2). Calculated based on the concentration of the elements, not the compounds.
b	Screening level is 10x Soluble Threshold Limit Concentraction (STLC). If screening level is exceeded in total analysis, California Waste Extraction Test (WET) should be run to evaluate whether STLC is exceeded.
c	Screening level is 20x RCRA Toxicity Characteristic (TC). If screening level is exceeded in total analysis, Toxicity Characteristic Leaching Procedure (TCLP) should be run to evaluate whether RCRA TC is exceeded.
d	Soluble threshold limit concentration from 22 CCR 66261.24(a)(2), measured using the WET. Calculated based on the concentration of the elements, not the compounds.
e	RCRA TC level from 22 CCR 66261.24(a)(1), measured using the TCLP.
f	A waste is assigned a RCRA waste code for each constituent where the results of the TCLP equal or exceed the RCRA TC level.
g	If o-, m- and p-Cresol concentrations cannot be differentiated, the total cresol (D026) concentration is used. The regulatory level of total cresol is 200 mg/L.
i	In the case of asbestos and elemental metals, the specified concentration limits apply only if the substances are in a friable, powdered or finely divided state. Asbestos includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite.
j	TTLC and STLC exclude barite. TTLC excludes barium sulfate.
k	For STLC, if the waste does not exceed the RCRA TC or exhibit another RCRA hazardous characteristic, the STLC is 560 mg/L, not 5 mg/L.
l	For TTLC, excludes molybdenum disulfide.
h	Quantitation limit is greater than the calculated regulatory level. The quantitation limit therefore becomes the regulatory level.

Figures

COLORADO RIVER

MW-20 Bench

See Figure A-1A
for Detailed Drawing
of the
Topock Compressor Station Area

Transwestern Bench

LEGEND

- Proposed Remedy System Soil Sample Location
- Proposed Remedy System Well and Vault Soil Sample Location
- Proposed RFI/RI Soil Sample Location
- Proposed XRF Screening Location
- Existing Soil Sample Location
- Existing Opportunistic Soil Sample Location

Provisional Wells:

- Extraction Well
- Injection Well
- Monitoring Well

- Planned Transformer
- Future Provisional Transformer
- Site Fence Boundary
- Stormwater Piping Below Ground
- Stormwater Piping Above Ground

Pipeline Corridor for Remedy

- Aboveground Pipe
- Underground Pipe/Conduit
- Property Boundaries
- Area of Potential Effects (APE)
- EIR Project Area

- Area for East Ravine (ER) Wells (ER-7 to ER-11)
- Area for Potential Slant Well Screens
- Area for Inner Recirculation Loop (IRL) Wells
- Area for River Bank Extraction Wells

Work Areas

- Solid Waste Management Unit (SWMU)
- Area of Concern (AOC)
- Other

Remedy Facilities

- Proposed Remedy Structure
- Contingent Freshwater Pre-injection Treatment System

Notes:
1. Soil sampling locations are approximate.
2. No baseline soil sampling is proposed for freshwater pipeline, wells, and associated infrastructure.
3. Baseline soil samples will be collected at 0.5 feet below ground surface (bgs) for aboveground pipelines/conduit runs and from the bottom of the trench for underground pipelines/conduit runs approximately every 500 linear feet along proposed pipeline/conduit runs (see Figure A-4 for more details).
4. Baseline soil samples will be collected at 0.5 feet bgs below the remedy structure on a 50-foot grid, or a minimum of one sample location within each remedy structure footprint (see Figure A-5 for more details).
5. Baseline soil samples will be collected at 1 foot bgs at each new monitoring, extraction, injection, and recirculation well and at 0.5 feet bgs from the bottom of the associated well vault.
6. If provisional groundwater remedy infrastructure and areas are needed, they will be sampled according to the baseline sampling program at the time of installation/use.
7. To minimize disturbance and potential impacts to sensitive resources, baseline soil samples have not been proposed at remedy infrastructure if soil RFI/RI Investigation proposed sample locations and/or existing soil data locations are located within 20 feet the infrastructure and meet the criteria of the baseline sample program.
8. All well and structure locations are approximate.

N

0 145 290 580 Feet

FIGURE A-1
GROUNDWATER REMEDY FEATURES, SOLID WASTE MANAGEMENT UNITS, AREAS OF CONCERN, BASELINE SOIL SAMPLE LOCATIONS, EXISTING AND PROPOSED RFI/RI SOIL SAMPLE LOCATIONS OUTSIDE THE COMPRESSOR STATION

GROUNDWATER REMEDY IMPLEMENTATION - SOIL MANAGEMENT PLAN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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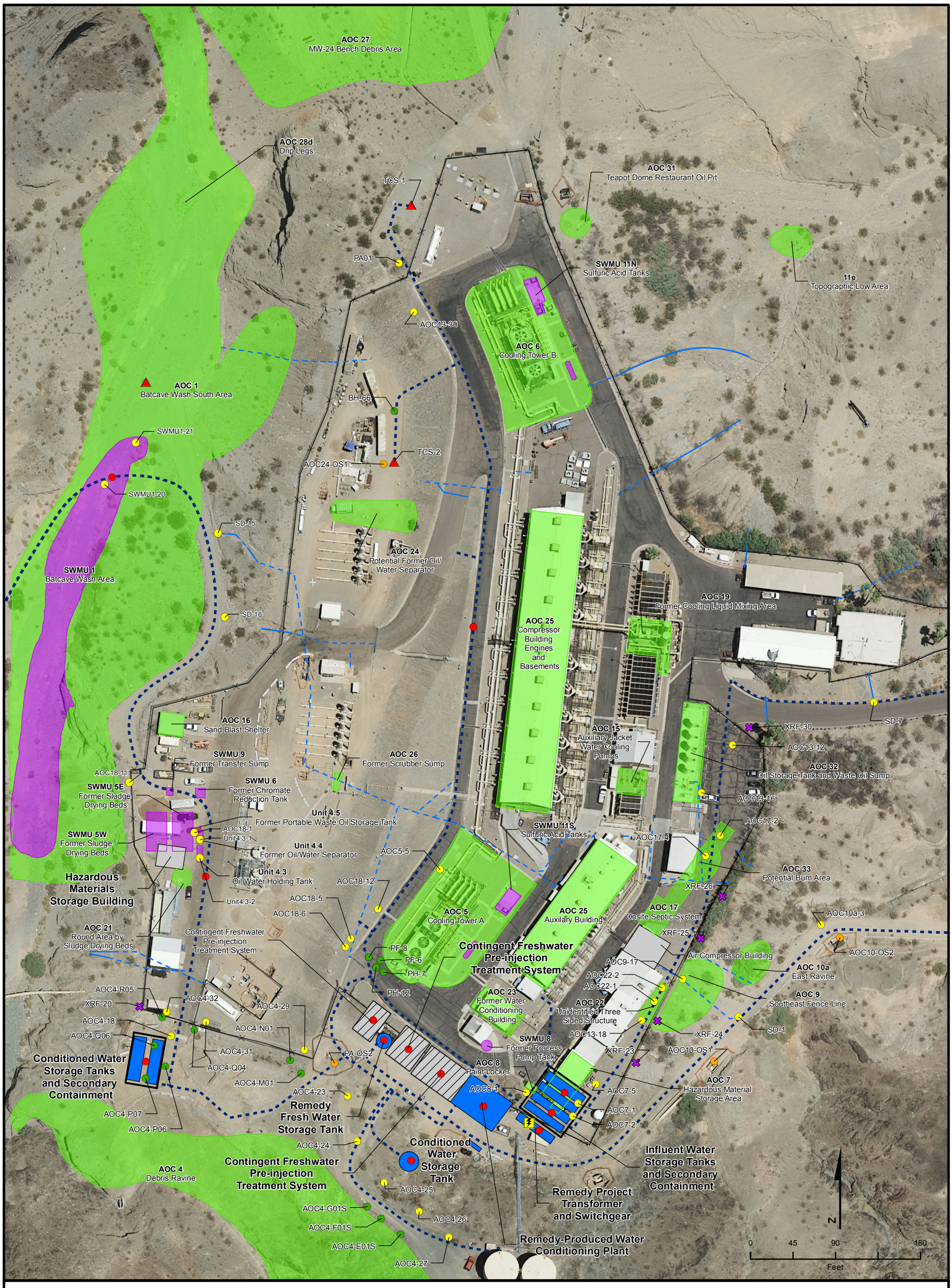


LEGEND

- Proposed Remedy System Soil Sample Location
- Planned Transformer
- Site Fence Boundary
- Stormwater Piping Below Ground
- Stormwater Piping Above Ground

Pipeline Corridor for Remedy

- Underground Pipe/Conduit

Work Areas

- Solid Waste Management Unit (SWMU)
- Area of Concern (AOC)

Remedy Facilities

- Proposed Remedy Structure
- Contingent Freshwater Pre-injection Treatment System

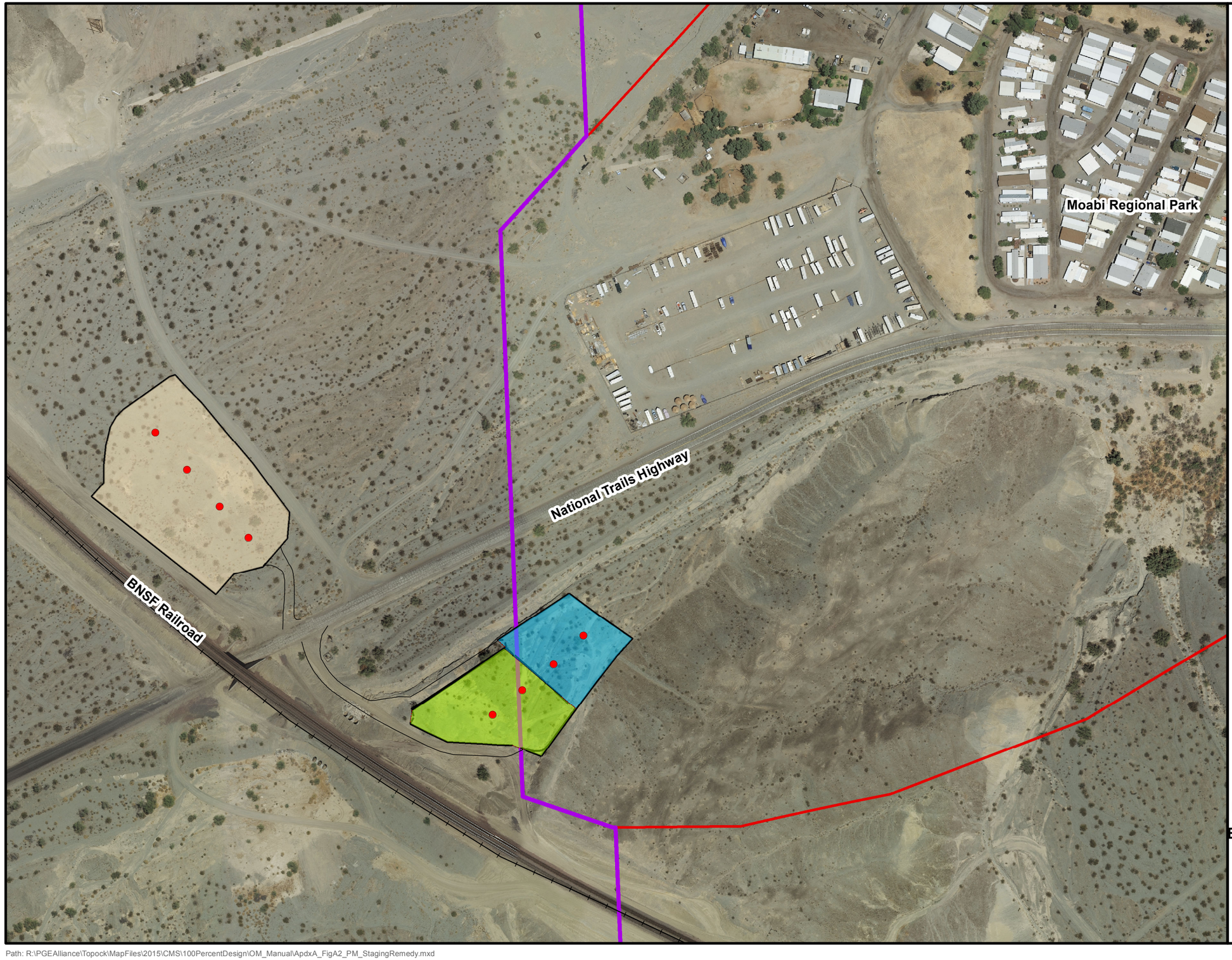
Notes:

1. Soil sampling locations are approximate.
2. No baseline soil sampling is proposed for freshwater pipeline, wells, and associated infrastructure.
3. Baseline soil samples will be collected approximately every 500 linear feet along proposed pipeline/conduit runs (see Figure A-4 for more details).
4. Baseline soil samples will be collected on a 50-foot grid, or a minimum of one sample location within each remedy structure footprint (see Figure A-5 for more details).
5. Baseline soil samples will be collected at each new monitoring, extraction, injection, and recirculation well and associated well vault.
6. If provisional groundwater remedy infrastructure and areas are needed, they will be sampled according to the baseline sampling program at the time of installation/use.
7. To minimize disturbance and potential impacts to sensitive resources, baseline soil samples have not been proposed at remedy infrastructure if soil RFI/RI Investigation proposed sample locations and/or existing soil data locations are located within 20 feet the infrastructure and meet the criteria of the baseline sample program.
8. All well and structure locations are approximate.

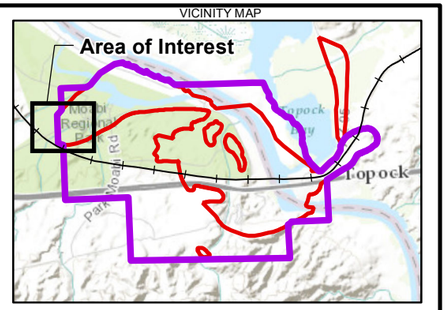
FIGURE A-1A
GROUNDWATER REMEDY FEATURES, SOLID WASTE MANAGEMENT UNITS, AREAS OF CONCERN, BASELINE SOIL SAMPLE LOCATIONS, EXISTING AND PROPOSED RFI/RI SOIL SAMPLE LOCATIONS WITHIN AND NEARBY THE COMPRESSOR STATION

GROUNDWATER REMEDY IMPLEMENTATION - SOIL MANAGEMENT PLAN
PG&E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

CH2MHILL



VICINITY MAP



LEGEND

- Proposed Remedy System Soil Sample Location
- Long-term Remedy Support Area (0.8 Acres Approximate)
- Soil Storage/Processing Area (2.56 Acres)
- Temporary Construction Laydown Area (1.05 Acres Approximate)
- Area of Potential Effects (APE)
- EIR Project Area

Notes:
1. Soil sampling locations are approximate.
2. Surface soil samples (0.5 feet below ground surface) on a 100 foot grid within the soil processing area and the longterm remedy support/temporary construction laydown area.

N

0 90 180 360 Feet

Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS

FIGURE A-2

MOABI REGIONAL PARK FACILITIES

BASELINE SOIL SAMPLE LOCATIONS

GROUNDWATER REMEDY IMPLEMENTATION -
SOIL MANAGEMENT PLAN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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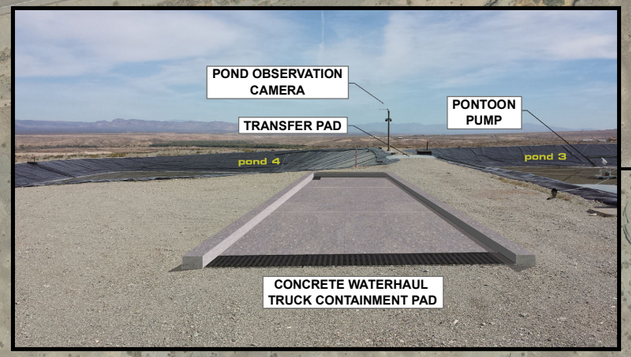


NYLON GUY WIRES

PONTOON PUMP (TYP)

POND 4

AGITATOR (TYP)

CONCRETE WATERHAUL TRUCK CONTAINMENT PAD

POND OBSERVATION CAMERA

POND 3

PONTOON PUMP (TYP)

AGITATOR (TYP)

POND 2

UTILITY BUILDING

THERMOELECTRIC GENERATORS

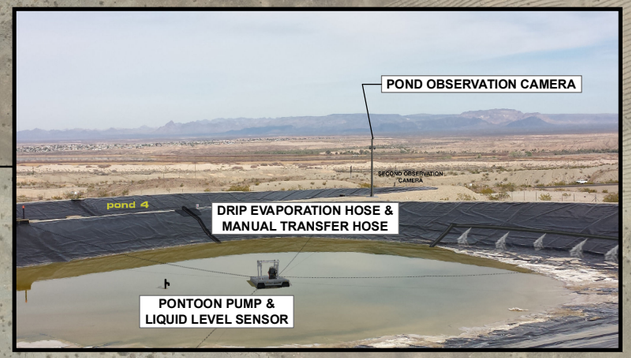
POND 1

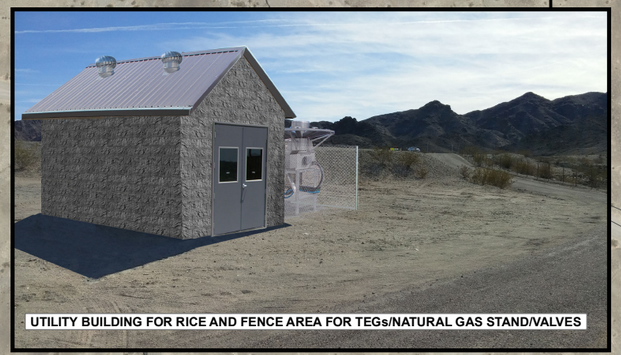
INSTRUMENTAL MOTOR OPERATED VALVE (TYP)

GAS SUPPLY

L-300B

L-300B





LEGEND

- Proposed Remedy System Soil Sample Location
- Underground Gas Supply Pipe
- Proposed Remedy Structure

Notes:

1. All remedy structure locations are approximate.

N

0 100 200 400 Feet

FIGURE A-3
TCS EVAPORATION PONDS BASELINE SOIL SAMPLE LOCATIONS
GROUNDWATER REMEDY IMPLEMENTATION - SOIL MANAGEMENT PLAN
PG&E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

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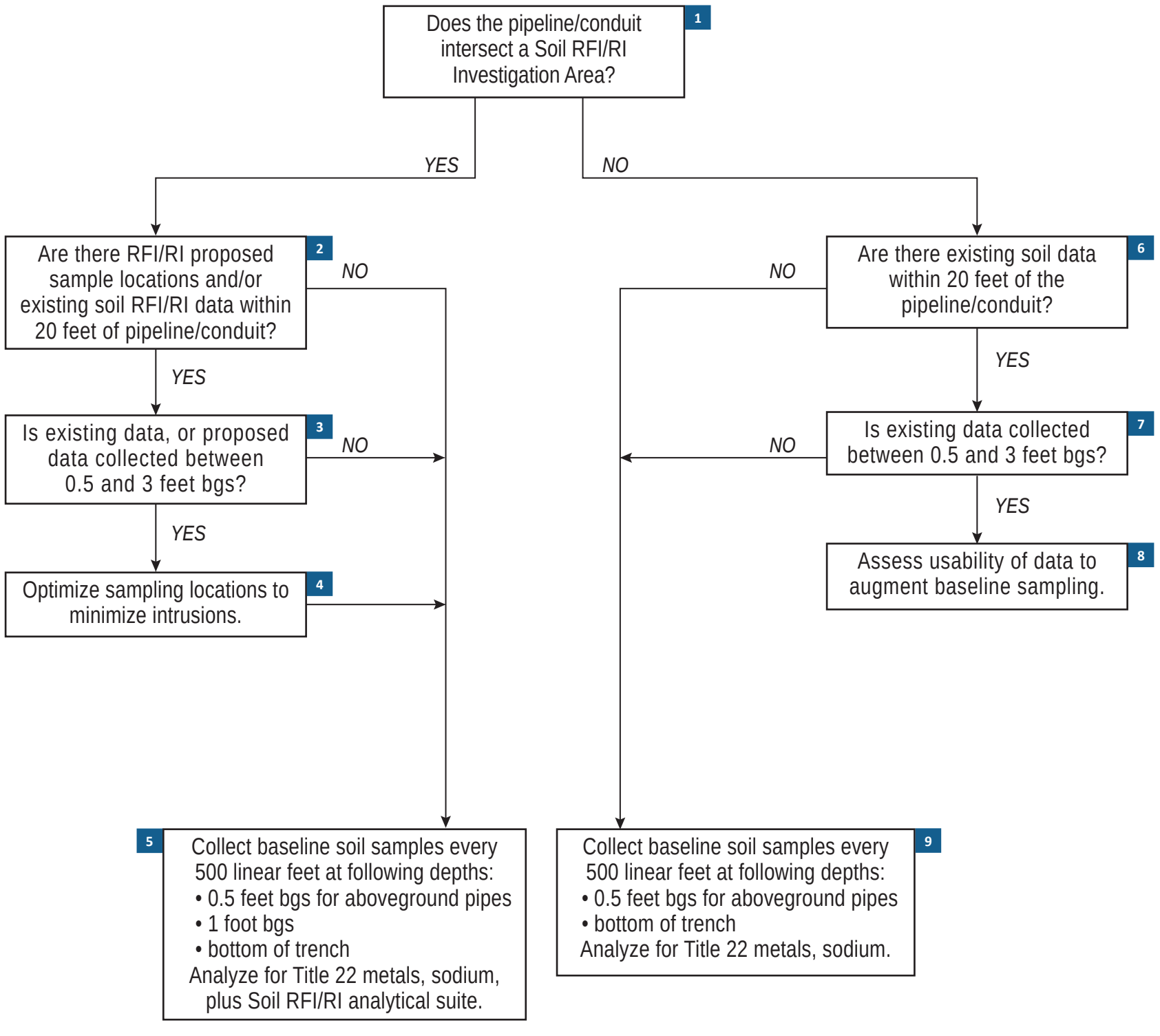
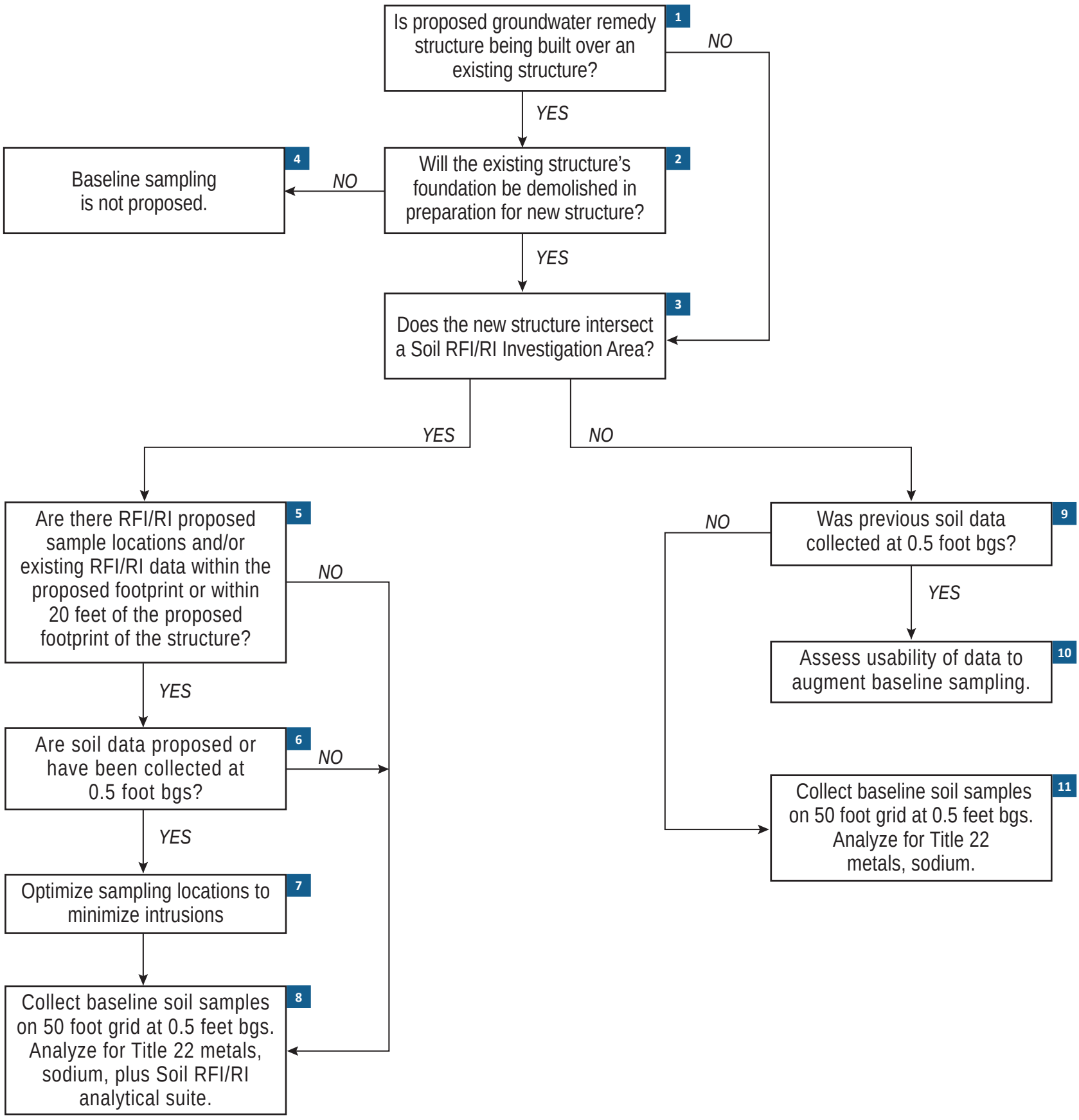


LEGEND

bgs below ground surface
RFI/RI Resource Recovery and Conservation Act Facility Investigation/Remedial Investigation

Figure A-4
Pipelines/Conduits Baseline Sampling Decision Tree
Groundwater Remedy Implementation – Baseline Soil Sampling and Analysis Plan
Pacific Gas and Electric Company
Topock Compressor Station
Needles, California



LEGEND

bgs below ground surface
RFI/RI Resource Recovery and Conservation Act Facility Investigation/Remedial Investigation

Figure A-5
Remedy Structure Baseline Sampling Decision Tree
Groundwater Remedy Implementation – Baseline Soil Sampling and Analysis Plan
Pacific Gas and Electric Company
Topock Compressor Station
Needles, California

Attachment 1
Standard Operating Procedures (SOPs)

(Provided on CD-ROM Only)

Well-SOP-01 Rev. 0

Standard Operating Procedure for Well and Borehole Permanent Decommissioning

PREPARED FOR:	Topock Groundwater Remediation Project
COPY TO:	Project File
PREPARED BY:	Pacific Gas & Electric Company
DATE:	August 27, 2014

This document defines the standard operating procedures (SOP) for decommissioning groundwater wells and boreholes associated with the Pacific Gas and Electric Company (PG&E) Topock Remediation Project, Needles, California (Site). This document was developed, in part, as a direct result of Tribal concerns that included dialog regarding future decommissioning activities at the site between PG&E, agencies, and Native American Indian Tribes (Tribes). PG&E acknowledges that the Topock Remediation Project is an area that is culturally important to the Tribes and that the activities, materials, and procedures used in this process are of specific interest. Tribes have raised concerns with drilling intrusions, well and borehole decommissioning, emplacement of foreign materials into the earth, and retention of soils displaced as a result of drilling. Based on Tribal input, the potential for use of displaced site material in the decommissioning process, which may require a variance with the applicable permitting agency, is included in this document (Section 2.2.3).

An initial draft of this SOP was submitted for review and comment by the agencies and Tribes. The comments received, PG&E responses to these comments, as well as the conclusions of discussion during a June 6, 2014 conference call regarding the PG&E responses to comments are documented in Attachment A.

This SOP will be used as a reference to guide the development of future work plans required for agency, Tribal, and stakeholder review prior to conducting all well and borehole decommissioning tasks associated with the groundwater remedy. For the purpose of this SOP, an exploratory borehole (borehole) is defined as a drilled borehole in which no casings have been installed, regardless of whether or not the borehole was drilled to the water table. However, California boreholes drilled to the water table must be decommissioned per water well standards. The technical procedures included in this SOP are based on applicable regulatory and project-specific guidance information; however, specific work plans for well decommissioning tasks are necessary to evaluate task-specific details and ensure overall compliance. The structure of the SOP has been developed to provide adequate flexibility such that it can be applied to different well types and sizes in a variety of environmental settings. Specifically, this SOP provides a summary of the following key criteria that must be considered when developing a scope of work to decommission a well or exploratory borehole:

- Regulatory information and project-specific resources
- General technical specifications and procedures used for well or borehole decommissioning
- Evaluation of the well or borehole decommissioning scenarios

1.0 Summary of Guidance Information

Multiple sources of guidance information must be considered prior to conducting well or borehole decommissioning activities. Groundwater wells at the Site are located in the states of California and Arizona. Both states regulate the minimum specifications and procedures for the decommissioning of groundwater monitoring and supply wells to protect the quality of groundwater. Further, project-specific documents provide additional guidance related to sensitive cultural and biological resources. A summary of key regulatory information (project-specific applicable or relevant and appropriate [ARAR] numbers are provided) and project-specific resource documents associated with conducting groundwater well or borehole decommissioning activities is provided in the following subsections.

1.1 Regulatory Information – California (ARAR #98)

Statewide minimum standards for decommissioning a groundwater well in the State of California were established by the California Department of Water Resources (DWR) in the California Well Standards. The California Well Standards were originally established in Bulletin 74 (February 1968), later re-written as Bulletin 74-81 (December 1981), and later supplemented by Bulletin 74-90 (June 1991). The DWR states that the California Well Standards may not be sufficient for local conditions and local permitting agencies may need to adopt more stringent standards to ensure groundwater quality protection. However, The County of San Bernardino is the local permitting agency for Site wells located in California and have adopted the DWR standards.

The California Well Standards identify well destruction (or decommissioning for this SOP) requirements for both water supply wells (Part III of Bulletin 74-81), and monitoring wells and exploratory boreholes[1] (Part III of Bulletin 74-90). Although San Bernardino County does not require permits for the decommissioning of boreholes that do not reach the water table, DTSC has stated that they may request that some exploratory boreholes that do not reach the water table be decommissioned as wells under certain circumstances. For example, a borehole that terminates within 10 to 20 feet the water table and is located in an area where the potential for infiltration (e.g., wash channels) or future spills (e.g., an area of active industrial operations) is greater. The general requirements for both well types are similar; however, special considerations for monitoring wells and exploratory boreholes address the potential for these well types to be in areas of known or potential pollution or contamination.

1.2 Regulatory Information – Arizona (ARARs #48 and #49)

Development of rules for adopting standards for the construction and abandonment (or decommissioning for this SOP) of a groundwater well in the State of Arizona are required under Arizona Revised Statute 45-594(A). In response to the statute, the Arizona Department of Water Resources (ADWR), adopted the Well Abandonment Rule. The Well Abandonment Rule as Arizona Administrative Code (A.A.C) R12-15-816 was originally established on March 5, 1984. An amendment to the rule was effected on June 18, 1990. The Well Abandonment Rule requires that the abandonment (decommissioning) of a well be accomplished through filling or sealing the well so as to prevent the well from allowing the vertical movement of water. The rule contained general guidance for the decommissioning process, but lacked specific information regarding applicable aquifer conditions, and for the depths, types of materials and methods for the well decommissioning. ADWR provided additional written guidance for well abandonment to comply with A.A.C. R12-15-816(G) in the Well Abandonment Handbook on October 3, 2008.

The Well Abandonment Handbook (WAH) provides a standard well decommissioning method to be used for the post-installation of any well or borehole, regardless of the aquifer or vadose zone conditions applicable to the well (Section IV A). In addition, the WAH details five alternative abandonment methods. The five alternatives are for specific vadose zone and aquifer conditions which may include contamination, single or multiple aquifers, or dry wells (Section IV B). For example, Alternative 4, which applies to wells that only penetrate a single aquifer without vertical flow components and no water quality contamination issues, might be applicable to wells in the Topock area that are 8-inches or greater in diameter. A variance option to Alternative 4 permits the use of clean fine sand to fill the well being decommissioned.

Legal authorization from the ADWR is required to decommission most types of wells in the State of Arizona. ADWR requires a statewide decommissioning form to be filed and reviewed prior to decommissioning. The notice of intention to abandon a well (NOIA) can be obtained from the ADWR Groundwater Management Support Section in Phoenix or other local offices. In addition, all forms are available online at http://www.azwater.gov/azdwr/WaterManagement/NOI/documents/PermitsFormsApplicationsNOI.htm. The permit must be signed and filed by the well owner. The information on the NOIA must include a well construction diagram with proposed decommissioning specifications; casing type, description of the proposed method of decommissioning (over-drilling, jacking, perforation, etc.); a description of the method of emplacing sealing or fill materials; and the specific type and estimated amount of grout material to be used (water-cement ratio, water-

[1] San Bernardino County does not require permits for the installation or decommissioning of boreholes that do not reach the water table.

bentonite ratio and/or other materials or additives used). ADWR performs a completeness and substantive review of the NOIA to determine whether the proposed abandonment methods and materials meet the requirements of the ADWR abandonment rule in R12-15-816(G). If an alternative method of decommissioning is proposed in lieu of the standard method, further substantive review is performed by ADWR to verify that the proposed methods apply, and whether appropriate fill materials were chosen. A proposal to use an alternative decommissioning method requires an application to ADWR for a variance from the well decommissioning rule (a deviation from the standard decommissioning method). Following ADWR confirmation that the proposed well decommissioning methods and materials meet the requirements of the rule, a well decommissioning authorization card is mailed to the designated well drilling contractor and well decommissioning operations may begin.

1.3 Project-specific Resources

In addition to regulatory guidance, project specific requirements or information must be considered prior to initiating well decommissioning activities. The following is a list of documents that may be applicable:

- **Topock Well Inventory Data Package** – Inventory of wells related to the Topock Remediation Project for reference when developing specific plans for well decommissioning. This data package includes a technical memorandum, well location map, and a searchable spreadsheet of well details. As requested by DTSC, the well inventory spreadsheet (electronic file) and available well logs associated with the Topock Project will be archived on the DTSC website. This archive will be updated periodically as additional wells and boreholes are installed.
- **Environmental Impact Report (EIR) Mitigation Measures Reporting Program (MMRP)** – This document details specific compliance criteria that must be considered before, during, and after implementation of well decommissioning activities.
- **Management Protocol for Handling and Disposition of Displaced Site Material** – This document identifies the general approach and management protocols required for the handling and disposition of soil and/or rock that is displaced as a result of activities associated with the Pacific Gas and Electric Company (PG&E) Topock Remediation Project. The use of displaced site material for use in the well decommissioning process is discussed in Section 2.2.3.
- **Special Handling for Clay Material Encountered During Drilling** – As requested by the Hualapai Department of Cultural Resources, special handling procedures for drill cuttings generated from clay beds will be used in the field (this does not include clay-containing sediment mixtures, only clay beds). If clay bed(s) are encountered during drilling, then the cutting from those interval(s) will be set aside on 100% cotton muslin (dye free) for future disposition, following discussions with the Tribes. PG&E will notify the agencies and Tribes in the event clay material is encountered and separated for storage.
- **Previous Well Decommissioning Work Plans** –
  - Well PGE-6 Revised Decommissioning Work Plan (November 10, 2006).
  - Final Revised Implementation Plan for Repair of Monitoring Wells MW-38S and MW-38D and Old Well/Pipe Reconnaissance (February 11, 2011).
- **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Permit Exemption –** Per the November 16, 2007 Memorandum from the United States Department of the Interior, remedial actions including well decommissioning are exempt from the federal, state, and local permitting process. Since the issuance of this memorandum, the applicability of this exemption has been confirmed with the County of San Bernardino, California in February 2008 and January 2011. However, the County of San Bernardino will need to be consulted in the event a variance to the California Well Standards is required. The applicability of this exemption has not been confirmed with the State of Arizona. Regardless of the permit exemption, all work plans for decommissioning activities will be reviewed and approved by the appropriate state and federal agencies prior to implementation.

1.4 General Technical Resources

In addition to regulatory guidance and project specific information various technical resources should be considered during the development of a work plan for well or borehole decommissioning. The following is a list of documents that may be useful:

- Monitoring Well Design and Construction for Hydrogeologic Characterization. Guidance Manual for Ground Water Investigations. July 1995. State of California, Environmental Protection Agency.
- ASTM Standard D5299-99 (2005), "Standard Guidance for Decommissioning of Groundwater Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities", ASTM International, West Conshohocken, PA, 2005, www.astm.org.
- ASTM Standard C150/C150M-12, "Standard Specification for Portland Cement", ASTM International, West Conshohocken, PA, 2012, www.astm.org.
- ASTM Standard D4380-84 (2006), "Standard Test Method for Density of Bentonitic Slurries", ASTM International, West Conshohocken, PA, 2012, www.astm.org.

2.0 General Technical Specifications and Procedures for Decommissioning Wells and Exploratory Boreholes

Monitoring wells or exploratory boreholes that are no longer useful must be properly decommissioned to ensure the quality of groundwater is protected and eliminate a possible physical hazard to humans and animals. Notification or permitting requirements should be evaluated prior to the initiation of well decommissioning activities in the field. Involved oversight agencies will be notified in advance of any decommissioning activities to ensure concurrence with decommissioning of a particular well(s). The general process for decommissioning a well at the Topock site is presented on Figure 1, Well Decommissioning Decision Protocol. The information provided in this section is intended to be applicable for wells or boreholes located in either California or Arizona; however, it is assumed that the details included in the specific work plan(s) will be designed in compliance with the appropriate state regulations, and reviewed by the appropriate permitting agency. In addition, depending on the condition of the aquifer and well(s) subject to decommissioning, potentially applicable variance options that include the minimization of the placement of sealing material should be evaluated with the lead agencies during well decommission work plan development (e.g., Arizona Alternative 4 – variance option). A discussion of the primary steps identified in this protocol, including the potential materials and methods required for each, is presented in the following subsections.

2.1 Evaluation of Well or Borehole

Key well or borehole information should be assembled and reviewed prior to initiating decommissioning activities to determine lithologic and well construction details, the current condition of the well or borehole, soil and water quality information, applicable regulatory criteria, and identification of the procedures and materials that should be used. The majority of this information will be available through review of drilling and well installation information, the Topock Well Inventory, groundwater sample collection logs, or other related documents. The Topock Well Inventory can be found online at: http://dtsc-topock.com/sites/default/files/Topock-Well-Inventory_Tech-Memo.pdf. However, it is possible that additional survey of the given well or borehole will be required to obtain all key information. The following is a list of survey techniques that may be utilized to evaluate the condition of well or borehole (list is not intended to be all-inclusive):

- Well measurement – Evaluation of the depth to the bottom of, or the depth to water within, a well or borehole. This is typically accomplished using a graduated measuring tape with a water sensor or blunt weight at the end.
- Video survey – An in-well video camera can be used to evaluate the condition of the well casing and screen, and identify obstructions. In-well cameras are typically calibrated for depth and orientation (i.e. north, south, east and west), and deployed on a cable using a winch.

- Geophysical survey – Depending on the well casing type, depth to water, potential presence of metallic centralizers or other well construction components, and other variables, select geophysical survey tools may be useful. Similar to an in-well camera, in-well geophysical tools are deployed on a cable using a winch. While not a complete list, examples of geophysical tools that may be useful include:
  - Acoustic (Cement Bond Log) – Used to determine the quality of cement bonding in cased or sealed wells.
  - Gamma – Used to determine intervals of bentonite seals and gravel pack.
  - Caliper – Used to verify diameter of the well or borehole, which is used to calculate borehole and well casing volumes, and identifies obstructions or areas of borehole washout or constriction.
  - Casing Inspection Thickness Measurement (CITM) – An in well survey that uses electromagnetic waves to measure well casing wall thickness in carbon based steels. Survey can be used to understand or measure the integrity of the well casing.

2.2 Identification of Materials and Placement Requirements

Different types of materials are required for different well or borehole decommissioning scenarios depending on above-ground, and subsurface environment. Sealing materials are required when the potential for flow of water through the material must be kept to an absolute minimum such that the volume of water and possible pollutants and contaminants passing through them will be of minimal consequence (no material is completely impervious). Filler material is permitted for use under some circumstances when the flow of water through the material is not of critical concern. Potential materials suitable for use during well and borehole decommissioning at the Topock site and associated placement requirements are listed in the following subsections.

2.2.1 Sealing Material

Conventional sealing activities are performed with the objective of completely filling the borehole or well casing, voids in the formation in the vicinity of the borehole, and if not over-drilled, the gravel pack and annular spaces. Sealing materials are required for use when decommissioning wells and boreholes regardless of whether they are located in an area of known or potential pollution or contamination. In uncontaminated areas where the well is wholly situated in unconsolidated material in an unconfined groundwater zone, the sealing material is focused in the upper 20 feet of the well or borehole to prevent the infiltration of potential surface contamination. In areas of known or potential soil or groundwater contamination, sealing material is required throughout the entirety of the well or borehole. The following is a list of sealing materials that may be used at the Topock site:

- Neat cement – Compose entirely of Type II/V Portland cement grout with up to 6% bentonite powder.
- Sand-cement grout – Composed of Portland cement with no more than two parts sand to one part cement by weight of sand.
- Concrete – Composed of Portland cement and aggregated mixed at a ratio of at least 564 lbs. of cement per cubic yard of aggregate. Aggregate used must be smaller than 1/5 of the radial thickness of the annular seal and is typically reserved for large volume/diameter borehole or well decommissioning.
- Bentonite clay – Composed of commercially prepared, powdered, granulated, pelletized, or chipped/crushed sodium montmorillonite clay with the largest dimension of pellet or chip being less than 1/5 the radial thickness of the annular seal. Bentonite cannot be used as a sealing material opposite zones of fractured rock, unless otherwise approved by lead agencies. As bentonite seals may have a tendency to dry, shrink and crack in arid and semi-arid areas where subsurface moisture levels can be low, they are not recommended for sealing the vadose zone at the Topock site. In addition, bentonite is not recommended for application in high TDS environments (e.g., >5,000 parts per million) due to the adverse effects on its ability to properly swell and seal in these conditions.

According to Arizona and California Well Standards, drilling mud or cuttings are not acceptable sealing materials.

Water used for the preparation of sealing materials should be potable, compatible with the type of sealing material used and free of contaminants and suspended matter. All manufacturers' specifications for mixture

volumes and curing times must be strictly followed (typically, ASTM C150, Standard Specification for Portland cement). Further, the use of any additives must comply with the requirements of ASTM C494 (Standard Specification for Chemical Admixtures for Concrete).

Sealing material must be placed into a well or borehole at the required interval(s) in one continuous decommissioning operation, which may include multiple lifts of sealant, using methods that prevent the free-fall, dilution, and/or separation of aggregates from the cementing materials. Typically, fluid sealing material is placed using a tremie pipe with positive displacement pumping (pumped under pressure), beginning at the bottom of the sealed interval with the end of the tremie pipe submerged two feet or more below the surface of the grout during placement. When using a tremie pipe, if sealing material is placed throughout the well or borehole, static water is either displaced out of the top by the injected column of sealing material, or into the formation (applicable SOPs for waste management/spill containment will followed). Alternatively, fluid sealing material may need to be pumped into the well under pressure, using the well casing as the conduit. In this case the static water and the sealing material are forced into the voids of the well/borehole and formation. When fluid sealing material is placed under pressure, the pressure must be maintained long enough for the sealing material to cure, as applicable. Dry sealing material, such as bentonite chips or pellets, are typically placed by using a tremie pipe or the well casing as a conduit. Dry sealing materials require water for hydration and proper sealing. Regardless of sealing material type or placement method, verification shall be made that the volume of the material placed in the well or borehole is at least equal to the calculated volume of void space to be sealed.

2.2.2 Filler Material

Filler materials are permitted for use in select portions of the decommissioned well or borehole when located in uncontaminated areas. Suitable filler materials include clay, silt, sand, gravel, crushed stone, native soils, mixtures of the aforementioned types, as well as sealing materials defined above. However, materials containing organic matter are not acceptable.

Filler material must be placed into the well or borehole from the bottom up, such that bridging does not occur and the entire void space is filled. To assure that bridging has not occurred during placement, verification shall be made that the volume of the material placed in the well or borehole (with appropriate porosity assumptions) is at least equal to the calculated volume of void space to be filled (i.e., empty hole).

2.2.3 Displaced Site Material

As discussed in Section 1.3 (Management Protocol for Handling and Disposition of Displaced Site Material), soil and rock that are displaced as a result of the Topock Remediation Project may be retained on site for future use. One of the potential reuses for this material identified in the management protocol is replacement into borings. If the material was generated as drill cuttings, then lead agencies must agree that the material can be used as a component of either sealing or filler material for the purpose of well or borehole decommissioning (a variance may be required).

The requirements for placement of displaced site material, should it be deemed appropriate for use based on physical and chemical composition, are the same as that for filler material. Additional processing of the displaced material may be required to ensure that grain size requirements are met, that the material is free of organic matter, and that the material can be practicably placed into the well or borehole (i.e., prevent bridging). This processing may require the use of heavy equipment for grading or crushing the material so that it is suitable for use in the decommissioning process. An appropriate onsite location would need to be identified if such processing were required.

2.3 Well or Borehole Decommissioning Scenarios

Following evaluation of the well or borehole and in coordination with lead agencies, it must be determined if the well can be decommissioned in place (with or without modification) or if the well materials must be removed. The following subsections define the decommissioning scenarios that may apply pending completion of the well evaluation and coordination with lead agencies, responsible agencies (San Bernardino County or Arizona

Department of Water Resources), affected land owner, Tribes, and other stakeholders. Artesian groundwater conditions have not been observed at the Topock site, and therefore, are not considered in this SOP.

All wells associated with the Topock Remediation Project are considered to be in non-urban areas. When developing work plans that include well or borehole decommissioning, lead and responsible agencies (San Bernardino County) in California will be consulted to confirm this assumption. For the purpose of this SOP, well or borehole decommissioning scenarios are presented for two types of well site environments. These environments, Type 1 and Type 2, are defined as:

- Type 1 Well Environment – A well classified as Type 1 is located outside the area of known or potential soil or groundwater contamination (e.g., as determined by the soil and/or groundwater quality data available for the location or the likelihood of a future release in the area) and is not located in an area that is subject to increased surface water infiltration relative to nearby upland areas (e.g., channel of Bat Cave Wash).
- Type 2 Well Environment – A well classified as Type 2 is located in an area of known or potential soil or groundwater contamination (e.g., as determined by the soil and/or groundwater quality data available for the location or the likelihood of a future release in the area) and/or in an area that is subject to increased surface water infiltration relative to nearby upland areas (e.g., channel of Bat Cave Wash). Any wells located on the Topock Compressor Station, within wash channels, within areas of concern (AOCs), or within/adjacent to roads are in a Type 2 environment.

Three approaches to well and borehole decommissioning, including one approach that would require the approval of a variance to the California Well Standards, were presented by DTSC as draft concepts for discussion during the January 19, 2012 TWG Meeting. This information is provided as Attachment B to this SOP for consideration when developing future work plans that involve borehole or well decommissioning. The overriding consideration for the variance scenario presented in Attachment B was that the decommissioning method would provide seals that had a net permeability equal to or less than the naturally occurring geologic materials encountered along the borehole.

2.3.1 Exploratory Borehole

Typically, exploratory boreholes at the Topock site are installed as part of a data collection effort (i.e., lithologic, soil or groundwater sample collection) and are immediately decommissioned once the data collection objectives for that borehole have been achieved. Therefore, the borehole is typically decommissioned while the drilling tools or casing is still in place, prior to demobilization from that borehole. The following general procedure should be followed for decommissioning an exploratory borehole:

1. Evaluate the borehole for obstructions immediately prior to conducting decommissioning activities. If an obstruction is encountered that will prevent successful sealing of the borehole, attempts must be made to remove it prior to placement of the sealing material.
2. Place sealing material from total depth to ground surface. Typically, sealing material will be placed using a tremie pipe with positive displacement pumping. Industry practice is to place sealing material from total depth to the ground surface. However, if the boring is not within an area of known or potential pollution or contamination as determined by the soil and/or groundwater quality data available for the borehole, evaluate using displaced site material, or filler material if displaced site material is not available or appropriate, in lieu of sealing material in the upper 5 to 10 feet of the borehole. The use of displaced site material or filler material may require a permit variance if the borehole reached the water table.
3. Verify that the resulting condition of the borehole opening at the surface does not present a physical hazard to humans or animals. If voids are present fill voids created with displaced site material, or filler material if displaced site material is not available or appropriate.

2.3.2 Decommissioning a Well in Place

Wells determined to have been constructed in conformance with applicable standards without indication of compromise since the time of installation may be decommissioned in place. This decommissioning option should be utilized whenever acceptable to the regulatory agencies as it represents the field procedures that are least intrusive and create the least amount of disturbance. Further, this decommissioning method is appropriate if the well is in good repair but cannot be removed (e.g., wells constructed with large diameter steel casing), or if removal would negatively influence sealing of the well (e.g., a collapse during removal). In this case the monitoring well casing and any other significant voids (i.e., pore spaces in the gravel pack), at a minimum, should be completely filled with sealing material. The following general procedure should be followed for decommissioning a well in place:

1. Conduct evaluation of the well as detailed in Section 2.1 and verify with lead agencies, responsible agencies (San Bernardino County or Arizona Department of Water Resources), affected land owner, Tribes, and other stakeholders that the well should be decommissioned in place, and whether it is in a location considered to be Type 2.
2. Evaluate well for obstructions immediately prior to conducting decommissioning activities. If an obstruction is encountered that will prevent successful sealing of the well, attempts must be made to remove it prior to placement of the sealing and/or filler material.
3. Place sealing material. Typically, if fluid sealing material is used, this will be conducted using a tremie pipe with positive displacement pumping.
    a. Type 1 Well – Evaluate using filler material in lieu of sealing material in portions of the well casing. Place sealing material from total depth to near ground surface.
    b. Type 2 Well – Place sealing material from total depth to within 5 feet of the ground surface (bgs).
4. Decommission well head.
    a. Type 1 Well – Remove all well head protection and excavate around the well casing to a depth of approximately 1 to 5 feet bgs, or as practicable. Remove all well materials to a depth of approximately 1 to 5 feet bgs, or as practicable, cap casing with sealing material such that it extends beyond the diameter of the borehole and will drain fluids away from the borehole. Backfill the void created with displaced site material, or filler material if displaced site material is not available or appropriate.
    b. Type 2 Well – Remove all well head protection and excavate around the well casing to a depth of 5 feet bgs. Remove all well materials to a depth of 5 feet bgs, cap casing with sealing material such that it extends beyond the diameter of the borehole and will drain fluids away from the borehole. Backfill the void created with displaced site material, or filler material if displaced site material is not available or appropriate.

Note that the Type 1 and Type 2 well scenarios are subtly different. While the Type 2 scenario requires the removal of all well materials to a depth of 5 feet bgs (per CA well standards), Type 1 wells do not require the removal of any well materials. The removal of well materials to a depth of approximately 1 to 5 feet bgs, or as practicable, is not required by CA well standards, but included per stakeholder comments.

2.3.3 Decommissioning a Well in Place with Modification

It may be determined that a well should be decommissioned in place, but requires modification prior to sealing. This method may be appropriate in the event well materials or an obstruction cannot be removed, clogged screen cannot be removed, or if removal would negatively influence sealing of the well. In this scenario it may be required to remove a portion of the well casing, perforate sections of the well screen or casing, or conduct other well modifications to facilitate proper sealing. The following general procedure should be followed for decommissioning a well in place when a modification is required:

1. Conduct evaluation of the well as detailed in Section 2.1 and verify with lead agencies, responsible agencies (San Bernardino County or Arizona Department of Water Resources), affected land owner, Tribes, and other stakeholders that the well should be decommissioned in place, what modification work is required, and whether it is considered to be Type 2.
2. Implement required well modification.
3. Place sealing material. The condition that warrants well modification must be evaluated to determine the method use to place the sealing material. For example, if casing perforations above the water table are required, sealing under pressure may be appropriate.
    a. Type 1 Well – Evaluate using filler material in lieu of sealing material in portions of the borehole. Place sealing material from total depth to near ground surface, or in the event casing is removed, the new top of casing depth. If a portion of the casing is removed, sealing or filler material requirements for the interval above the top of casing must be determined through discussion with lead agencies, responsible agencies (San Bernardino County or Arizona Department of Water Resources), affected land owner, Tribes, and other stakeholders.
    b. Type 2 Well – Place sealing material from total depth to within 5 feet of the ground surface (bgs). If a portion of the casing is removed, sealing or filler material requirements for the interval above the top of casing must be determined through discussion with lead agencies, responsible agencies (San Bernardino County or Arizona Department of Water Resources), affected land owner, Tribes, and other stakeholders.
5. Decommission well head.
    a. Type 1 Well –Remove all well head protection and excavate around the well casing to a depth of approximately 1 to 5 bgs, or as practicable. Removal all well materials to a depth of approximately 1 to 5 feet bgs, or as practicable, cap casing with sealing material such that it extends beyond the diameter of the borehole and will drain fluids away from the borehole. Backfill the void created with displaced site material, or filler material if displaced site material is not available or appropriate.
    b. Type 2 Well – Remove all well head protection and excavate around the well casing to a depth of 5 bgs. Removal all well materials to a depth of 5 feet bgs, cap casing with sealing material such that it extends beyond the diameter of the borehole and will drain fluids away from the borehole. Backfill the void created with displaced site material, or filler material if displaced site material is not available or appropriate.

2.3.4 Decommissioning a Well by Removing Well Materials

In some cases a well may be decommissioned by complete removal of the well materials. This method may be appropriate in the event a well was not constructed in accordance with applicable standards and the deficiencies may prevent the proper sealing of the well, even with modification. Further, when removal is practicable, lead agencies, responsible agencies (San Bernardino County or Arizona Department of Water Resources), affected land owner, or other stakeholders may determine this method preferable to others. Removal is typically conducted by over-drilling the existing well materials with larger diameter drilling tools. Typically, this method is only applied to wells constructed with polyvinyl chloride (PVC) casing or limited lengths of smaller diameter steel casing. Other methods of casing removal (e.g., hydraulic casing jacks) may be useful to remove limited lengths of larger diameter steel casing. The following general procedure should be followed for decommissioning a well by removing the well materials:

1. Conduct evaluation of the well as detailed in Section 2.1 and verify with lead agencies, responsible agencies (San Bernardino County or Arizona Department of Water Resources), affected land owner, Tribes, and other stakeholders that the well should be decommissioned by removal.
2. Remove well materials. Typically, this is conducted by over-drilling or in some cases by combination of the use of hydraulic casing jacks combined with over-drilling.

3. Evaluate borehole for obstructions immediately prior to conducting decommissioning activities. If an obstruction is encountered that will prevent successful sealing of the borehole, it must be removed prior to placement of the sealing material.
4. Place sealing/filler material from total depth to ground surface. Typically, this will be conducted using a tremie pipe with positive displacement pumping. Industry practice is to place sealing material from total depth to the ground surface. However, if the boring is not within an area of known or potential pollution or contamination, evaluate using filler material in lieu of sealing material in portions of the borehole.
5. Decommission remaining elements of the well head protection and fill voids created with displaced site material, or filler material if displaced site material is not available or appropriate.

Other methods may be employed for removal of the well, particularly for steel well materials and steel conductor casings used to seal off upper lithologic zones. Specifically, the well string (or conductor casing) may be pulled by jacking with external equipment, or with the drill rig. Once the well string is removed from the borehole, the remaining materials in the original borehole should be over-drilled to remove them from the formation.

2.4 Well Decommissioning Reporting

Following completion of well decommissioning tasks, reporting of field activities must be completed in compliance with the lead agencies requirements. In addition, project-specific reporting must be completed (as required) and the Topock Well Inventory must be updated to reflect the results of decommissioning activities. The timeline for reporting requirements will be specified in the project-specific work plan. The Well Decommissioning Report will be submitted to lead agencies no later than 90 days after completion of well decommissioning activities and will include, at a minimum:

- A summary of the approval process completed prior to well decommissioning, including reference to submitted work plans, subsequent communication and modifications (as applicable) and documentation of approval to proceed;
- Discussion regarding application of the Well Decommissioning Decision Protocol;
- Details of the work performed, including explanation of the applicable well decommissioning scenario and materials utilized;
- Documentation of compliance with applicable permitting requirements, and;
- Signature and seal of an appropriately licensed professional geologist or engineer.

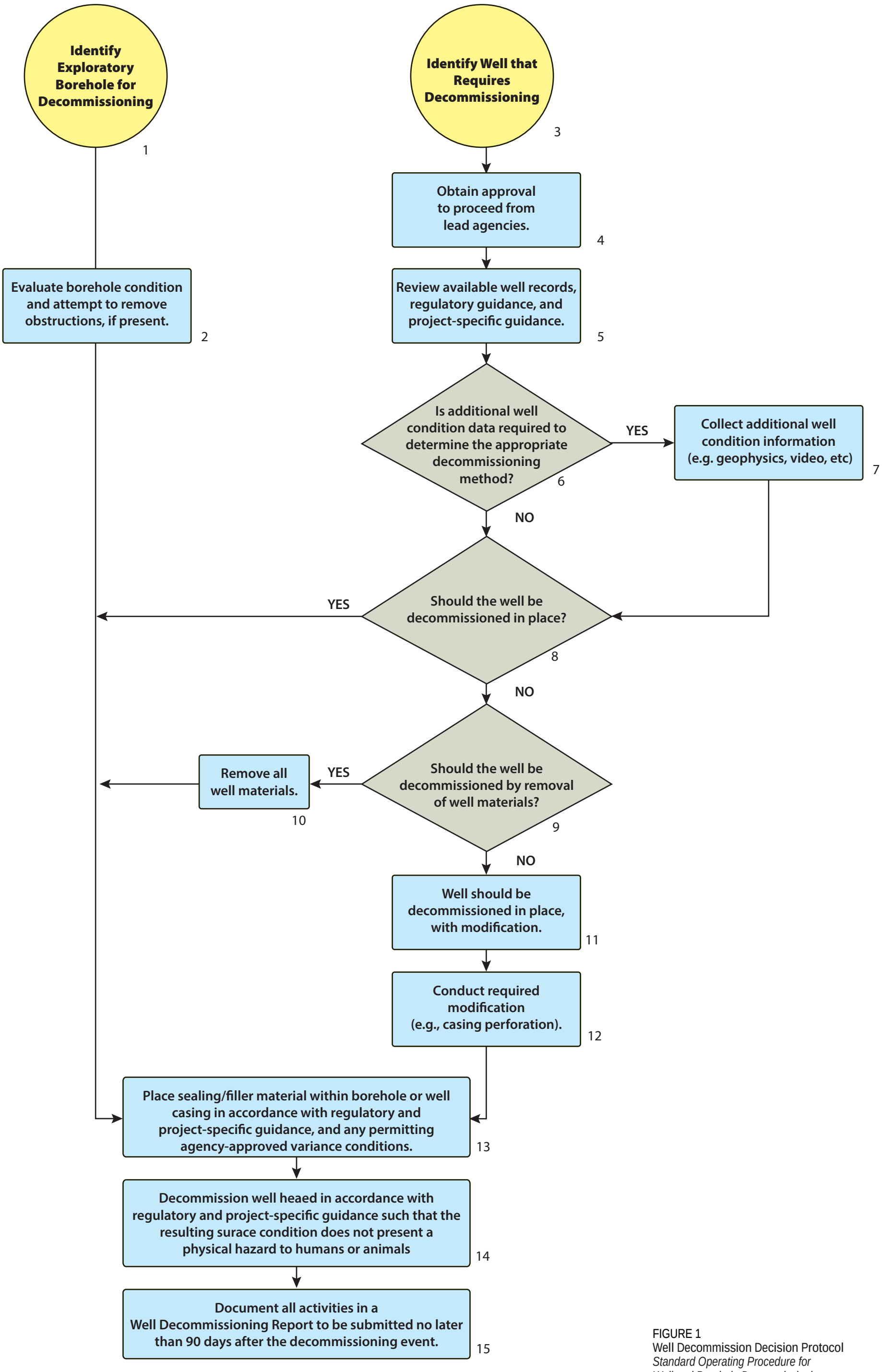


FIGURE 1
Well Decommission Decision Protocol
Standard Operating Procedure for
Well and Borehole Decommissioning
PG&E Topock Compressor Station
Needles, California

Attachment A
Responses to Comments on Draft *Standard Operating Procedure for Well and Borehole Decommissioning*

Responses to Comments on *Standard Operating Procedure for Well and Borehole Decommissioning*, Pacific Gas and Electric Company, Topock Compressor Station, Needles, California

Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
1	Arizona Department of Water Resources (ADWR) February 28, 2013 Letter ADWR-1			The text in the Standard Operation Procedure (SOP), section 1.2 states that all required forms can be obtained from the Phoenix ADWR offices. All forms are available online at: http://www.azwater.gov/iazdwr/WaterManagement/NOI/documents/PermitsFormsApplicationsNOI.htm	The text in **bold** will be added to the following statement. The notice of intention to abandon a well (NOIA) can be obtained from the ADWR Groundwater Management Support Section in Phoenix or other local offices. **In addition, all forms are available online at:** http://www.azwater.gov/iazdwr/WaterManagement/NOI/documents/PermitsFormsApplicationsNOI.htm	No additional comments.
2	ADWR-2			The SOP document describes requirements for abandoning (decommissioning) wells in Arizona and California and technical specifications and procedures for abandoning wells at the Topock Compressor Station remediation site. The proposed methods are thorough, protective of the aquifer, and consistent with minimum well construction and abandonment requirements in Arizona Administrative Code (A.A.C.) R12-15-816 and substantive policy described in the ADWR "Well Abandonment Handbook" (2008).	PG&E appreciates the review and input from ADEQ and ADWR on this SOP.	No additional comments.
3	ADWR-3			The proposed methods suggested for abandoning exploratory boreholes in Arizona utilizing "granulated material" are satisfactory. The methods are consistent with the variance option of Alternative 4 in the "Well Abandonment Handbook". Notices of Intent to Abandon a Well must be accompanied with a written request for a variance from the provisions of the minimum well construction and abandonment standards and in accordance with A.A.C. R12-15-820.	This comment is specific to the *Revised Implementation Plan for Evaluation of Alternative Freshwater Sources in the Topock Remediation Project Area, Pacific Gas and Electric Company, Topock Compressor Station, Needles, California* (January 28, 2013). However, as noted by the Fort Mojave Indian Tribe in comment FMIT-6, this represents an example of successful application of a variance to the standard well decommissioning procedure in Arizona. This variance was approved by ADWR based on project-specific information about the condition of the aquifer and planned boreholes (not a well in this example). PG&E anticipates similar discourse with the regulatory agencies based on future project-specific information in the development of future well decommissioning work plans.	No additional comments.
4	Department of Toxics Substances Control (DTSC) Document edits in redline strikeout DTSC-1	2nd paragraph	However, California boreholes drilled to the water table must be decommissioned per water well standards.	[DTSC Comment CG1]: Revise text. Clarify that an exploratory borehole drilled to the water table in California must comply with well decommissioning standards. Underlined text indicates new text inserted into document.	The text in **bold** will be added to the following statement. For the purpose of this SOP, an exploratory borehole (borehole) is defined as a drilled borehole in which no casings have been installed, regardless of whether or not the borehole was drilled to the water table. **However, California boreholes drilled to the water table must be decommissioned per water well standards.**	No additional comments.
5	DTSC-2	1.1	[1.] San Bernardino County does not require permits for the installation or decommissioning of boreholes that do not reach the water table.	[DTSC Comment CG2]: Please note that DTSC may request that some exploratory boreholes that do not reach the water table be decommissioned as wells under certain circumstances (e.g., deep boreholes that almost reach the water table). Please incorporate this concept into the SOP.	The text in **bold** will be added to the following statement. The California Well Standards identify well destruction (or decommissioning for this SOP) requirements for both water supply wells (Part III of Bulletin 74-81), and monitoring wells and exploratory boreholes[1]. **Although San Bernardino County does not require permits for the decommissioning of boreholes that do not reach the water table, DTSC has stated that they may request that some exploratory boreholes that do not reach the water table be decommissioned as wells under certain circumstances. For example, a borehole that terminates within 10 to 20 feet the water table and is located in an area where the potential for infiltration (e.g., wash channels) or future spills (e.g., an area of active industrial operations) is greater.**	No additional comments.

Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
6	DTSC-3	1.3	However, the County of San Bernardino will need to be consulted in the event a variance to the California Well Standards is required.	[DTSC Comment CG3]: As the SOP is now sufficiently developed, it is important to have San Bernardino review the next version and provide input as they are a key decision maker regarding well decommissioning.	After PG&E response to comments from ADWR, DTSC, Fort Mojave Indian Tribe and the Hualapai Dept of Cultural Resources included in this table have been addressed and discussed by the Well Decommissioning Subgroup, a draft of this SOP will be submitted to the County San Bernardino for their review and input.	No additional comments.
7	DTSC-4	2.0	Involved oversight agencies will be notified in advance of any decommissioning activities to ensure concurrence with decommissioning of a particular well(s).	Underlined text indicates new text inserted into document.	The proposed text has been added to the document.	No additional comments.
8	DTSC-5	2.1	drilling and well installation information	[DTSC Comment YA4]: A repository of drilling logs and installation notes should be put into a central archive for access by involved stakeholders.	Drilling logs and installation notes, where available, have been included in various documents submitted to the agencies following field work. As specific well decommissioning work plans are developed, this information will be included in those plans. **Further, as requested by DTSC, the well inventory spreadsheet (electronic file) and available well logs associated with the Topock Project will be archived on the DTSC website. This archive will be updated periodically as additional wells and boreholes are installed.** The text above in **bold** will be added to Section 1.3, first bullet (Topock Well Inventory Data Package).	No additional comments.
9	DTSC-6	2.1	Topock Well Inventory	[DTSC Comment CG5]; Include the current Topock Well Inventory as an electronic attachment to this SOP.	The text in **bold** will be added to the following statement. The majority of this information will be available through review of drilling and well installation information, the Topock Well Inventory, groundwater sample collection logs, or other related documents**. An electronic copy of the Topock Well Inventory has been included in this SOP under Attachment A.**	No additional comments.
10	DTSC-7	2.1	Geophysical survey – Depending on the well casing type, depth to water, presence or absence of centralizers, and other variables, select geophysical survey tools may be useful.	Underlined text indicates new text inserted into document.	The modified text in **bold** will be added to the statement. Geophysical survey – Depending on the well casing type, depth to water, **potential presence of metallic centralizers or other well construction components**, and other variables, select geophysical survey tools may be useful.	No additional comments.
11	DTSC-8	2.2.1	Bentonite cannot be used as a sealing material opposite zones of fractured rock, unless otherwise approved by lead agencies (DTSC/DOI).	Underlined text indicates new text inserted into document. Deleted text includes "the permitting" agency. Subsequent comment from DTSC regarding when bentonite is appropriate as a sealing material…	The proposed edit has been incorporated into the document. In addition, based on subsequent discussion with DTSC, the following text in **bold** has been added to Section 2.2.1, fourth bullet (bentonite clay): **In addition, bentonite is not recommended for application in high TDS environments (e.g., >5,000 parts per million) due to the adverse effects on its ability to properly swell and seal in these conditions.**	No additional comments.
12	DTSC-9	2.2.3	If the material was generated as drill cuttings, then lead agencies must agree that the material can be used as a component of either sealing or filler material for the purpose of well or borehole decommissioning (a variance may be required).	[DTSC Comment CG6]: Change text as a permit exemption may be used and since DOI and DTSC will, at a minimum, be approving agencies. Underlined text indicates new text inserted into document. Deleted text includes "the permitting" agency.	The proposed edit has been incorporated into the document.	No additional comments.

Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
13	DTSC-10	2.3	Following evaluation of the well or borehole and in coordination with the lead agencies, it must be determined if the well can be decommissioned in place (with or without modification) or if the well materials must be removed.	Underlined text indicates new text inserted into document. Deleted text includes "the permitting" agency.	The proposed edit has been incorporated into the document.	No additional comments.
14	DTSC-11	2.3	The following subsections define the decommissioning scenarios that may apply pending completion of the well evaluation and coordination with lead agencies, responsible agencies **(San Bernardino County or Arizona Department of Water Resources)**, affected land owner, **Tribes,** and other stakeholders.	Underlined text indicates new text inserted into document. Deleted text includes "the permitting" agency.	The proposed edit has been incorporated into the document.	Tech in **bold and underlined** in the "Reference Text" column has been added globally as requested during the call.
15	DTSC-12	2.3.2	1. Conduct evaluation of the well as detailed in Section 2.1 and verify with lead agencies, responsible agencies, affected land owner, and other stakeholders that the well should be decommissioned in place.	[DTSC Comment CG7]: The urban versus non-urban terms created concern to some tribes and distracted from the technical issues at hand. It is recommended that explicit reference to the term be minimized (see highlights in text and Figure 1). Perhaps just referencing the standards will suffice. Underlined text indicates new text inserted into document. Deleted text includes "the permitting" agency.	The proposed edit has been incorporated into the document. See response to comment DTSC-16 regarding the urban and non-urban topic. Reference June 6, 2014 RTC Discussion and what changes result (e.g. Type 1 and Type 2).	As a result of the June 6, 2014 RTC Discussion the terms "urban" and "non-urban" have been removed from the SOP. These terms have been replaced throughout with "Type 1" and "Type 2". A definition for these terms has been added to the beginning of Section 2.3. In addition, Figure 1 has been revised to include the new terminology.
16	DTSC-13	2.3.2	a. Non-urban Area – Place sealing material from total depth to near ground surface.	Yellow highlight added.	See response to comment DTSC-16.	See summary for comment DTSC-12.
17	DTSC-14	2.3.2	b. Urban Area – Place sealing material from total depth to within 5 feet of the ground surface (bgs).	Yellow highlight added.	See response to comment DTSC-16.	See summary for comment DTSC-12.
18	DTSC-15	2.3.2	c. For urban or non-urban area wells located outside an area of known or potential pollution or contamination as determined by the soil and/or groundwater quality data available for the location, evaluate using filler material in lieu of sealing material in portions of the well casing.	[DTSC Comment CG8]: Made edit assuming that well is left in place and could only fill well casing with filler or sealing material. Yellow highlight added. Underlined text indicates new text inserted into document. Deleted text includes "borehole".	The proposed edits have been incorporated into the document. See response to comment DTSC-16 regarding highlighted text.	See summary for comment DTSC-12.

Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
19	DTSC-16	2.3.2	a. Non-urban Area – Remove all well head protection and excavate around the well casing to a depth of approximately 5 feet bgs, or as practicable. Remove all well materials to a depth of approximately 5 feet bgs, or as practicable, cap casing with sealing material such that it extends beyond the diameter of the borehole and will drain fluids away from the borehole. Backfill the void created with displaced site material, or filler material if displaced site material is not available or appropriate. b. Urban Area – Remove all well head protection and excavate around the well casing to a depth of 5 <u>feet</u> bgs. <u>Remove</u> all well materials to a depth of 5 feet bgs, cap casing with sealing material <u>such that it extends beyond the diameter of the borehole and will drain fluids away from the borehole</u>. Backfill the void created with displaced site material, or filler material if displaced site material is not available or appropriate.	[DTSC Comment YA9]: Urban and non-urban decommissioning scenarios appear to be the same. If that the case, let's not differentiate between the two. Yellow highlight added. Underlined text indicates new text inserted into document.	The proposed edits have been incorporated into the document. The following text in **bold** has been added at the end of Section 2.3.2 to address the comment regarding the urban and non-urban topic: **Note that the urban and non-urban scenarios are only subtly different. While the urban scenario requires the removal of all well materials to a depth of 5 feet bgs (per CA well standards), non-urban areas do not require the removal of any well materials. The removal of well materials to a depth of approximately 5 feet bgs, or as practicable, is not required by CA well standards, but included per stakeholder comments.** To further clarify this difference in the text, bullet 4a (decommission well head, non-urban area) has been revised to indicate a range of 1 to 5 feet bgs. The same revision has been made to Section 2.3.3, bullet 4a, and Figure 1.	See summary for comment DTSC-12.
20	DTSC-17	2.3.3	1. Conduct evaluation of the well as detailed in Section 2.1 and verify with <u>lead agencies</u>, <u>responsible agencies</u>, affected land owner, and other stakeholders that the well should be decommissioned in place, what modification work is required, and whether it is in a location considered to be urban.	Underlined text indicates new text inserted into document. Deleted text includes "the permitting".	The proposed edit has been incorporated into the document.	See summary for comment DTSC-11.
21	DTSC-18	2.3.3	a. Non-urban Area – Place sealing material from total depth to near ground surface, or in the event casing is removed, the new top of casing depth. If a portion of the casing is removed, sealing or filler material requirements for the interval above the top of casing must be determined through discussion with <u>lead agencies, responsible agencies</u>, affected land owner, and other stakeholders.	Yellow highlight added. Underlined text indicates new text inserted into document. Deleted text includes "the permitting".	The proposed edit has been incorporated into the document. See response to comment DTSC-16 regarding highlighted text.	See summary for comment DTSC-12.
22	DTSC-19	2.3.3	b. Urban Area – Place sealing material from total depth to within 5 feet of the ground surface (bgs). If a portion of the casing is removed, sealing or filler material requirements for the interval above the top of casing must be determined through discussion with <u>lead agencies, responsible agencies</u>, affected land owner, and other stakeholders.	Yellow highlight added. Underlined text indicates new text inserted into document. Deleted text includes "the permitting".	The proposed edit has been incorporated into the document. See response to comment DTSC-16 regarding highlighted text.	See summary for comment DTSC-12.

Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
23	DTSC-20	2.3.3	c. For urban or non-urban area wells located outside an area of known or potential pollution or contamination, evaluate using filler material in lieu of sealing material in portions of the borehole.	Yellow highlight added.	See response to comment DTSC-16.	See summary for comment DTSC-12.
24	DTSC-21	2.3.3	a. Non-urban Area –Remove all well head protection and excavate around the well casing to a depth of approximately 5 bgs, or as practicable. Remove all well materials to a depth of approximately 5 feet bgs, or as practicable, cap casing with sealing material such that it extends beyond the diameter of the borehole and will drain fluids away from the borehole. Backfill the void created with displaced site material, or filler material if displaced site material is not available or appropriate. b. Urban Area – Remove all well head protection and excavate around the well casing to a depth of 5 bgs. Removal all well materials to a depth of 5 feet bgs, cap casing with sealing material such that it extends beyond the diameter of the borehole and will drain fluids away from the borehole. Backfill the void created with displaced site material, or filler material if displaced site material is not available or appropriate.	[DTSC Comment CG10]: See Comment YA9 above. Urban and non-urban decommissioning scenarios appear to be the same. If that the case, let's not differentiate between the two. Yellow highlight added.	See response to comment DTSC-16.	See summary for comment DTSC-12.
25	DTSC-22	2.3.4	Further, when removal is practicable, lead agencies, responsible agencies, affected land owner, or other stakeholders may determine this method preferable to others. Removal is typically conducted by over-drilling the existing well materials with larger diameter drilling tools.	Underlined text indicates new text inserted into document. Deleted text includes "the permitting".	The proposed edit has been incorporated into the document.	See summary for comment DTSC-11.
26	DTSC-23	2.3.4	1. Conduct evaluation of the well as detailed in Section 2.1 and verify with lead agencies, responsible agencies, affected land owner, and other stakeholders that the well should be decommissioned by removal.	Underlined text indicates new text inserted into document. Deleted text includes "the permitting".	The proposed edit has been incorporated into the document.	See summary for comment DTSC-11.
27	DTSC-24	2.4	Following completion of well decommissioning tasks, reporting of field activities must be completed in compliance with the lead agencies requirements.	Underlined text indicates new text inserted into document.	The proposed edit has been incorporated into the document.	No additional comments.
28	DTSC-25	2.4	The Well Decommissioning Report will be submitted to lead agencies no later than 90 days after completion of well decommissioning activities.	Underlined text indicates new text inserted into document.	The proposed text and text deletions have been incorporated into the document.	No additional comments.
29	DTSC-26	Figure 1	Between steps 3 and 4	Insert step: "Obtain approval to proceed from lead agencies"	The proposed revision to Figure 1 has been incorporated.	

Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
30	DTSC-27	Figure 1	After step 13	Insert step: "Document all activities in a Well Decommissioning Report to be submitted no later than 90 days after the decommissioning event.	The proposed revision to Figure 1 has been incorporated.	
31	DTSC-28	Figure 1	Step 12	Delete "e.g., urban area vs. non-urban area" within the brackets.	The proposed revision to Figure 1 has been incorporated.	
32	Hargis + Associates, Inc. Fort Mojave Indian Tribe (FMIT) April 19, 2013 Letter FMIT-1	General	No specific text.	The Tribe has asked for and supported this effort to proceduralize the decommissioning of the physical intrusions into the landscape created by the drilling of wells and boreholes. Nevertheless, the alternatives available for the decommissioning procedure remain hurtful as they represent a permanent disfiguration of the hallowed landscape across which the project will be constructed. Basically, once a well/borehole is in place, the options for decommissioning involve either the emplacement of foreign, unnatural materials in place of the materials emplaced for during well construction/operation, or attempting to destroy the original downhole materials. In the process of well destruction, however, an even greater disturbance results. Neither option is attractive to the Tribe. Avoiding further disturbances by not constructing additional wells/boreholes of course is the Tribe's preference, particularly recognizing that the cumulative number of anticipated intrusions will perhaps be 350 or more before the project is over. Nevertheless, considering the reality that more disturbances will be created as a result of the remedy, the Tribe emphasizes that flexibility must be maintained. The decision as to how to proceed with decommissioning will necessarily be case-specific and requires advance discussions and consultations with the Tribes.	Comment noted. PG&E has drafted this SOP in coordination with the agencies and Tribes to meet regulatory requirements and minimize both disturbance and the placement of foreign materials. PG&E anticipates further discussions with and input from the Tribes on future work plans, as well as consultation with Tribes in accordance with the consultation protocol detailed in the Programmatic Agreement.	
33	FMIT-2	Preface	"This document was developed as a direct result of Tribal concerns …	The preface claims that "This document was developed as a direct result of Tribal concerns …" While this is in part true, it should be acknowledged that it would have been necessary to develop and SOP for this purpose for overall project purposes anyway. The Tribal request is consistent with the ARARs identified for this action.	Comment noted. The second sentence of the first paragraph has been edited to read as follows (new text in **bold**): This document was developed**, in part,** as a direct result of Tribal concerns that included dialog regarding future decommissioning activities at the site between PG&E, agencies, and Native American Indian Tribes (Tribes).	No additional comments.
34	FMIT-3	Preface	"… use of displaced site material in the decommissioning process …"	The preface also asserts that the "… use of displaced site material in the decommissioning process …" is based on Tribal input. This again is not a possibility related to Tribal input or preference. Provisions for backfilling certain boreholes with drill cuttings is an option that is commonly exercised, such as for exploratory borings. Nevertheless, the Tribe generally regards the earth materials removed from their natural place as a disturbance and potentially a desecration of the land. This section should probably also reference the preparation of an SOP for the handling and disposition of soils displaced as a result of project activities.	While permits are not required for the decommissioning of exploratory boreholes that do not reach the water table, based on the regulations~~, it is not best industry practice to backfill boreholes with drill cuttings~~. The SOP for the handling of disposition of soils displaced as a result of project activities (Management Protocol for Handling and Disposition of Displaced Site Material) is referenced in Section 1.3. A reference to the use of displaced site material (Section 2.2.3) is already included in the first paragraph of the document.	The response has been revised per the discussion. Changes shown in ~~strikeout~~.
35	FMIT-4	Preface	"exploratory borehole."	The preface offers a definition of an "exploratory borehole." Considering that the shelf life of this document is anticipated to be in excess of three decades, there should be a definition section for this term as well as others used throughout the text, such as "decommissioning," "displaced site material," "sealing material," "filler material," "monitor well," "production or extraction well," "injection well," etc. It is understood that some of these terms do not presently appear in the text, but it is necessary to establish the types of wells/boreholes to which this SOP applies. Perhaps a section further explaining the applicability and scope of this SOP is needed.	The first sentence of the second paragraph of the SOP has been revised as follows (new text in **bold**): This SOP will be used as a reference to guide the development of future work plans required for agency, Tribal, and stakeholder review prior to conducting **all** well and borehole decommissioning tasks **associated with the groundwater remedy**. Based on the revised text definition of well types would only add complexity to the SOP. The definition of "sealing material", "filler material", and "displaced site material" is provided in detail in Sections 2.2.1, 2.2.2, and 2.2.3, respectively.	No additional comments.

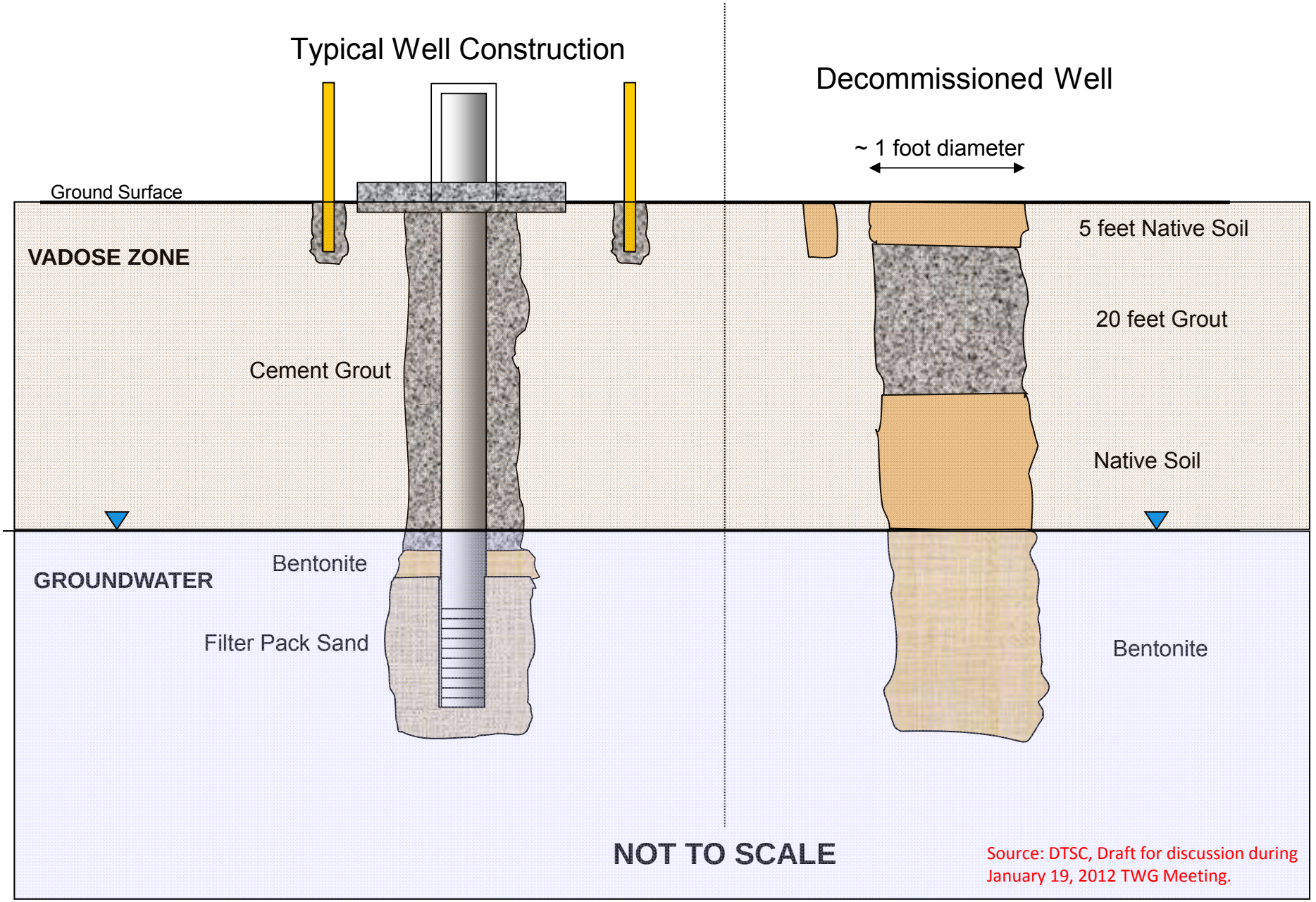
Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
36	FMIT-5	Section 1.0		Both California and Arizona regulatory requirements are outlined in Section 1.0, however, the respective subsections fail to mention provisions for variances within the regulations and guidance documents cited. Additionally, are there any conflicts between the rules promulgated by the two states?	Section 1.2 (Regulatory Information – Arizona [ARARs #48 and #49]) states: *If an alternative method of decommissioning is proposed in lieu of the standard method, further substantive review is performed by ADWR to verify that the proposed methods apply, and whether appropriate fill materials were chosen. A proposal to use an alternative decommissioning method requires an application to ADWR for a variance from the well decommissioning rule (a deviation from the standard decommissioning method).* The technical specifications and procedures for decommissioning well and exploratory boreholes presented in Section 2 of the SOP were developed to be in compliance with both California and Arizona regulations.	No additional comments.
37	FMIT-6	Section 1.3		Section 1.3 discusses CERCLA exemptions for permitting proposed well abandonment. It refers to various discussions with San Bernardino County authorities in this regard and further indicates that, to date, no discussions have been scheduled. It is strongly recommended that PG&E initiate the further discussions with the respective regulatory authorities in both California and Arizona. In fact, it may be advisable to familiarize the regulatory personnel with the context of this particular procedure. The Tribe notes that a preliminary exchange has been made with the Arizona Department of Water Resources (ADWR) through the Arizona Department of Environmental Quality (ADEQ) in regard to the decommissioning of borings proposed in support of exploration for a freshwater source in Arizona. The February 28, 2013, letter from ADWR addresses a proposed variance for this purpose. This seems to indicate ADWR's willingness to work with PG&E in regard to such requests. Accordingly, further liaison with these agencies may be helpful in future situations. If the Tribe can do anything to facilitate such discussions in the interest of its preferences, it stands ready to support such an effort.	PG&E appreciates the Tribe's willingness to assist with discussions with state permitting agencies related to well decommissioning variance options. PG&E anticipates holding these discussions with the agencies when future work plans that involves well decommissioning are being developed so that specific aquifer and well conditions can be contemplated in the context of potential variance options. Further, given that the groundwater remediation project is estimated to last for tens of years, the evaluation of variance options at the time each well decommissioning plan is developed will allow for potential changes in well decommissioning regulations to also be considered.	No additional comments.

Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
38	FMIT-7	Section 2.0		Section 2.0 discusses general procedures for decommissioning. Considering the subsections that follow, it appears that PG&E is targeting a specific recommendation for the well/borehole decommissioning procedure under consideration. As discussed earlier, the Tribe requires discussion and consultation on a case-by-case basis because of the variation in construction characteristics, location, and other factors that enter into the decision. Accordingly, at the outset of such discussions, the Tribe would need information in regard to the alternative procedures available for each case. This information would facilitate the Tribes' decisions on the long-term fate of the intrusions.	As stated at the beginning Section 2.0, *The information provided in this section is intended to be applicable for wells or boreholes located in either California or Arizona; however, it is assumed that the details included in the specific work plan(s) will be designed in compliance with the appropriate state regulations, and reviewed by the appropriate permitting agency.* To more clearly acknowledge that potential for well decommissioning procedures that would require a variance to the applicable state regulations, the following statement in **bold** has been added to the document after the text referenced above: **In addition, depending on the condition of the aquifer and well(s) subject to decommissioning, potentially applicable variance options that include the minimization of the placement of sealing material should be evaluated with the lead agencies during well decommission work plan development (e.g., Arizona Alternative 4 – variance option).** In addition, the following text has been added to the end of the second paragraph in Section 1.2 (new text in **bold**): *The Well Abandonment Handbook (WAH) provides a standard well decommissioning method to be used for the post-installation of any well or borehole, regardless of the aquifer or vadose zone conditions applicable to the well (Section IV A). In addition, the WAH details five alternative abandonment methods. The five alternatives are for specific vadose zone and aquifer conditions which may include contamination, single or multiple aquifers, or dry wells (Section IV B).* ***For example, Alternative 4, which applies to wells that only penetrate a single aquifer without vertical flow components and no water quality contamination issues, might be applicable to wells in the Topock area that are 8-inches or greater in diameter. A variance option to Alternative 4 permits the use of clean fine sand to fill the well being decommissioned.*** Further, the text included in box number 13 on the decision flow chart presented in Figure 1 has been revised as follows (including text strikeout per comment DTSC-28 and with new text in **bold**): Place sealing/filler material within the borehole or well casing in accordance with regulatory and project-specific guidance**, and any permitting agency-approved variance conditions**.	During the June 6, 2014 subgroup discussion, the Tribes requested that additional information on potential variance conditions that had been previously developed by DTSC be added to this SOP. Please advise if the three schematics included in new Attachment A to this SOP are appropriate and meet the intent of this comment. Thank you.
39	FMIT-8	Section 2.2		The subsections under Section 2.2 do not appear to recognize provisions for variances as discussed earlier. Indeed such scenarios need to be developed and discussions held with the respective regulatory authorities as to the acceptability, need and justifications, and technical rationale for such requests. To this point, the subcommittee has spent time on alternative conceptual designs. This SOP does not include or acknowledge this work.	The subsections under Section 2.2 simply present the different types of materials that can be used for various well or borehole decommissioning scenarios, and not is not intended to evaluate or disqualify variance well decommissioning options. See the response to FMIT-7, which adds text to more clearly acknowledge the potential for variance options.	During the June 6, 2014 subgroup discussion, the Tribes requested that additional information on potential variance conditions that had been previously developed by DTSC be added to this SOP. Please advise if the three schematics included in new Attachment A to this SOP are appropriate and meet the intent of this comment. Thank you.

Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
40	FMIT-9	Section 2.3		Section 2.3 develops different scenarios. However, these scenarios only relate to standard situations and again do not consider the possibilities of variances. The situations in which variances are appropriate and applicable for consideration need to be developed in this procedure, otherwise those following the procedure will simply adhere strictly to the content. Additionally, this section appears to only consider the California rules, which distinguish between "urban" and "non-urban" areas. This, for example, is not a relevant consideration for the Site and is not referenced in the Arizona guidelines. The design for well decommissioning should not have to be a choice between these two options.	The evaluation of scenarios in Section 2.3 were developed in consideration of both California and Arizona regulations. The distinction between urban and non-urban is subtle and has been clarified as detailed in the response to comment DTSC-16. Both California and Arizona regulations detail specific procedures depending on aquifer and well conditions. California regulations do not reference any variance conditions, while the Arizona regulations reference alternatives to the recommended standard decommissioning procedure and some variance options associated with those alternatives. Variance conditions or potential scenarios that may or may not be approved by regulatory agencies should not be included in an SOP. Also, see comment FMIT-7.	During the June 6, 2014 subgroup discussion, the Tribes requested that additional information on potential variance conditions that had been previously developed by DTSC be added to this SOP. Please advise if the three schematics included in new Attachment A to this SOP are appropriate and meet the intent of this comment. Thank you.
41	FMIT-10	Section 2.4		Section 2.4 discusses "Well Decommissioning Reporting," and specifies that the information be reported in the Topock Well Inventory. Is this information also reported in the Well Registry for the respective states?	Yes, well decommissioning reports are filed with ADWR and California DWR in accordance with the respective well standards for each state. As noted in the first sentence of Section 2.4 (including edit made in accordance with comment DTSC-24): Following completion of well decommissioning tasks, reporting of field activities must be completed in compliance with the lead agencies requirements.	No additional comments.
42	FMIT-11	Figure 1		Figure 1 needs to be changed to reflect the above comments.	See response to comment FMIT-7.	No additional comments.
43	Hualapai Department of Cultural Resources (HDCR) April 24, 2013 Letter HDCR-1			On behalf of the Hualapai Tribe, we feel that is very important to have minimal disturbance in an area that has been under constant environmental change due to the operations of the Topock Compressor Station. As wells and well materials are intrusive, we feel that it is best that all well casings be left in-situ when and if wells are to be decommissioned. This will be the least intrusive and create the least amount of disturbance.	PG&E agrees that the decommissioning procedure which involves the least amount of disturbance that is acceptable to the regulatory agencies should be implemented. The following text in **bold** has been added to Section 2.3.2 (Decommissioning a Well in Place): **This decommissioning option should be utilized whenever acceptable to the regulatory agencies as it represents the field procedures that are least intrusive and create the least amount of disturbance.**	No additional comments.
44	HDCR-2			In the process of decommissioning, Hualapai prefer that natural materials from the immediate vicinity be placed inside the well-casings, and that wells be capped with the least amount of invasive materials, i.e. concrete, steel bolts, etc. As wells come under the decommissioning process, Hualapai would like to be informed about each well that is going to be subject to decommissioning.	See response to comment FMIT-1 regarding consultation with the Tribes on future work plans, and FMIT-7 regarding clarifying information that is being added to the document to acknowledge the potential for variance conditions.	No additional comments.

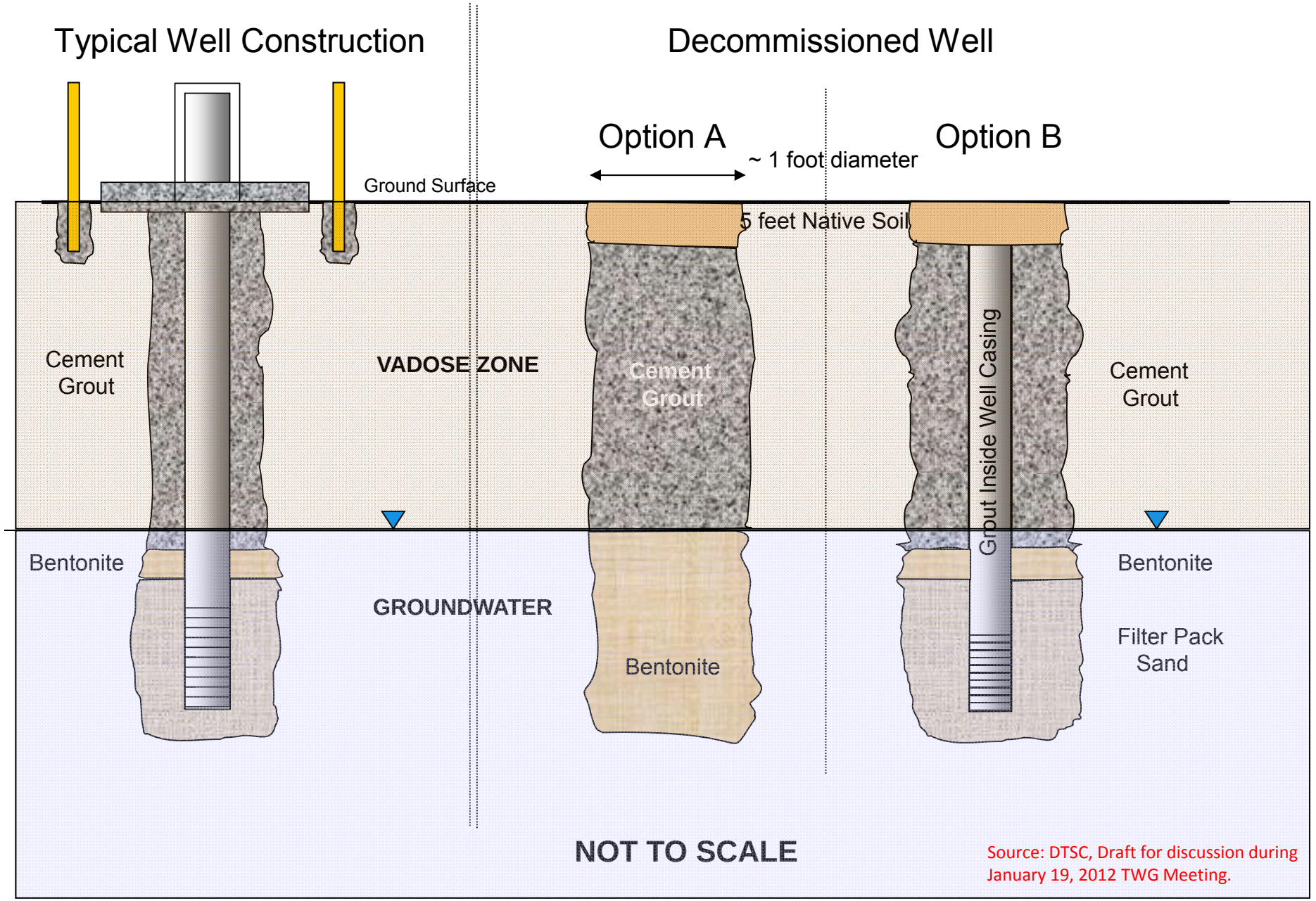
Attachment B
Draft DTSC Concepts for Well and Borehole Decommissioning

Category 1: Contaminant Free – No Variance



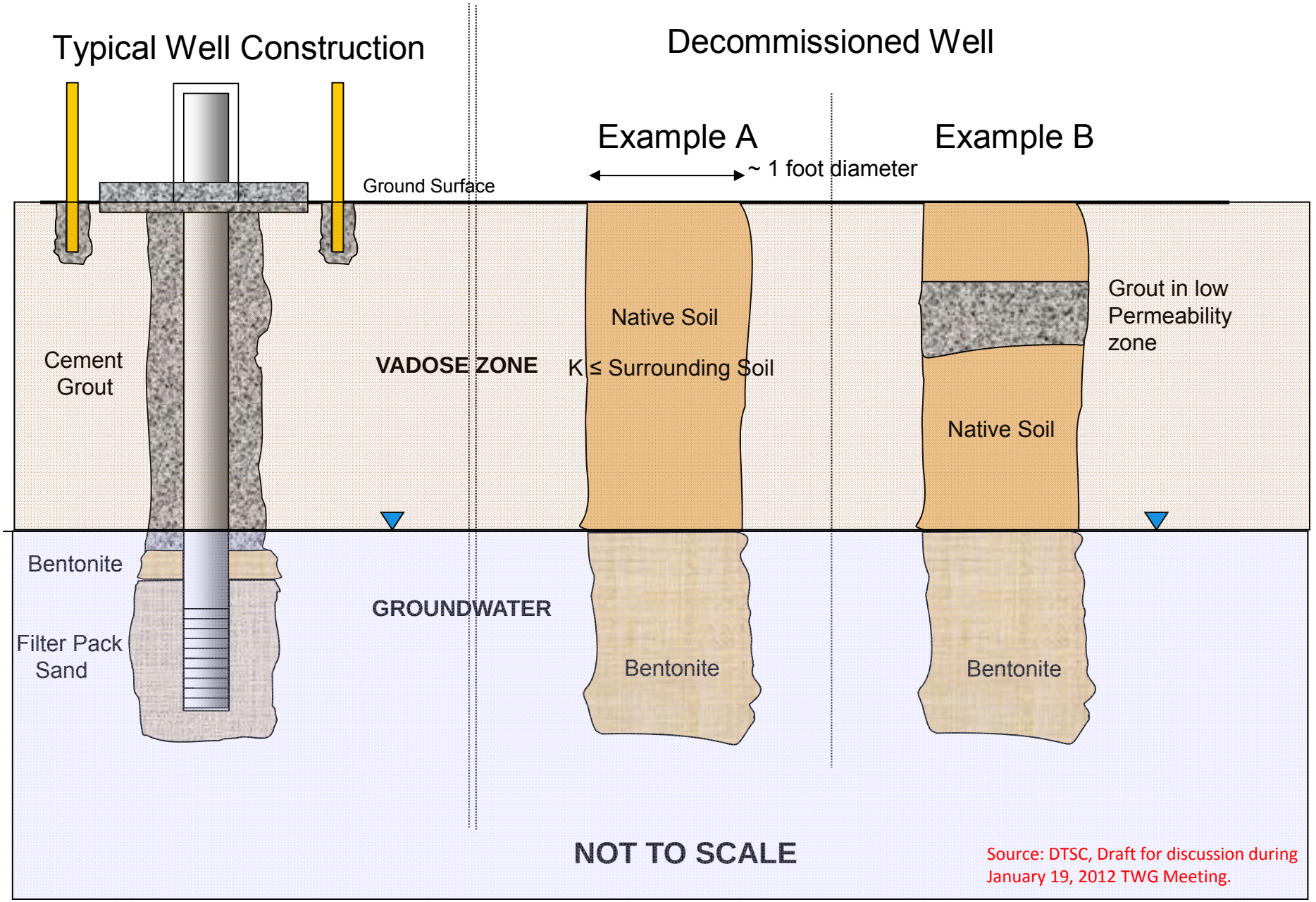
Source: DTSC, Draft for discussion during January 19, 2012 TWG Meeting.

Category 2: Contaminanted Area – No Variance



Source: DTSC, Draft for discussion during January 19, 2012 TWG Meeting.

Category 3: Contaminant Free – Variance



Source: DTSC, Draft for discussion during January 19, 2012 TWG Meeting.

SOP-B2

Soil Classification and Logging Procedures
Standard Operating Procedures for PG&E Topock Program

This standard operating procedure (SOP) provides guidance to obtain accurate and consistent descriptions of soil characteristics during soil-sampling operations. The characterization is based on visual examination and manual tests not on laboratory determinations.

REQUIRED DOCUMENTS

1) Event-specific sampling and analysis plan, work plan or event-specific field instructions. Planned borehole depth, proposed well construction/specifications, and field sampling summary table, if available.

2) Applicable project work plan or monitoring plan. Refer to Topock Program *Sampling, Analysis, and Field Procedures Manual* and *Quality Assurance Project* Plan (Procedures Manual), as required.

3) Topock Program Health and Safety Plan (HSP).

4) Previous sampling, drilling, or well construction logs from other boreholes or wells in the vicinity, if available.

5) Blank field notebook.

6) Blank CH2M HILL soil boring log Form D1586.

PREPARATION AND SETUP

1) Review event-specific work plan or event-specific field instructions, previous sampling logs, Procedures Manual, and HSP.

2) Initiate field logbook for sampling activity.

3) Review sampling procedures and equipment, and planned sample depths with drilling contractor and field crew.

EQUIPMENT LIST

- Indelible pens
- Tape measure or ruler
- Field logbook
- Spatula
- HCl, 10-percent solution
- Squirt bottle/Spray bottle with water

- Rock- or soil-color chart (e.g., Munsell)
- Grain-size chart
- Hand lens
- Unified Soil Classification System index charts and tables to help with soil classification

PROCEDURES

This section covers several aspects of the soil characterization: instructions for completing the CH2M HILL soil boring log (see Form D1586, Attachment A) and the field logging of soil using the "Unified Soil Classification System and Logging Criteria" (Attachment B).

Instructions for Completing Soil Boring Logs

- Soil boring logs will be completed on field boring log forms. Information collected will be consistent with that required for Form D1586 (attached), a standard CH2M HILL form, or an equivalent form that supplies the same information.
- The information collected in the field to perform the soil characterization is described below.
- Field personnel should review completed logs for accuracy, clarity, and thoroughness of detail. Samples also should be checked to see that information is correctly recorded on both jar lids and labels and on the log sheets.

Heading Information

1) **Boring/Well Number.** Enter the boring/well number. A numbering system should be chosen that does not conflict with information recorded for previous exploratory work done at the site. Number the sheets consecutively for each boring.
2) **Location.** If stationing, coordinates, mileposts, or similar project layout information is available, indicate the position of the boring to that system using modifiers such as "approximate" or "estimated," as appropriate.
3) **Elevation.** Elevation will be determined at the conclusion of field activities.
4) **Drilling Contractor.** Enter the name of the drilling company and the city and state where the company is based.
5) **Drilling Method and Equipment.** Identify the bit size and type, drilling fluid (if used), and method of drilling (e.g., rotary, hollow-stem auger, sonic). Information on the drilling equipment (e.g., CME 55, Mobile B61) should be noted.
6) **Water Level and Date.** Enter the depth below ground surface to the apparent water level in the borehole. The information should be recorded as a comment. If free water is not encountered during drilling or cannot be detected because of the drilling method, this information should be noted. Record date and time of day (for tides, river stage) of each water level measurement.

7) **Date of Start and Finish.** Enter the dates the boring was started and completed. Time of day should be added if several borings are performed on the same day.

8) **Logger.** Enter the first initial and full last name of the logger.

Technical Data

1) **Depth Below Surface.** Use a depth scale that is appropriate for the sample spacing and for the complexity of subsurface conditions.

2) **Sample Interval.** Note the depth at the top and bottom of the sample interval.

3) **Sample Type and Number.** Enter the sample type and number. SS-1 = split spoon, first sample. Number samples consecutively regardless of type. Enter a sample number even if no material was recovered in the sampler.

4) **Sample Recovery.** Enter the length to the nearest 0.1 foot of soil sample recovered from the sampler. Often, there will be some wash or caved material above the sample; do not include the wash material in the measurement. Record recovery in feet.

5) **Soil Description.** The soil classification should follow the format described in the "Field Classification of Soil" subsection below.

6) **Comments.** Include all pertinent observations (changes in drilling fluid color, rod drops, drilling chatter, rod bounce as in driving on a cobble, damaged Shelby tubes, and equipment malfunctions). In addition, note if casing was used, the sizes and depths installed, and if drilling fluid was added or changed. You should instruct the driller to alert you to any significant changes in drilling (changes in material, occurrence of boulders, and loss of drilling fluid). Such information should be attributed to the driller and recorded in this column. Specific information might include:

   - The date and the time drilling began and ended each day.
   - The depth and size of casing and the method of installation.
   - The date, time, and depth of water level measurements.
   - Depth of rod chatter.
   - Depth and percentage of drilling fluid loss.
   - Depth of hole caving or heaving.
   - Depth of change in material.
   - Health and safety monitoring data.
   - Drilling interval through a boulder.

Field Classification of Soil

This section presents the format for the field classification of soil. In general, the approach and format for classifying soils should conform to the "United Soils Classification System and Logging Criteria" (see charts and criteria, Attachment B).

- The Unified Soil Classification System (USCS) is based on numerical values of certain soil properties that are measured by laboratory tests (ASTM D 2487). It is possible, however, to estimate these values in the field with reasonable accuracy using visual-manual procedures (ASTM D 2488). In addition, some elements of a complete soil description, such as the presence of cobbles or boulders, changes in strata, and the relative proportions of soil types in a bedded deposit can be obtained only in the field.
- Soil descriptions should be precise and comprehensive without being verbose. The correct overall impression of the soil should not be distorted by excessive emphasis on insignificant details. In general, similarities rather than differences between consecutive samples should be stressed.

Soil Descriptions

Soil descriptions must be recorded for every soil sample collected. The format and order for soil descriptions should be:

1) Soil name (synonymous with ASTM D 2488 Group Name) with appropriate modifiers. Soil name should be in all capitals in the log, for example "POORLY-GRADED SAND."
2) Group symbol, in parentheses, for example, "(SP)."
3) Color, using Munsell color designation.
4) Particle size distribution (i.e., sand, silt, clay).
5) Moisture content.
6) Relative density or consistency.
7) Soil structure, mineralogy, or other descriptors.

This order follows, in general, the format described in ASTM D 2488.

(1) Soil Name

The basic name of a soil should be the ASTM D 2488 Group Name on the basis of visual estimates of gradation and plasticity. The soil name should be capitalized.

Examples of acceptable soil names are illustrated by the following descriptions:

- A soil sample is visually estimated to contain 15-percent gravel, 55-percent sand, and 30-percent fines (passing No. 200 sieve). The fines are estimated as either low- or highly-plastic silt. This visual classification is SILTY SAND WITH GRAVEL with a Group Symbol of (SM).
- Another soil sample has the following visual estimate: 10-percent gravel, 30-percent sand, and 60-percent fines (passing the No. 200 sieve). The fines are estimated as low-plastic silt. This visual classification is SANDY SILT. The gravel portion is not included in the soil name because the gravel portion was estimated as less than 15 percent. The Group Symbol is (ML).

The gradation of coarse-grained soil (more than 50 percent retained on No. 200 sieve) is included in the specific soil name in accordance with ASTM D 2488.

- There is no need to further document the gradation.
- However, the maximum size and angularity or roundness of gravel and sand-sized particles should be recorded.
- For fine-grained soil (50 percent or more passing the No. 200 sieve), the name is modified by the appropriate plasticity/elasticity term in accordance with ASTM D 2488.

Interlayered soil should each be described starting with the predominant type.

- An introductory name, such as "Interlayered Sand and Silt," should be used.
- In addition, the relative proportion of each soil type should be indicated (see Table 1 for example).

Where helpful, the evaluation of plasticity/elasticity can be justified by describing results from any of the visual-manual procedures for identifying fine-grained soils, such as reaction to shaking, toughness of a soil thread, or dry strength as described in ASTM D 2488.

(2) Group Symbol

The appropriate group symbol from ASTM D 2488 must be given after each soil name.

1) The group symbol should be placed in parentheses to indicate that the classification has been estimated.
2) In accordance with ASTM D 2488, dual symbols (e.g., GP-GM or SW-SC) can be used to indicate that a soil is estimated to have about 10-percent fines.
3) Borderline symbols (e.g., GM/SM or SW/SP) can be used to indicate that a soil sample has been identified as having properties that do not distinctly place the soil into a specific group. Generally, the group name assigned to a soil with a borderline symbol should be the group name for the first symbol. The use of a borderline symbol should not be used indiscriminately. Every effort should be made to first place the soil into a single group.

(3) Color

Soil color is described by comparing the sample with the Munsell Soil Color Charts. The Munsell colors should be used unless directed otherwise by project sampling plans. Instructions for their proper use are in the color charts. The color name shall precede the Munsell color notation (e.g., "yellowish brown, 10 YR 5/4"), with color hue and chroma number parenthetically entered in the borelog description. If no color chip is available, the color should be simply described as primary color (i.e., green, brown, gray, yellow, tan, etc.).

(4) Particle Size Distribution

Within the gravel sizes and the sand sizes, there are further divisions based on particle sizes. Gravel is divided into fine and coarse gravel. Fine-gravel particles (pebbles) are those that would pass through 3/4-inch opening but not a 1/4-inch opening. The fine gravel ranges from pea- to marble-sized. Coarse-gravel particles are those that would pass through a 3-inch opening but not a 3/4-in opening. Common objects of this size are grapes and tennis balls. Cobbles range from 3 inches to 12 inches in size; boulders are larger than 12 inches.

Sand is divided into three sizes: fine, medium, and coarse. Sand passes a No. 4 sieve (approximately 1/4 inch) and is retained in a No. 200 sieve (0.003 inch). Fine-sand particles pass a No. 40 sieve (approximately 1/64 inch) and are retained in the No. 200 (0.003 inch) sieve. These particles are sugar- or table salt-sized. Medium sand passes the No. 10 sieve (approximately 1/2 inch) and retained on the No. 40 sieve. These particles are about the same size as the openings in window screening. Coarse-sand particles would pass a No. 4 sieve (approximately 1/4 inch) and be retained on a No. 10 sieve. Rock salt granules fall in this size range. Sand and gravel particle sizes are illustrated in ASTM D2488 along with percentage estimating charts. The percentages of different grain size fractions are important in the soil type determination.

(5) Moisture Content

Soil moisture content shall be estimated using only the terminology described below:

- Dry - Absence of moisture, dusty, dry to the touch
- Moist - Damp but no visible water
- Wet - Visibly free water, usually sampled from below the water table

(6) Relative Density or Consistency

An estimate of the consistency shall accompany descriptions of all fine-grained soil (silt and clay where more than 50 percent of the material would pass the No. 200 sieve). A pocket penetrometer is the most accurate method for estimating the consistency of fine-grained soils. The table below lists characteristics for soil consistency identification.

Consistency	Unconfined Compressive Strength (tons/ft)[a]	Blows/foot (SPT) [b]	Manual Procedure
Very soft	<0.25	0 – 4	Thumb will penetrate soil more than 1 inch (25 mm).
Soft	0.25 - 0.50	4 – 8	Thumb will penetrate soil about 1 inch (25 mm).
Firm (formerly stiff)	-1.50	8 – 15	Thumb will indent soil about 1/4 inch (6 mm).
Hard	-2.00	15 – 30	Thumb will not indent soil but readily indented with thumbnail.
Very hard	>4.0	> 30	Thumbnail will not indent soil.

Notes:

[a] Pocket penetrometer

[b] Blows/foot is defined as the total number of blows required to drive the second and third 6 inches of penetration (blow counts for the first 6 inches are also noted) while driving an 18-inch SPT sampler with a 140-pound hammer falling a free height of 30 inches. Conversion factors may be applied when the field log information is transferred to the final log when using a sampler other than an SPT (Standard penetrometer) (e.g., S&H or Modified California), or when using different hammer weights and drop. The conversion factor is approximately 0.5 for an S&H sampler with a hammer weight of 140 pounds falling 30 inches.

Descriptions of all coarse-grained soil (sand and gravel where less than 50 percent of the material would pass the No. 200 sieve and 100 percent would pass the 3-inch sieve) shall be

accompanied by an estimate of the density based upon standard penetrometer (SPT) blow counts. The following terminology should be used:

Density	Blows/foot (SPT)
Very loose	< 4
Loose	4-10
Medium dense	10-30
Dense	30-50
Very dense	> 50

(7) Soil Structure, Mineralogy, and Other Descriptors

Discontinuities and inclusions are important and should be described. Such features include joints or fissures, slickensides, bedding or laminations, veins, root holes, and wood debris.

Significant mineralogical information such as cementation, abundant mica, or unusual mineralogy should be described.

Other descriptors may include particle angularity or shape, maximum particle size, hardness of large particles, plasticity of fines, dry strength, dilatancy, toughness, reaction to HCl, and staining, as well as other information such as organic debris, odor, or presence of free product. Criteria for the use of these other descriptions include:

- Structure:
  - Stratified - Alternating layers of varying material or color with layers at least 1/4-inch thick; note thickness.
  - Laminated - Alternating layers of varying material or color with the layers less than 1/4-inch thick; note thickness.
  - Fissured - Breaks along definite planes of fracture with little resistance.
  - Slickensides - Fracture planes appear polished or glossy, often striated.
  - Blocky - Cohesive soil that can be broken down into small angular lumps that resist further breakdown.
  - Lensed - Inclusion of small pockets of different soils, such as lenses of sand within clay; note thickness.
  - Homogeneous - Same color and appearance throughout.
  - Grading - Whether the particles increase or decrease in size toward the top of logged interval.
- Particle Shape:
  - Flat - Particles with width/thickness ratio > 3.
  - Elongated - Particles with length/width ratio > 3.

  - Elongated and flat - Particles meet criteria for both flat and elongated.

- Particle Angularity:
  - Angular - Particles have sharp edges and relatively planar sides with unpolished surfaces.
  - Subangular - Particles are similar to angular description but have rounded edges.
  - Subrounded - Particles have nearly planar sides but have well-rounded corners and edges.
  - Rounded - Particles have smoothly-curved sides and no edges.
- Cementation:
  - Weak - rumbles or breaks with handling or little finger pressure.
  - Moderate - Crumbles or breaks with considerable finger pressure.
  - Strong - Will not crumble or break with finger pressure.
- Reaction with HCl:
  - None - No visible reaction.
  - Weak - Some reaction, bubbles forming slowly.
  - Strong - Vigorous reaction, bubbles forming immediately.

Comments

This section should be reserved for information not pertaining to lithologic description. Sample information including sample identifier, analysis, matrix, and depth interval should be included in the boring log comments. Information related to drilling, such as drilling rate, chatter, and equipment malfunctions should also be well documented in the comments section of the boring log. Additionally interpretations of the lithologic data may also be presented in the comments section. Examples of this include "transition between Older Alluvium and Fanglomerate," "paleosol horizon B," or "conductive zone."

Recovery

Recovery data are entered along the left side of the boring log. Enter the length of retrieved core to the nearest 0.1 foot of sample recovered and record the value in feet. Do not count slough or caved material as part of the total recovered length of core. Record total length and percent of sample recovered. If using a 5-foot sample barrel, multiply the total length by 2 and 100 to get a percentage number. Similarly, if using a 2.5-foot sampler, multiply by 4 and 100 to get the percent recovery.

Backfilling

When a boring is completed and the water level measured, the boring shall be backfilled to ground surface according to applicable regulations. The destruction of the hole shall be noted on the log. Borehole destruction should follow SOP 28 *Soil Boring Abandonment*

Attachments

- Soil Boring Log, CH2M HILL Form D1586, and a completed example
- Unified Soil Classification System and Logging Criteria

Key Checks and Preventive Maintenance

Check entries to the soil boring log and field logbook in the field; because the samples will be disposed of, confirmation and corrections cannot be made later. Check that sample numbers and intervals are properly specified. Check that drilling and sampling equipment is decontaminated using the procedures defined in SOP *Decontamination of Drilling Rigs and Equipment*.

ATTACHMENT A

Examples of Soil Bore Logs

CH2MHILL

PROJECT NUMBER	BORING NUMBER SHEET OF

SOIL BORING LOG

PROJECT _____ LOCATION _____

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT _____

WATER LEVELS _____ START _____ FINISH _____ LOGGER _____

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE	RECOVERY (FT)	6"-6"-6" (N)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION

REV 9/96 FORM D1586

SHEET 1 of 9	**PROJECT NUMBER:** 326128.01.16.EN	**BORING NUMBER:** *MW-47*

SOIL BORING LOG - DRAFT FOR DISCUSSION

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 288.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,450.05	**EASTING (CCS NAD 27 Z 5):** 7,615,629.49	**DATE STARTED:** 02/27/2006	**DATE COMPLETED:** 03/13/2006
DRILLING METHOD: Rotosonic			**DRILLING EQUIPMENT:** Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** B. Moayyad, K. Ebel	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	USCS CODE	SOIL DESCRIPTION SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
5			6	SP	**POORLY GRADED SAND (SP)** - very lt brn (10YR7/3), =2% fines, 98% f to m lithic quartz sand, subang to subrnd, dry - fine roots, iron staining, some iron oxide coating on grains	Hand augured to 5' bgs
10			10	SP	- slightly moist - dry	Rapid drill rate, no chatter
15						
20			16	SW	**WELL GRADED SAND w/ GRAVEL (SW)** - lt yellowish brn (10YR6/4), 45% gravel up to 7cm, 50% f to m sand, 5% fines, loose, met subang gravel, dry(moist@ 17') - cobble present in slough - one subrnd chert gravel - Possible Fluvially Reworked Alluvium - lt grey (10YR7/2), subang to rnd met gravel up to 9cm, 2% to 5% fines - dk yellowish brn (10YR4/4), mostly c sand subang to ang, met, some Miocene conglomerate gravel	
25					- 65% sand, 30% gravel up to 4cm, 5% fines	
30				SW	**WELL GRADED SAND w/ GRAVEL (SW)** - dk yellowish brn (10YR3/6), 35% gravel up to 4cm, 55% m to c sand, 10% silty fines, met clasts are grain supported some mm siltstone - some oxide staining	
35				SW	**WELL GRADED SAND w/ GRAVEL AND CLAY (SW)** - dk yellowish brn (10YR3/6), 30% subang met gravel up to 7 cm, 55% subrnd to subang m to c sand, 15% clayey fines, m density, moist	Drill rate slowed to clean out 8" pipe

CH2MHILL

PROJECT NUMBER: 326128.01.16.EN

BORING NUMBER: *MW-47*

SOIL BORING LOG - DRAFT FOR DISCUSSION

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 288.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,450.05	**EASTING (CCS NAD 27 Z 5):** 7,615,629.49	**DATE STARTED:** 02/27/2006	**DATE COMPLETED:** 03/13/2006
DRILLING METHOD: Rotosonic			**DRILLING EQUIPMENT:** Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** B. Moayyad, K. Ebel	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	USCS CODE	SOIL DESCRIPTION SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
			2.5	SW	**WELL GRADED SAND w/ GRAVEL (SW)** - dr yellowish brn (10YR3/6), 30% gravel, 60% sand, 10% silty fines	Drilling smooth but preceeds less rapidly
40			10	SW	**WELL GRADED SAND w/ GRAVEL (SW)** - 40% subang met gravel up to 6cm, 55% subrnd to ang sand, 5% fines - more gravel below 38'	
45					- gravel is mostly fine	
50			10	SW	**WELL GRADED SAND w/ GRAVEL (SW)** - Pale brn (10YR6/3), 30% subang met gravel up to 5cm, 60% subrnd to subang m to c met sand, 10% silty fines, wet	Soil sample collected
				SP	**POORLY GRADED SAND w/ GRAVEL (SP)** - pale brn (10TR6/3), 30% f subang gravel up to 2 cm, 65% mostly c sand, =2% fines	
55				SW	**WELL GRADED SAND w/ GRAVEL (SW)** - yellowish brn (10YR5/4), 40% subang met gravel up to 9cm, 55% f to c met sand, 5% silty fines, clast supported, m density, wet	
60			9.5	GW	**WELL GRADED GRAVEL w/ SILT AND SAND (GW)** - brn (7.5YR5/4), 55% subang to ang met gravel up to 4cm, 25% f to c sand, 20% silty fines, dense, moist to dry - soil dries out	Collected Isoflow sample
65					- lt grey (10YR7/2) and powder dry - moist sandy zone, 55% gravel, 35% sand, 10% fines - dry silty lt grey GW below 65'	Drill rate slows to 2' / min
70				SW	**WELL GRADED SAND w/ GRAVEL (SW)** - yellowish brn (10YR5/4), 35% subang met gravel up to 4cm, 60% subrnd sand, 5% silty fines, loose, moist to wet	Moderate Drill Rate

CH2MHILL

PROJECT NUMBER: 326128.01.16.EN

BORING NUMBER: *MW-47*

SOIL BORING LOG - DRAFT FOR DISCUSSION

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 288.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,450.05	**EASTING (CCS NAD 27 Z 5):** 7,615,629.49	**DATE STARTED:** 02/27/2006	**DATE COMPLETED:** 03/13/2006
DRILLING METHOD: Rotosonic			**DRILLING EQUIPMENT:** Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** B. Moayyad, K. Ebel	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	USCS CODE	SOIL DESCRIPTION SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
			6	SP	**POORLY GRADED SAND w/ SILT (SP)** - brn (7.5YR4/4), 5% subrnd to subang met gravel up to 4cm, 85% f to c sand, 10% fines, poorly graded, wet, no odor	
145			3	SM	**SILTY SAND W/ GRAVEL (SM)** - brn (7.5YR4/4), 20% subang to subrnd gravel up to 6cm, 60% f to c sand, 20% silty fines, well graded, m consolidated, met, wet, no odor	
150			5	SM	**SILTY SAND w/ GRAVEL (SM)** - dk yellowish brn (10YR4/4), 25% subang to subrnd up to 4cm met gravel, 60% well graded f to c sand, 15% fines, wet, no odor	
155			4	SW	**WELL GRADED SAND w/ SILT AND SAND (SW)** - dr yellowish brn (10YR4/4), 10% subang to subrnd up to 3cm met gravel, 75%well graded f to c sand, 15% fines, moist to wet	
			2	SW	**SILTY SAND (SM)** - brn (7.5YR4/4), 5% ang to subrnd met gravel up to 1.5cm increasing with depth, 85% poorly graded m to c sand, 10% fines, loose, wet	
			2	SM	**SILTY SAND w/ GRAVEL (SM)** - dk yellowish brn (10YR4/4), 15% subang to subrnd up to 2.5cm met gravel, 75% well graded f to c sand, 10% fines, mostly met, trace chert, loose, wet, no odor	Collected Isoflow sample
160			4	SM	**SILTY SAND W/ GRAVEL (SM)** - brn (7.5YR4/4), 25% subang to subrnd gravel up to 6.5cm, 60% m to c sand, 15% silty fines, well graded, m consolidated, met, wet, no odor	Drill rate = 0.75' to 1.5' / min
165			4	SW	**SILTY SAND (SW)** - mottled dk reddish brn (5YR3/4), 10% subang to subrnd gravel up to 2.5cm, 50% well graded f to m sand, 40% silt, metamorphic, dry to damp, no odor, interbedded sandy silt laminations	
170			5.5	SW	**SAND w/ GRAVEL (SW)** - dk reddish brn (5YR3/4), 20% subang to subrnd gravel up to 5cm, 75% f to c sand, 5% fines, well graded, loose, met, wet	
175			2.5	SM	**SILTY SAND w/ GRAVEL (SM)** - brn (7.5YR4/4), 15% subang to subrnd gravel, 70% f to m sand, 15% fines, poorly graded, met,increasingly consolidated, slightly to moderately calcareous, moist to wet	

PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	*MW-47*

SOIL BORING LOG - DRAFT FOR DISCUSSION

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 288.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,450.05	**EASTING (CCS NAD 27 Z 5):** 7,615,629.49	**DATE STARTED:** 02/27/2006	**DATE COMPLETED:** 03/13/2006
DRILLING METHOD: Rotosonic			**DRILLING EQUIPMENT:** Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** B. Moayyad, K. Ebel	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	USCS CODE	SOIL DESCRIPTION SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
285			0	BR	**MIOCENE CONGLOMERATE BEDROCK (BR)** - 60% well graded subang to rnd gravel up to 10cm, 30% well graded sand, 10% fines, very calcareous, well consolidated to mostly hard, mod to very altered locally, mostly met, dry to moist	
					Boring Terminated at 288 ft	

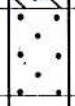
ABBREVIATIONS

cc = continuous core run
brn = brown
lt = light
dk = dark
vf = very fine-grained
f = fine-grained
m = medium-grained
c = coarse-grained
vc = very coarse-grained
ang = angular
subang = subangular
subrnd = subrounded
rnd = rounded
br = bedrock formation
ss = sandstone
conglom = conglomerate
comptd = compacted
qtz = quartz

CH2MHILL

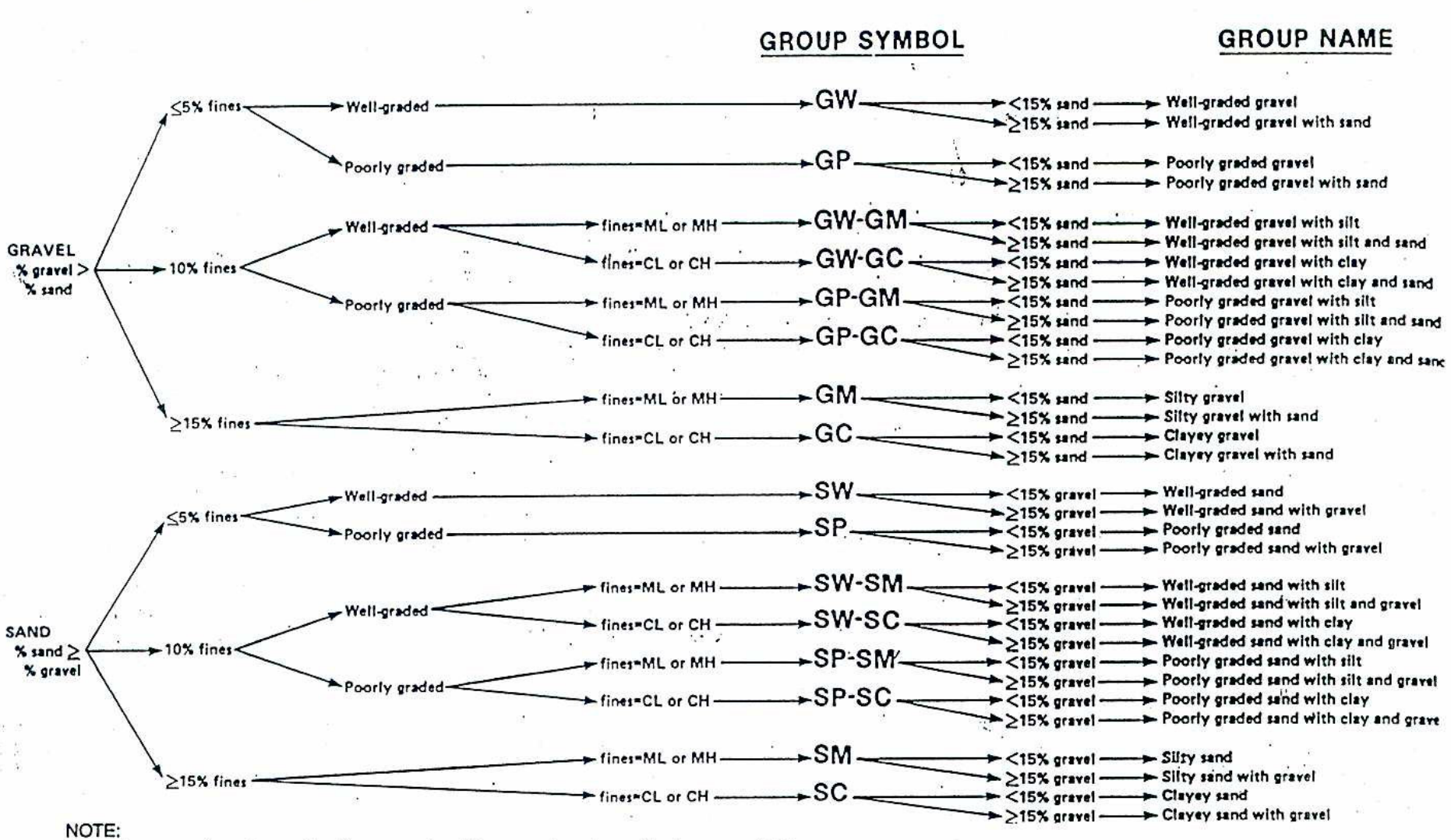
ATTACHMENT B

Unified Soil Classification System and Logging Criteria

GENERAL SOIL CATEGORIES			SYMBOLS		TYPICAL SOIL TYPES
COARSE GRAINED SOILS More than half is larger than No. 200 sieve	GRAVEL More than half coarse fraction is larger than No. 4 sieve size	Clean Gravel with little or no fines	GW		Well Graded Gravel, Gravel-Sand Mixtures
			GP		Poorly Graded Gravel, Gravel-Sand Mixtures
		Gravel with more than 12% fines	GM		Silty Gravel, Poorly Graded Gravel-Sand-Silt Mixtures
			GC		Clayey Gravel, Poorly Graded Gravel-Sand-Clay Mixtures
	SAND More than half coarse fraction is smaller than No. 4 sieve size	Clean sand with little or no fines	SW		Well Graded Sand, Gravelly Sand
			SP		Poorly Graded Sand, Gravelly Sand
		Sand with more than 12% fines	SM		Silty Sand, Poorly Graded Sand-Silt Mixtures
			SC		Clayey Sand, Poorly Graded Sand-Clay Mixtures
FINE GRAINED SOILS More than half is smaller than No. 200 sieve	SILT AND CLAY Liquid Limit Less than 50%		ML		Inorganic Silt and Very Fine Sand, Rock Flour, Silty or Clayey Fine Sand, or Clayey Silt with Slight Plasticity
			CL		Inorganic Clay of Low to Medium Plasticity, Gravelly Clay, Sandy Clay, Silty Clay, Lean Clay
			OL		Organic Clay and Organic Silty Clay of Low Plasticity
	SILT AND CLAY Liquid Limit Greater than 50%		MH		Inorganic Silt, Micaceous or Diatomaceous Fine Sandy or Silty Soils, Elastic Silt
			CH		Inorganic Clay of High Plasticity, Fat Clay
			OH		Organic Clay of Medium to High Plasticity, Organic Silt
HIGHLY ORGANIC SOILS			PT		Peat and Other Highly Organic Soils

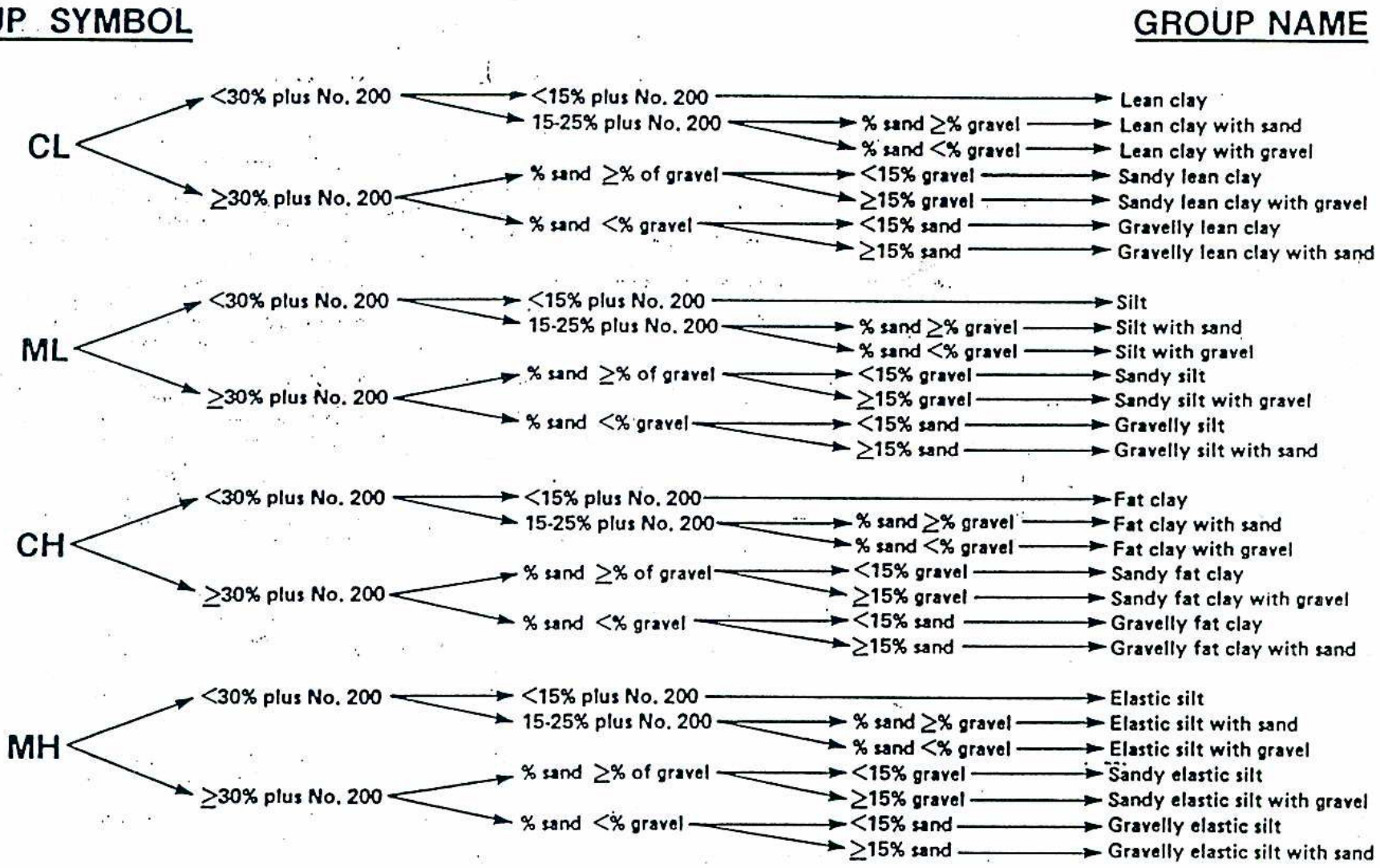
UNIFIED SOIL CLASSIFICATION SYSTEM

JOB NUMBER	DATE	APPROVED	PLATE



NOTE:
Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5%
(After ASTM Designation D2488 Standard Test Method for Classification of Soils for Engineering Purposes)

Flow Chart for Classifying Coarse-grained Soil
(50% or more retained on No. 200 sieve)
Field Guide for Soil Classification and Logging Procedures



NOTE:
Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5%
(After ASTM Designation D2488 Standard Test Method for Classification of Soils for Engineering Purposes)

Flow Chart for Classifying Fine-grained Soil
(50% or more passing No. 200 sieve)
Field Guide for Soil Classification and Logging Procedures

similar, the material is classified as poorly graded or well sorted. If fines represent less than 5 percent of the total mass, the symbol SP is used for a poorly-graded sand and SW for a well graded sand. If silts and/or clays exceed 12 percent, the symbols GC, SC, GM, and SM are used, respectively.

If the silts and clays are between 5 to 12 percent of the total sample weight, a dual classification with two group symbols is used. The first symbol is GW, GP, SW, or, SP, and the second is GC, GM, SC, or SM. The group name corresponds to the first group symbol plus the modifying words "with clay" or "with silt" to indicate the plasticity characteristics. If the fines plot on the CL-ML range on the plasticity chart (Figure 2-2), possible dual classification group names are:

GW-GM	well graded gravel with silt
GW-GC	well graded gravel with clay
GP-GM	poorly graded gravel with silt
GP-GC	poorly graded gravel with clay
SW-SM	well graded sand with silt
SW-SC	well graded sand with clay
SP-SM	poorly graded sand with silt
SP-SC	poorly graded sand with clay

If silts and clays exceed 12 percent of the total weight of sample, the modifiers "M" and "C" are used, respectively. If a sand or gravel has more than 15 percent of the other coarse-grained constituent, the words "with gravel" or "with sand" are added to the group name. A flow chart for classifying coarse-grained soils is presented in Figure 2-3.

2.2 Fine-grained Soils

Particles passing the No. 200 sieve are silts (M) and clays (C). These soils must undergo testing in order to differentiate between them. Typical tests used are: dry strength, dilatancy, toughness, and plasticity. These terms are further discussed in Tables 2-2 through Table 2-6. Silts have little or no dry strength when dry, while clays have considerable dry strength. Dry strength, dilatancy, and toughness are also used to identify the fine-grained fraction of coarse-grained soils.

TABLE 2-2
Criteria for Describing Dry Strength

Description	Criteria
None	The dry specimen crumbles into powder with the mere pressure of handling.
Low	The dry specimen crumbles into powder with some finger pressure.
Medium	The dry specimen breaks into pieces or crumbles with considerable finger pressure.
High	The dry specimen cannot be broken with finger pressure. The specimen will break into pieces between the thumb and a hard surface.
Very high	The dry specimen cannot be broken between the thumb and a hard surface.

TABLE 2-3
Criteria for Describing Dilatancy

Description	Criteria
None	There is no visible change in the specimen.
Slow	Water appears slowly on the surface of the specimen during shaking, and does not disappear, or disappears slowly upon squeezing.
Rapid	Water appears quickly on the surface of the specimen during shaking, and disappears quickly upon squeezing.

TABLE 2-4
Criteria for Describing Toughness

Description	Criteria
Low	Only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and soft.
Medium	Medium pressure is required to roll the thread to near the plastic limit. The thread and the lump have medium stiffness.
High	Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness.

TABLE 2-5
Identification of Inorganic Fine-grained Soils from Manual Tests

Soil Symbol	Dry Strength	Dilatancy	Toughness
ML	None to low	Slow to rapid	Low or thread cannot form
CL	Medium to high	None to slow	Medium
MH	Low to medium	None to slow	Low to medium
CH	High to very high	None	High

TABLE 2-6
Criteria for Describing Plasticity

Description	Criteria
Nonplastic	A 1/8-inch (3-mm) thread cannot be rolled at any water content.
Low	The thread can barely be rolled, and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll, and not much time is required to read the plastic limit. The thread cannot be re-rolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be re-rolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier that the plastic limit.

Fine-grained soils are accurately determined in the laboratory using the Atterberg Limits test. This test include liquid limit, plastic limit, and plasticity index measurements. The liquid limit is the water content of a soil at the point of transition from a plastic to a liquid state. The plastic limit is the water content of a soil at the point of transition from a semisolid to a plastic state. The plasticity index is the difference between the liquid limit and the plastic limit.

As shown in the Figure 2-2, five fields have been identified. These include:

- Silty Clays (CL), Organic Silts (OL) or Organic Silty Clays (OL) of low plasticity
- Fat Clays (CH) and Organic Clays (OH)
- Inorganic Silts (ML) and Organic Silty Clays (OL) of low plasticity
- Silts (MH) and Organic Clays (OH) of a high plasticity
- Silty Clays to Clayey Silt (CL-ML) of low plasticity

Fine-grained soils with a liquid limit > 50 are modified by the symbol H (MH or CH), and those with a liquid limit < 50 are modified by the symbol L (ML or CL). Fine-grained soils containing 30 percent or more coarse-grained fraction should be modified by descriptive terms, such as "gravelly" or "sandy." If the coarse fraction is between 15 and 30 percent, the words" with sand and/or gravel" should be added to the group name. A flow chart for classifying fine-grained soils is presented in Figure 2-4.

2.3 Organic Soils

To classify organic soils, the percentage organic material present in the soil as well as the non-organic fines must be estimated. When the organic content ranges from 18 to 36 percent, the material is an organic clay or an organic silt, depending on the nature of the fine-grained constituents. When the organic content is between 36 and 90 percent, the material is designated a muck or peaty muck (OL or OH). A flow chart for classifying organic soil is presented in Figure 2-4. The term "peaty" is added if the organic remains are

SOP-B3

Borehole Sampling and Logging of Soil Borings
Standard Operating Procedures for PG&E Topock Program

This standard operating procedure (SOP) provides guidance for sample collection from soil borings during the drilling process, and proper documentation necessary. Detailed guidance for sample collection, preservation and handling is provided in Section 4.0 of the site Quality Assurance Project Plan (QAPP) and in the Topock Program *Sampling, Analysis, and Field Procedures Manual* (Procedures Manual). SOP-B2 provides detailed guidance for soil characterization and logging.

REQUIRED DOCUMENTS

1) Event-specific sampling and analysis plan (SAP), work plan or event-specific field instructions. Planned borehole depth, proposed well construction/specifications, and field sampling summary table, if available.

2) Applicable project work plan or monitoring plan. Refer to the Procedures Manual and QAPP, as required.

3) Topock Program Health and Safety Plan (HSP).

4) Previous sampling, drilling, or well construction logs from other boreholes or wells in the vicinity, if available.

5) Blank sampling log and field notebook.

PREPARATION AND SETUP

1) Review event-specific work plan or event-specific field instructions, previous sampling logs, Procedures Manual, and HSP.

2) Initiate field logbook for sampling activity.

3) Review sampling procedures and equipment, and planned sample depths with drilling contractor and field crew.

Equipment List

- Field logbook
- Borehole log
- Blue or black waterproof or permanent ink pens
- Trash bags
- Plastic sandwich bags
- Paper towels

- Stainless steel sampling equipment (provided by driller)
- Decontamination equipment (Alconox® solution in spray bottle, brushes, buckets, rinse water spray bottle)
- Soil sample containers appropriate for sample analysis and preservation as called for in SAP and QAPP (glass jars, brass sleeves, Encore® containers, sandwich bags, etc.)
- Soil sampling equipment not provided by driller (spatula or putty knife, stainless steel compositing bowl, hand auger, etc.)
- Groundwater sample containers appropriate for sample analysis and preservation as called for in SAP and QAPP (glass jars, VOA vials, plastic jars, etc.)
- Groundwater sample equipment not provided by driller (pump, filters, tubing, power supply, etc.)
- Water quality meters
- Water level indicator
- Distilled water
- Coolers with ice
- Protective waterproof gloves (nitrile or latex)

GUIDELINES

Soil Boring Logs Documentation

Soil boring logs will be completed on the soil boring log forms during the drilling activities at the time of the logging and soil descriptions. Information collected will be consistent with the standard CH2M HILL form (See SOP-B2 attachment A). Sample data may also be documented in the comments section of the boring log.

Items documented on the borehole log include:

1) **Sample Interval:** The top and bottom depth of each sample run should be recorded on the borelog. Sampling includes samples collected for analysis as well as core retrieved for logging purposes.

2) **Sample Type and Number:** Enter the sample type and number consistent with the sampling and analysis plan at the correct depth intervals. An "x" should be placed across the vertical interval where the environmental soil, grab groundwater, or geotechnical sample was collected.

3) **Sample Recovery:** Enter the length of retrieved core to the nearest 0.1 foot of sample recovered, and record the value in feet. Do not count slough or caved material as part of the total recovered length of core. Record total length and percent of sample recovered. If using a 5-foot sample barrel, multiply the total length by 2 and 100 to get a percentage number. Similarly, if using a 2.5-foot sampler, multiply by 4 and 100 to get the percent recovery.

4) **Sampling:** Sampling difficulties shall be noted. Disturbed samples shall be noted on the log as well as the sample recovery. The top of the sample shall be marked on the container.

5) **Water Levels:** Water-level measurements, where groundwater is encountered, are required for each boring. Changes in soil moisture shall be noted and, if there is no water encountered, a note to that effect shall be included on the borehole log. The date and time of water-level measurements shall be documented.

At a minimum, sample identifiers (IDs) should be noted on boring logs at the depth collected. When time and space allows, a summary of analytical sample information can be included. When inclusion of these data prevents documentation of drilling information, sample data should be omitted in order to document drilling.

Borehole Sampling by Drilling—General Procedure

Split-spoon sampling procedures shall be executed in accordance with American Society for Testing and Materials (ASTM) D1586, "Standard Method for Penetration Test and Split-barrel Sampling of Soils" (ASTM 1984). California (2-inch) or Modified California (2.5-inch) split-barrel samplers may also be used.

1) The split-spoon or split-barrel sampler shall be advanced to the top of the sampling interval using a wire-line or sample rods such as A or AW. The larger-diameter samplers may be fitted with three 6-inch-long stainless-steel sleeves. The sampler shall be driven 18 inches or to refusal, with a 140-pound hammer dropping repeatedly 30 inches. Refusal shall be defined as requiring 50 blows with the hammer to advance the sampler less than 6 inches.

2) The number of blows required to drive the sampler each 6 inches shall be recorded on the borelog.

3) As the sample tubes are disassembled, an organic vapor monitor probe shall be inserted into the gap between two sample liners, and the liner exhibiting the highest reading shall be selected for analysis.

4) In general, the middle liner is collected for laboratory analysis, and 10 percent of the bottom liners are collected for quality assurance testing. A sample of the soil in the top liner typically is placed in a re-sealable plastic bag or 8-ounce clear glass jar and left in the sun for approximately 15 minutes to allow any volatile organic compounds (VOC) to volatilize.

5) After the 15 minute volatilization period, the soil vapor in the plastic bag is then measured for VOCs by taking a reading of the headspace. Background VOCs for the bag are determined by monitoring the air in an empty bag.

6) Results of the organic vapor monitoring are recorded on the boring log.

7) Small portions of soil at the ends of the sleeve are scraped off for classification.

Borehole Sampling by Drilling—Split Spoon Sampling

1) Samples collected for laboratory analysis using split spoon sampling device will be separated and transferred from the split-spoon halves into sample jars by clean stainless-steel utensils.

2) Samples for VOCs will be separated and collected first, followed by semivolatile organic compounds samples.

3) For VOC samples, avoid mixing the soil before sampling and sample directly from the split spoon. See SOPs for guidance on homogenizing soil samples and for VOC sampling using EnCore samplers, respectively.

Borehole Sampling by Drilling—Direct-push Sampling

1) Samples collected for laboratory analysis using a direct-push sampling drill rig will be handled by either opening the tube and placing the soil in sample jars or cutting the acetate tube and submitting it the laboratory directly.

2) For samples that will be removed from the acetate tube, the tube will be cut open longitudinally using a double-bladed razor knife.

   - Soil will be inspected and logged prior to removal of soil samples.
   - A short section of soil will be removed from the acetate sleeve using a stainless-steel utensil, homogenized in a clean stainless-steel bowl, and placed in sample jars.
   - Soil collected for VOC analysis will be sampled directly from the split acetate sleeve using EnCore samplers.

3) Alternatively, a short (6-inch) length of liner will be cut from the acetate sleeve and collected directly for laboratory analysis.

   - The section of acetate liner will be removed, capped with Teflon sheeting and plastic end caps at both ends, and taped with clear label or packing tape.
   - Labels shall be affixed to the liners with job designation, time, boring number, sample depth interval, sample number, date sampled, and the initials of the sampler clearly marked.
   - The samples shall then be enclosed in a plastic bag and stored in a cooler maintained at 4°C.
   - Sample information shall be placed on the chain-of-custody, the borelog, and the field logbook. All samples shall be handled in accordance with *Chain of Custody Procedures*.

Borehole Sampling by Drilling—Split-barrel Sampling

Soil samples can also be collected using a 3-foot-long or 5-foot-long split-barrel sampler. The split-barrel sampler is similar to the split-spoon sampler that is used to hold steel or brass sampling sleeves, but the split-barrel sampler typically is not used to hold sample sleeves.

1) The sampler is lowered to the base of the drill bit and is advanced slightly ahead of the drill bit and augers (or conductor casing). The weight of the drill string and sample barrel along with the drilling and cutting action of the drill bit advances the face of the split-barrel sampler into the formation.

2) Once the desired depth interval is reached, the split-barrel sampler is retrieved using a cable or tool steel sections.

3) The retrieved sampler is unscrewed, and one or both halves are laid on the sample table. The soil typically will form a continuous column of soil in one of the split-barrel halves.

4) The soil column is split longitudinally for soil descriptions using a putty knife or spatula.

5) Samples for VOC analysis are collected immediately directly from the soil column.

6) Other soil samples are collected after the core section has been described and logged. The soil is described following the procedures in the following sections.

Groundwater Sampling

1) Groundwater samples can be collected by hydropunch by bailer or by pumping from an isolated zone. Collection of groundwater by bailing is not an accurate method of collection depth discrete groundwater samples, as the zone sampled is poorly isolated.

2) Hydropunch samples are collected below the bit of the drill stem, in relatively undisturbed soil zone. This method of sample collection may be difficult in fine-textured soils and in very rocky soils. To collect these samples, a point is driven below the depth of the drill bit, then a screen zone is opened within this point and water allowed to flow in. The hydropunch tool must be decontaminated between samples.

Groundwater can also be collected from the open or cased borehole with a bailer. A disposable or decontaminated stainless-steel bailer is lowered into the boring, and water is collected. This method is preferable for collection of groundwater from the water table. Attempts can be made to collect discrete groundwater samples beneath the water table; however, the boring must be cased with watertight, stainless-steel pipe, and the boring must be evacuated prior to collection of samples.

Alternatively, discrete groundwater samples can be collected by isolating a zone with casing and packers. To collect these samples, the borehole is first advanced to the depth at which a sample is required. Then casing is advanced to within 20 feet of the sample zone. Next, a pump and packers are lowered into the hole. The zone from which samples are to be collected is isolated with a packer, and water is pumped directly from the target zone.

Sample Handling

Sample preservation and sampling procedures are detailed in Section 4.0 of the QAPP. Additional information is provided in the Procedures Manual and in the appropriate SAP.

KEY CHECKS AND ITEMS

- Check entries to the soil boring log and field logbook in the field during sampling activities because the samples will be disposed at the end of the fieldwork, confirmation and corrections cannot be made later.

- Check that the sample numbers and intervals are properly specified.
- Ensure that drilling equipment is decontaminated prior to the beginning of work and between each borehole.
- All materials generated during sampling (debris, PPE, decontamination liquids, etc.) will be placed in 55-gallon drums or roll-off bins for storage pending analysis and disposal off site, as outlined in SOP 39, Standard of Practice H-83, and Appendix D of the project *Soil and Groundwater Management Plan*.

ATTACHMENT A

Examples of Soil Bore Logs

CH2MHILL

PROJECT NUMBER	BORING NUMBER SHEET OF

SOIL BORING LOG

PROJECT _____ LOCATION _____

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT _____

WATER LEVELS _____ START _____ FINISH _____ LOGGER _____

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE	RECOVERY (FT)	6"-6"-6" (N)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION

REV 9/96 FORM D1586

SHEET 1 of 9	**PROJECT NUMBER:** 326128.01.16.EN	**BORING NUMBER:** *MW-47*

SOIL BORING LOG - DRAFT FOR DISCUSSION

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 288.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,450.05	**EASTING (CCS NAD 27 Z 5):** 7,615,629.49	**DATE STARTED:** 02/27/2006	**DATE COMPLETED:** 03/13/2006
DRILLING METHOD: Rotosonic			**DRILLING EQUIPMENT:** Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** B. Moayyad, K. Ebel	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	USCS CODE	SOIL DESCRIPTION SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
5			6	SP	**POORLY GRADED SAND (SP)** - very lt brn (10YR7/3), =2% fines, 98% f to m lithic quartz sand, subang to subrnd, dry - fine roots, iron staining, some iron oxide coating on grains	Hand augured to 5' bgs
10			10	SP	- slightly moist - dry	Rapid drill rate, no chatter
15						
20			16	SW	**WELL GRADED SAND w/ GRAVEL (SW)** - lt yellowish brn (10YR6/4), 45% gravel up to 7cm, 50% f to m sand, 5% fines, loose, met subang gravel, dry(moist@ 17') - cobble present in slough - one subrnd chert gravel - Possible Fluvially Reworked Alluvium - lt grey (10YR7/2), subang to rnd met gravel up to 9cm, 2% to 5% fines - dk yellowish brn (10YR4/4), mostly c sand subang to ang, met, some Miocene conglomerate gravel	
25					- 65% sand, 30% gravel up to 4cm, 5% fines	
30				SW	**WELL GRADED SAND w/ GRAVEL (SW)** - dk yellowish brn (10YR3/6), 35% gravel up to 4cm, 55% m to c sand, 10% silty fines, met clasts are grain supported some mm siltstone - some oxide staining	
35				SW	**WELL GRADED SAND w/ GRAVEL AND CLAY (SW)** - dk yellowish brn (10YR3/6), 30% subang met gravel up to 7 cm, 55% subrnd to subang m to c sand, 15% clayey fines, m density, moist	Drill rate slowed to clean out 8" pipe

CH2MHILL

PROJECT NUMBER: 326128.01.16.EN

BORING NUMBER: *MW-47*

SOIL BORING LOG - DRAFT FOR DISCUSSION

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 288.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,450.05	**EASTING (CCS NAD 27 Z 5):** 7,615,629.49	**DATE STARTED:** 02/27/2006	**DATE COMPLETED:** 03/13/2006
DRILLING METHOD: Rotosonic			**DRILLING EQUIPMENT:** Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** B. Moayyad, K. Ebel	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	USCS CODE	SOIL DESCRIPTION SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
			2.5	SW	**WELL GRADED SAND w/ GRAVEL (SW)** - dr yellowish brn (10YR3/6), 30% gravel, 60% sand, 10% silty fines	Drilling smooth but preceeds less rapidly
40			10	SW	**WELL GRADED SAND w/ GRAVEL (SW)** - 40% subang met gravel up to 6cm, 55% subrnd to ang sand, 5% fines - more gravel below 38'	
45					- gravel is mostly fine	
50			10	SW	**WELL GRADED SAND w/ GRAVEL (SW)** - Pale brn (10YR6/3), 30% subang met gravel up to 5cm, 60% subrnd to subang m to c met sand, 10% silty fines, wet	Soil sample collected
				SP	**POORLY GRADED SAND w/ GRAVEL (SP)** - pale brn (10TR6/3), 30% f subang gravel up to 2 cm, 65% mostly c sand, =2% fines	
55				SW	**WELL GRADED SAND w/ GRAVEL (SW)** - yellowish brn (10YR5/4), 40% subang met gravel up to 9cm, 55% f to c met sand, 5% silty fines, clast supported, m density, wet	
60			9.5	GW	**WELL GRADED GRAVEL w/ SILT AND SAND (GW)** - brn (7.5YR5/4), 55% subang to ang met gravel up to 4cm, 25% f to c sand, 20% silty fines, dense, moist to dry - soil dries out	Collected Isoflow sample
65					- lt grey (10YR7/2) and powder dry - moist sandy zone, 55% gravel, 35% sand, 10% fines - dry silty lt grey GW below 65'	Drill rate slows to 2' / min
70				SW	**WELL GRADED SAND w/ GRAVEL (SW)** - yellowish brn (10YR5/4), 35% subang met gravel up to 4cm, 60% subrnd sand, 5% silty fines, loose, moist to wet	Moderate Drill Rate

CH2MHILL

PROJECT NUMBER: 326128.01.16.EN

BORING NUMBER: *MW-47*

SOIL BORING LOG - DRAFT FOR DISCUSSION

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 288.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,450.05	**EASTING (CCS NAD 27 Z 5):** 7,615,629.49	**DATE STARTED:** 02/27/2006	**DATE COMPLETED:** 03/13/2006
DRILLING METHOD: Rotosonic			**DRILLING EQUIPMENT:** Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** B. Moayyad, K. Ebel	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	USCS CODE	SOIL DESCRIPTION SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
			6	SP	**POORLY GRADED SAND w/ SILT (SP)** - brn (7.5YR4/4), 5% subrnd to subang met gravel up to 4cm, 85% f to c sand, 10% fines, poorly graded, wet, no odor	
145			3	SM	**SILTY SAND W/ GRAVEL (SM)** - brn (7.5YR4/4), 20% subang to subrnd gravel up to 6cm, 60% f to c sand, 20% silty fines, well graded, m consolidated, met, wet, no odor	
150			5	SM	**SILTY SAND w/ GRAVEL (SM)** - dk yellowish brn (10YR4/4), 25% subang to subrnd up to 4cm met gravel, 60% well graded f to c sand, 15% fines, wet, no odor	
155			4	SW	**WELL GRADED SAND w/ SILT AND SAND (SW)** - dr yellowish brn (10YR4/4), 10% subang to subrnd up to 3cm met gravel, 75%well graded f to c sand, 15% fines, moist to wet	
			2	SW	**SILTY SAND (SM)** - brn (7.5YR4/4), 5% ang to subrnd met gravel up to 1.5cm increasing with depth, 85% poorly graded m to c sand, 10% fines, loose, wet	
			2	SM	**SILTY SAND w/ GRAVEL (SM)** - dk yellowish brn (10YR4/4), 15% subang to subrnd up to 2.5cm met gravel, 75% well graded f to c sand, 10% fines, mostly met, trace chert, loose, wet, no odor	Collected Isoflow sample
160			4	SM	**SILTY SAND W/ GRAVEL (SM)** - brn (7.5YR4/4), 25% subang to subrnd gravel up to 6.5cm, 60% m to c sand, 15% silty fines, well graded, m consolidated, met, wet, no odor	Drill rate = 0.75' to 1.5' / min
165			4	SW	**SILTY SAND (SW)** - mottled dk reddish brn (5YR3/4), 10% subang to subrnd gravel up to 2.5cm, 50% well graded f to m sand, 40% silt, metamorphic, dry to damp, no odor, interbedded sandy silt laminations	
170			5.5	SW	**SAND w/ GRAVEL (SW)** - dk reddish brn (5YR3/4), 20% subang to subrnd gravel up to 5cm, 75% f to c sand, 5% fines, well graded, loose, met, wet	
175			2.5	SM	**SILTY SAND w/ GRAVEL (SM)** - brn (7.5YR4/4), 15% subang to subrnd gravel, 70% f to m sand, 15% fines, poorly graded, met,increasingly consolidated, slightly to moderately calcareous, moist to wet	

PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	*MW-47*

SOIL BORING LOG - DRAFT FOR DISCUSSION

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 288.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,450.05	**EASTING (CCS NAD 27 Z 5):** 7,615,629.49	**DATE STARTED:** 02/27/2006	**DATE COMPLETED:** 03/13/2006
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LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** B. Moayyad, K. Ebel	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	USCS CODE	SOIL DESCRIPTION SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
285			0	BR	**MIOCENE CONGLOMERATE BEDROCK (BR)** - 60% well graded subang to rnd gravel up to 10cm, 30% well graded sand, 10% fines, very calcareous, well consolidated to mostly hard, mod to very altered locally, mostly met, dry to moist	
					Boring Terminated at 288 ft	

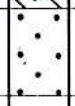
ABBREVIATIONS

cc = continuous core run
brn = brown
lt = light
dk = dark
vf = very fine-grained
f = fine-grained
m = medium-grained
c = coarse-grained
vc = very coarse-grained
ang = angular
subang = subangular
subrnd = subrounded
rnd = rounded
br = bedrock formation
ss = sandstone
conglom = conglomerate
comptd = compacted
qtz = quartz

CH2MHILL

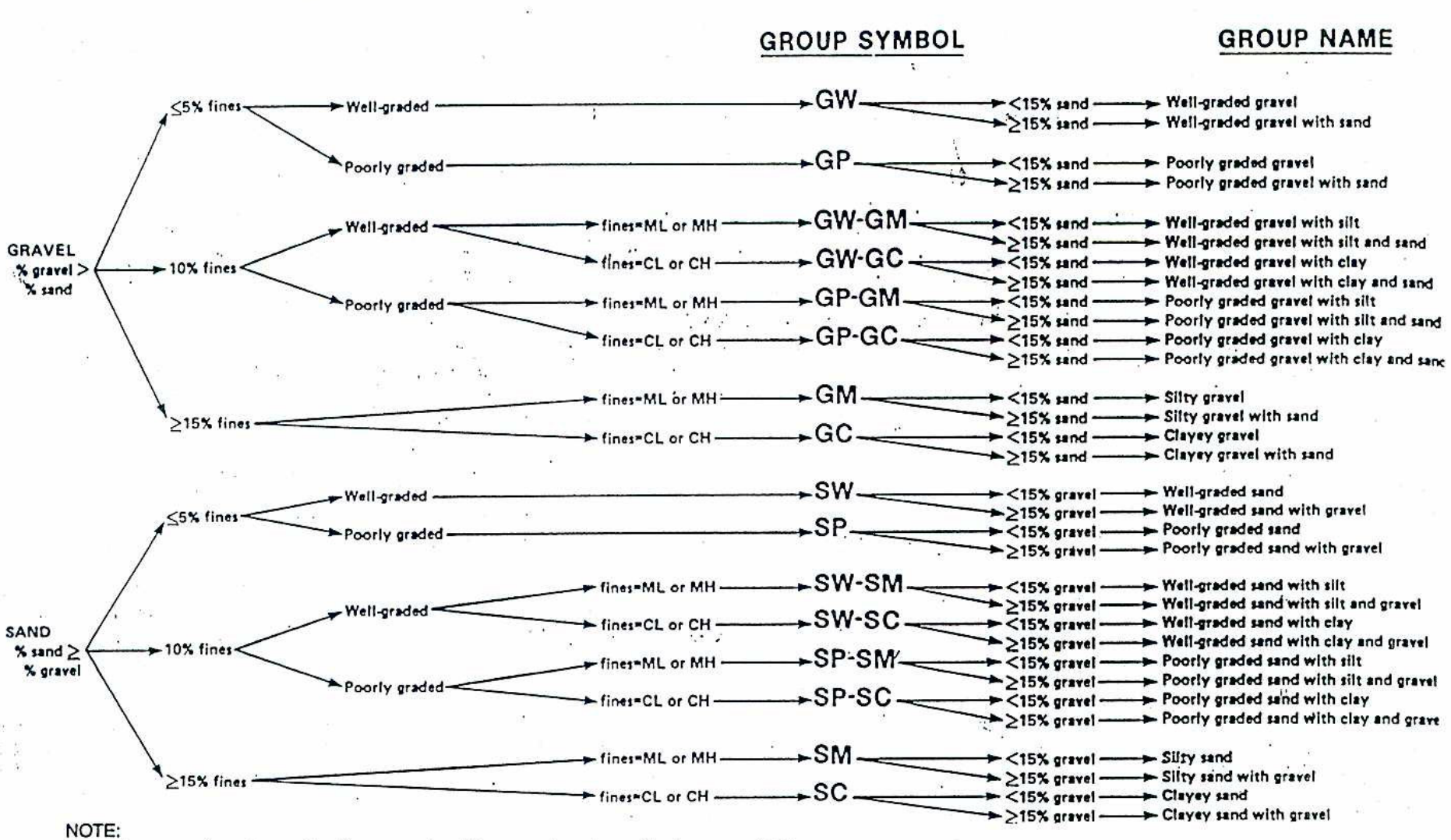
ATTACHMENT B

Unified Soil Classification System and Logging Criteria

GENERAL SOIL CATEGORIES			SYMBOLS		TYPICAL SOIL TYPES
COARSE GRAINED SOILS More than half is larger than No. 200 sieve	GRAVEL More than half coarse fraction is larger than No. 4 sieve size	Clean Gravel with little or no fines	GW		Well Graded Gravel, Gravel-Sand Mixtures
			GP		Poorly Graded Gravel, Gravel-Sand Mixtures
		Gravel with more than 12% fines	GM		Silty Gravel, Poorly Graded Gravel-Sand-Silt Mixtures
			GC		Clayey Gravel, Poorly Graded Gravel-Sand-Clay Mixtures
	SAND More than half coarse fraction is smaller than No. 4 sieve size	Clean sand with little or no fines	SW		Well Graded Sand, Gravelly Sand
			SP		Poorly Graded Sand, Gravelly Sand
		Sand with more than 12% fines	SM		Silty Sand, Poorly Graded Sand-Silt Mixtures
			SC		Clayey Sand, Poorly Graded Sand-Clay Mixtures
FINE GRAINED SOILS More than half is smaller than No. 200 sieve	SILT AND CLAY Liquid Limit Less than 50%		ML		Inorganic Silt and Very Fine Sand, Rock Flour, Silty or Clayey Fine Sand, or Clayey Silt with Slight Plasticity
			CL		Inorganic Clay of Low to Medium Plasticity, Gravelly Clay, Sandy Clay, Silty Clay, Lean Clay
			OL		Organic Clay and Organic Silty Clay of Low Plasticity
	SILT AND CLAY Liquid Limit Greater than 50%		MH		Inorganic Silt, Micaceous or Diatomaceous Fine Sandy or Silty Soils, Elastic Silt
			CH		Inorganic Clay of High Plasticity, Fat Clay
			OH		Organic Clay of Medium to High Plasticity, Organic Silt
HIGHLY ORGANIC SOILS			PT		Peat and Other Highly Organic Soils

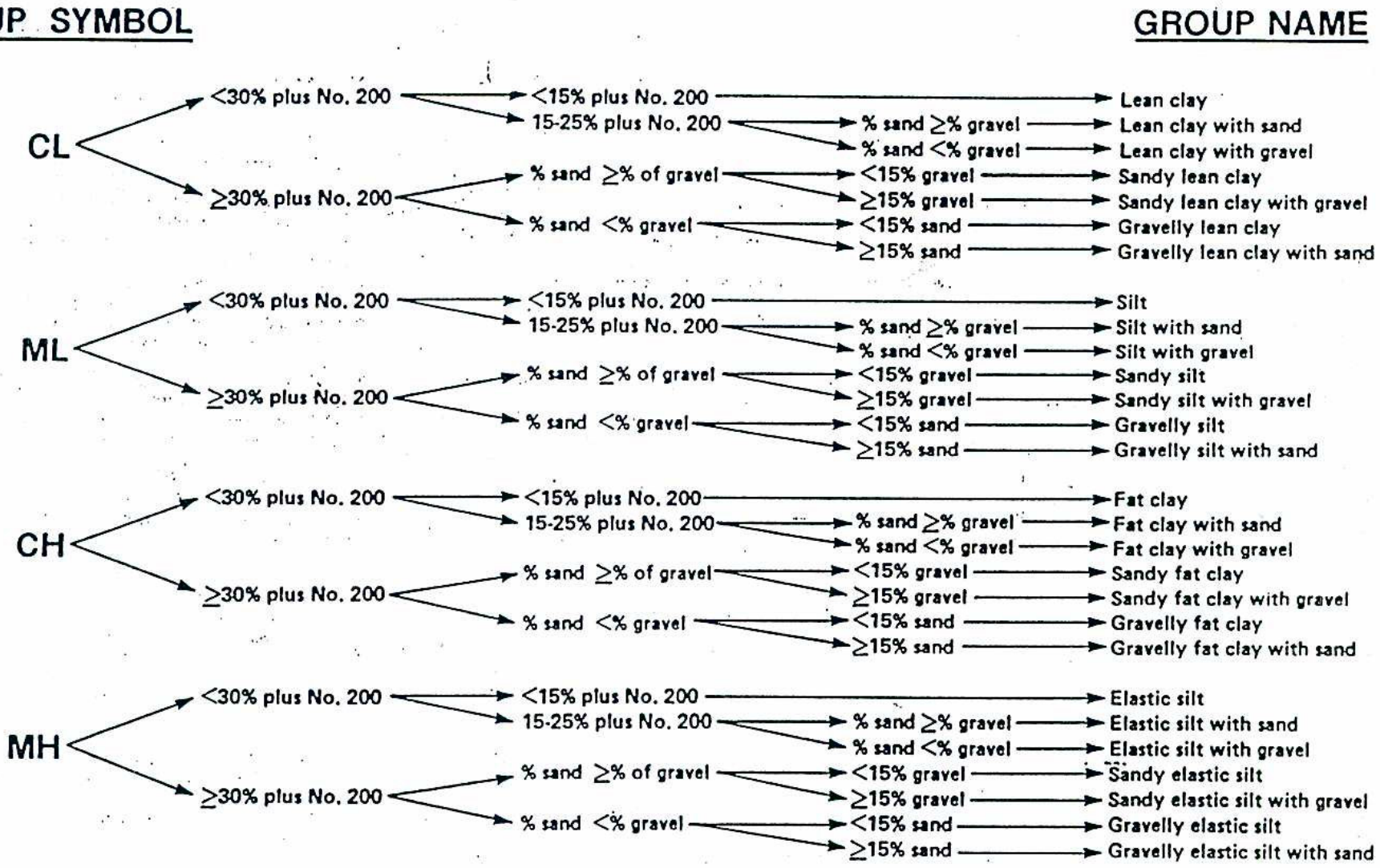
UNIFIED SOIL CLASSIFICATION SYSTEM

JOB NUMBER	DATE	APPROVED	PLATE



NOTE:
Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5%
(After ASTM Designation D2488 Standard Test Method for Classification of Soils for Engineering Purposes)

Flow Chart for Classifying Coarse-grained Soil
(50% or more retained on No. 200 sieve)
Field Guide for Soil Classification and Logging Procedures



NOTE:
Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5%
(After ASTM Designation D2488 Standard Test Method for Classification of Soils for Engineering Purposes)

Flow Chart for Classifying Fine-grained Soil
(50% or more passing No. 200 sieve)
Field Guide for Soil Classification and Logging Procedures

similar, the material is classified as poorly graded or well sorted. If fines represent less than 5 percent of the total mass, the symbol SP is used for a poorly-graded sand and SW for a well graded sand. If silts and/or clays exceed 12 percent, the symbols GC, SC, GM, and SM are used, respectively.

If the silts and clays are between 5 to 12 percent of the total sample weight, a dual classification with two group symbols is used. The first symbol is GW, GP, SW, or, SP, and the second is GC, GM, SC, or SM. The group name corresponds to the first group symbol plus the modifying words "with clay" or "with silt" to indicate the plasticity characteristics. If the fines plot on the CL-ML range on the plasticity chart (Figure 2-2), possible dual classification group names are:

GW-GM	well graded gravel with silt
GW-GC	well graded gravel with clay
GP-GM	poorly graded gravel with silt
GP-GC	poorly graded gravel with clay
SW-SM	well graded sand with silt
SW-SC	well graded sand with clay
SP-SM	poorly graded sand with silt
SP-SC	poorly graded sand with clay

If silts and clays exceed 12 percent of the total weight of sample, the modifiers "M" and "C" are used, respectively. If a sand or gravel has more than 15 percent of the other coarse-grained constituent, the words "with gravel" or "with sand" are added to the group name. A flow chart for classifying coarse-grained soils is presented in Figure 2-3.

2.2 Fine-grained Soils

Particles passing the No. 200 sieve are silts (M) and clays (C). These soils must undergo testing in order to differentiate between them. Typical tests used are: dry strength, dilatancy, toughness, and plasticity. These terms are further discussed in Tables 2-2 through Table 2-6. Silts have little or no dry strength when dry, while clays have considerable dry strength. Dry strength, dilatancy, and toughness are also used to identify the fine-grained fraction of coarse-grained soils.

TABLE 2-2
Criteria for Describing Dry Strength

Description	Criteria
None	The dry specimen crumbles into powder with the mere pressure of handling.
Low	The dry specimen crumbles into powder with some finger pressure.
Medium	The dry specimen breaks into pieces or crumbles with considerable finger pressure.
High	The dry specimen cannot be broken with finger pressure. The specimen will break into pieces between the thumb and a hard surface.
Very high	The dry specimen cannot be broken between the thumb and a hard surface.

TABLE 2-3
Criteria for Describing Dilatancy

Description	Criteria
None	There is no visible change in the specimen.
Slow	Water appears slowly on the surface of the specimen during shaking, and does not disappear, or disappears slowly upon squeezing.
Rapid	Water appears quickly on the surface of the specimen during shaking, and disappears quickly upon squeezing.

TABLE 2-4
Criteria for Describing Toughness

Description	Criteria
Low	Only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and soft.
Medium	Medium pressure is required to roll the thread to near the plastic limit. The thread and the lump have medium stiffness.
High	Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness.

TABLE 2-5
Identification of Inorganic Fine-grained Soils from Manual Tests

Soil Symbol	Dry Strength	Dilatancy	Toughness
ML	None to low	Slow to rapid	Low or thread cannot form
CL	Medium to high	None to slow	Medium
MH	Low to medium	None to slow	Low to medium
CH	High to very high	None	High

TABLE 2-6
Criteria for Describing Plasticity

Description	Criteria
Nonplastic	A 1/8-inch (3-mm) thread cannot be rolled at any water content.
Low	The thread can barely be rolled, and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll, and not much time is required to read the plastic limit. The thread cannot be re-rolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be re-rolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier that the plastic limit.

Fine-grained soils are accurately determined in the laboratory using the Atterberg Limits test. This test include liquid limit, plastic limit, and plasticity index measurements. The liquid limit is the water content of a soil at the point of transition from a plastic to a liquid state. The plastic limit is the water content of a soil at the point of transition from a semisolid to a plastic state. The plasticity index is the difference between the liquid limit and the plastic limit.

As shown in the Figure 2-2, five fields have been identified. These include:

- Silty Clays (CL), Organic Silts (OL) or Organic Silty Clays (OL) of low plasticity
- Fat Clays (CH) and Organic Clays (OH)
- Inorganic Silts (ML) and Organic Silty Clays (OL) of low plasticity
- Silts (MH) and Organic Clays (OH) of a high plasticity
- Silty Clays to Clayey Silt (CL-ML) of low plasticity

Fine-grained soils with a liquid limit > 50 are modified by the symbol H (MH or CH), and those with a liquid limit < 50 are modified by the symbol L (ML or CL). Fine-grained soils containing 30 percent or more coarse-grained fraction should be modified by descriptive terms, such as "gravelly" or "sandy." If the coarse fraction is between 15 and 30 percent, the words" with sand and/or gravel" should be added to the group name. A flow chart for classifying fine-grained soils is presented in Figure 2-4.

2.3 Organic Soils

To classify organic soils, the percentage organic material present in the soil as well as the non-organic fines must be estimated. When the organic content ranges from 18 to 36 percent, the material is an organic clay or an organic silt, depending on the nature of the fine-grained constituents. When the organic content is between 36 and 90 percent, the material is designated a muck or peaty muck (OL or OH). A flow chart for classifying organic soil is presented in Figure 2-4. The term "peaty" is added if the organic remains are

SOP-B5

Decontamination of Personnel and Equipment, Well Drilling, and Subsurface Sampling and Investigations
Standard Operating Procedures for PG&E Topock Program

This standard operating procedure provides general guidelines for the decontamination of personnel, sampling equipment, and monitoring equipment used in potentially-contaminated areas.

REQUIRED DOCUMENTS

1) Event-specific sampling and analysis plan (SAP).
2) Applicable project work plan or monitoring plan, which includes a health and safety plan. Refer to Topock Program *Sampling, Analysis, and Field Procedures Manual* and *Quality Assurance Project Plan*, as required.

PREPARATION AND SETUP

1) Initiate field log sampling book for activity.
2) Inspect all equipment necessary to carry out activities detailed in event-specific SAP.
3) Review decontamination guidelines for equipment necessary to carry out activities.

Equipment List

- Demonstrated analyte-free, deionized water (specifically, ASTM Type II water)
- Distilled water
- Potable water; must be from a municipal water supplier, otherwise an analysis must be run for appropriate volatile and semivolatile organic compounds and inorganic chemicals (e.g., Target Compound List and Target Analyte List chemicals)
- 2.5% (W/W) Liquinox® and water solution
- Large plastic pails or tubs for Liquinox® and water, scrub brushes, spray or squirt bottles for Liquinox® solution, and distilled or deionized water, plastic bags, and sheets
- Department of Transportation (DOT)-approved 55-gallon drum for disposal of waste
- Nitrile or latex gloves
- Decontamination pad and steam cleaner/high pressure cleaner for large equipment

GUIDELINES

Personnel Decontamination

Decontamination should be performed after completion of tasks whenever personnel come in contact with contaminated (or potentially-contaminated) soils or fluids. Full or emergency decontamination should be performed when contaminant concentrations are not known and when potentially-contaminated fluids come into contact with skin beneath clothing, eyes, nose, or ears.

Procedures for full/emergency decontamination are to:

1) Remove contaminated clothing.

2) Step into containment area (decontamination pad or large pail).

3) Rinse away fluids and soil.

4) Wash skin with Liquinox® solution in such a way as to not abrade skin. (Liquinox® solution should be made with potable water and sufficient detergent to create foamy suds.) Eyes and mucus membranes in contact with contaminants must be washed with eye wash or drinking water continuously for at least 15 minutes.

5) Rinse with potable water.

6) If no other clothes are available, wash affected clothes in Liquinox® solution prior to donning. If other clothes are available, contaminated clothes may be isolated for later wash or disposed of along with personal protective equipment (PPE).

7) Any PPE worn (including disposable latex booties, gloves, and disposable coveralls) should be discarded into DOT-approved 55-gallon drum located at the MW-20 bench.

8) Dispose of wash and rinseate water in an appropriate container with other chromium contaminated fluids. These fluids may be taken to the MW-20 bench for treatment or to a Baker® tank within the PG&E facility for containerization.

9) Replace all appropriate clothing and PPE before resuming work or departing site.

Moist soil or water containing known concentrations of hexavalent chromium less than 50 parts per billion that comes into contact with hands need not require full decontamination. Dry soil containing chromium that comes into contact with clothing can also be decontaminated in an abbreviated manner.

Daily decontamination and minor exposure contact decontamination procedures are to:

1) Wash hands and skin that comes in contact with soils or water that may contain small concentrations of chromium as soon as possible after contact. Wash with Liquinox® solution and rinse with potable water.

2) If contaminated soil or water contacts hands through hole or over lip of gloves, remove gloves and wash hands thoroughly before donning new gloves.

3) Discard gloves into DOT-approved 55-gallon drum located on the MW-20 bench at the end of the day or event.

4) Remove coveralls or dry soils from clothing before leaving site. Clothing contaminated by moist soil or water containing hexavalent chromium should be removed and promptly washed.

5) At the end of the work day, shower entire body, including hair, either at the work site or at hotel.

Sampling Equipment Decontamination—Groundwater Sampling Pumps

Sampling pumps are decontaminated after each use as follows:

1) Don waterproof (nitrile or latex) gloves.

2) Run pump and reusable tubing through with Liquinox® solution (made with potable water) so that the pump and all portions or the tubing have been flushed with the solution for at least 30 to 60 seconds. More time is required if water is present in the tubing. If unsure, run for 2.5 minutes. Outside of the tubing should also be submerged and washed in the solution.

3) Run pump and reusable tubing through first rinse (with potable or distilled water) so that the pump and all portions or the tubing have been flushed with the solution for at least 60 seconds. More time is required if any suds are present in the pump or tubing.

4) Run pump and reusable tubing through second rinse (with distilled water) so that the pump and all portions or the tubing have been flushed with the solution for at least 30 seconds. More time is required if water from first rinse is present in tubing.

5) Equipment blank samples may be taken at this point using ASTM Type II water or distilled water as required by laboratory.

Sampling Equipment Decontamination—Other Equipment

Reusable sampling equipment is decontaminated after each use as follows:

1) Don nitrile or latex gloves.

2) Wash all equipment surfaces that contacted the potentially contaminated soil/water with Liquinox® solution (made from potable water). Water quality meters that are not placed within wells should not be washed with detergent, as this will degrade sensors; these meters should be double-rinsed. Any portion of equipment that is placed inside wells (including cables and pipe) and that comes in contact with moisture should be washed with detergent.

3) Rinse equipment and supplies with potable water, if the equipment is not used to collect groundwater or soil samples. Equipment used to collect samples or take water quality parameters should be rinsed with distilled water.

4) Air dry or towel dry with paper towels.

5) Collect all rinseate and dispose of in Baker® tank within the PG&E facility or Denbeste® tank at the MW-20 bench.

6) Decontamination materials (e.g., plastic sheeting, tubing, etc.) that have come in contact with used decontamination fluids or sampling equipment will be disposed of in DOT-approved 55-gallon drums if highly contaminated. If not contaminated, equipment can be washed and disposed of in trash.

7) Preserved bottles may need to be washed before being packed or handed without gloves. The outsides of filled bottles should be rinsed and toweled dry to prevent contact with strong acids or based.

Heavy Equipment and Tools

Heavy equipment such as drilling rigs, drilling rods/tools, and the backhoe will be decontaminated upon arrival at the site and between locations as follows:

1) Set up a decontamination pad in designated area.

2) Steam clean heavy equipment until no visible signs of dirt are observed. This may require wire or stiff brushes to dislodge dirt from some areas.

KEY CHECKS AND ITEMS

- Clean with solutions of Liquinox® and potable water. Rinse with distilled or deionized water if equipment is used to collect samples or water readings; otherwise, rinse with potable water.
- Equipment placed within wells should be thoroughly decontaminated and before being placed in a well. All potions of this equipment that come into contact with moisture should be decontaminated.
- Decontaminate filled sample bottles before relinquishing them to anyone.

SOP-B7

Homogenization of Soil and Sediment Samples
Standard Operating Procedures for PG&E Topock Program

The homogenization of soil and sediment samples is performed to minimize any bias of sample representativeness introduced by the natural stratification of constituents within the sample. Standard techniques for soil and sediment homogenization and equipment are provided in this SOP. These procedures do not apply to aliquots collected for volatile organic compounds (VOCs) or field gas chromography screening; samples for these analyses should NOT be homogenized.

REQUIRED DOCUMENTS

1) Event-specific sampling and analysis plan (SAP).
2) Applicable project work plan or monitoring plan. Refer to Topock Program *Sampling, Analysis, and Field Procedures Manual* and *Quality Assurance Project Plan,* as required.
3) Topock Program Health and Safety Plan (HSP).
4) Previous sampling logs.
5) Blank sampling logs and field notebook.

PREPARATION AND SETUP

1) Review event-specific SAP or event-specific field instructions, previous sampling logs, Procedures Manual, and HSP.
2) Initiate field logbook for sampling activity.

EQUIPMENT LIST

- Sample containers
- Stainless-steel spoons or spatulas
- Stainless-steel pans
- Phthalate-free gloves

PROCEDURES

Sample Homogenization

1) Soil and sediment samples to be analyzed for semivolatiles, pesticides, polychlorinated biphenyls, metals, cyanide, or field x-ray fluorescence screening should be homogenized in the field.
2) After a sample is taken, a stainless-steel spatula should be used to remove the sample from the split spoon or other sampling device. The sampler should not use fingers to do this, as gloves may introduce organic interferences into the sample.

3) Samples for VOCs should be taken immediately upon opening the spoon and should not be homogenized.

4) Prior to homogenizing the soil or sediment sample, any rocks, twigs, leaves, or other debris should be removed from the sample.

5) The sample should be placed in a decontaminated stainless-steel pan and thoroughly mixed using a stainless-steel spoon. The soil or sediment material in the pan should be scraped from the sides, corners, and bottom, rolled into the middle of the pan, and initially mixed.

6) The sample should then be quartered and moved to the four corners of the pan. Each quarter of the sample should be mixed individually, then rolled to the center of the pan and mixed with the entire sample again.

Equipment Decontamination

1) All stainless-steel spoons, spatulas, and pans must be decontaminated following procedures specified in SOP *Decontamination of Personnel and Equipment* prior to homogenizing the sample.

2) A composite equipment rinse blank of homogenization equipment should be taken each day it is used.

SOP-B9

Drilling--Sonic Method
Standard Operating Procedures for PG&E Topock Program

REQUIRED DOCUMENTS

1) Event-specific sampling and analysis plan (SAP), Work Plan or event-specific field instructions. Planned borehole depth, proposed well construction/specifications, and field sampling summary table, if available.

2) Applicable project work plan or monitoring plan. Refer to Topock Program Sampling, Analysis, and Field Procedures Manual and QAPP (Procedures Manual), as required.

3) Topock Program Health and Safety Plan (HSP)

4) Previous sampling, drilling, or well construction logs from other boreholes or wells in the vicinity, if available

5) Blank sampling log and field notebook

Equipment List:

- Drilling rig (Sonic)
- Drill rods and core barrel

GUIDELINES

PRIOR TO INTRUSIVE ACTIVITIES AT ANY DRILLING LOCATION THE AREA WILL HAVE BEEN CLEARED OF ALL UTILITIES AND THE CLEARANCE RECORDED IN THE FIELD LOGBOOK. It is also the field team leader's responsibility to confirm that all required access permits are in place.

Prior to the start of drilling, the area of site activity will be identified and delineated using stakes and/or flagging. The extent of impact will be mineralized at all times and the delineated area of activity decreased when possible. All sensitive vegetation or habitats will be delineated with stakes and/or flagging and no impact will occur in these areas.

Sampling depths and total depths of holes shall be determined by temporary marking of drill equipment, by reference to standard equipment dimensions (for example, 5-foot hollow-stem auger flights), or by measurement using a fiberglass tape. Final total depth measurements will be confirmed using a weighted fiberglass tape. Observations by the field geologist or engineer shall be recorded directly in the borehole log.

The field borehole log is the standard form used to document subsurface geologic conditions. The borehole log is divided into two areas. One portion contains spaces for noting information on the drilling and sampling methods. The second portion contains space for noting lithologic descriptions. All sheets shall be filled out completely, legibly, and in ink. The borehole log will be filled out in the field at the time of the drilling and sampling. The original logs shall be permanent records, and information on the logs may not be

erased. If corrections are needed, information shall be crossed out with a single line and the correction shall be initialed and dated.

The use of water and drilling fluid to assist in sonic drilling for monitoring well installation will be avoided, unless required for such conditions as running sands or drilling bedrock formations.

Temporary outer casing, drill rods, core barrels, and other downhole drilling tools will be properly decontaminated prior to the initiation of drilling activities and between each borehole location. Core barrels and other downhole soil sampling equipment will also be properly decontaminated before and after each use.

Sonic inner casing (sample tube) will have an inside diameter of at least 3.25 inches. Samples may be collected for chemical analysis. For sonic drilling, these samples are collected in a metal trough. A continuous core is collected and the sample interval is selected from the length of core run.

Surface casing may be installed where soil borings will penetrate a confining layer or when there is risk of eroding soil during the drilling process if water is used.

PROCEDURES

Instructions for Completing Soil Boring Logs

Soil boring logs will be completed in the field log books. Information collected will be consistent with that required for Form D1586 (attached), a standard CH2M HILL form or an equivalent form that supplies the same information. Procedures will follow the SOP "*Soil*

Non-Core Collection Drilling

At locations or depths from which core collection is not required, drilling may proceed without the recovery of soil cores. The drilling will include advancing the larger outer casing and the use of water to facilitate cuttings removal from the boring. The inner casing drill rods may or may not be used, depending on the cuttings recovery when drilling with the larger outer casing.

Continuous Core Drilling

At locations or depths when core collection is required, drilling will proceed using an outer casing and an inner core sample tube. The inner core sampling tube will be advanced first without the use of water. Before removal of the sampling tube, the outer casing will be advanced, using water only as needed for cuttings removal, to the same total depth as the inner casing. The outer casing will stabilize the boring when the sampling tube is removed. The process is repeated in 10 to 20 foot intervals, as the lithology of the boring permits.

The length of each drilling interval should be adjusted depending on the lithology and the quality and recovery percentage of the sample cores retrieved. At locations with very hard drilling (i.e. with large cobbles or hard materials) or when percent recovery decreases, the drilling interval should be decreased until such time that the conditions change.

After retrieval of the inner sampling core tube, the minimally disturbed sample cores will be collected into plastic liner sleeves in intervals of 2 to 3 feet. The plastic sleeves will be

immediately sealed on both ends. The cores will be used for visual descriptions and may be used for analysis for geochemical and geotechnical parameters.

KEY CHECKS AND ITEMS

- Check entries to the soil boring log and field logbook in the field during sampling activities because the cores will be disposed at the end of the fieldwork, confirmation and corrections cannot be made later.
- Check that the sample numbers and intervals are properly specified.
- Ensure that drilling equipment is decontaminated prior to the beginning of work and between each borehole.
- All materials generated during sampling (debris, PPE, decontamination liquids, etc.) will be placed in approved IDW storage containers pending analysis and disposal off site as outlined in SOP-B6, *Disposal of Waste Fluids and Solids (IDW)*.

SOP-B11

Site Clearance and Permitting
Standard Operating Procedures for PG&E Topock Program

This standard operating procedure (SOP) addresses the procedures for site clearance and permitting at the Topock site. This SOP should be used to obtain proper site clearance and permits before any work is performed at a site.

REQUIRED DOCUMENTS

1) Applicable project work plan, event-specific sampling and analysis plan (SAP), and/or Procedures Manual, if applicable.

2) Topock Program Health and Safety Plan (HSP).

3) Site map with work locations identified.

PREPARATION AND SETUP

1) Review applicable project work plan, event-specific SAP, Procedures Manual, and HSP.

2) Identify locations where work will be performed, determine if any subsurface work will be needed.

3) Before the start of any work obtain approval by the appropriate land agencies (such as BLM, USFWS, County of San Bernardino). Activities located on PG&E property fall under the jurisdiction of the County; however, approval may also be required from BLM and/or USFWS for activities such as access, waste management, etc. Work in Topock, Arizona falls under the jurisdiction of the Arizona Department of Water Resources.

4) Before the start of any work obtain appropriate approval by the regulatory agencies. These include at a minimum the DTSC if in California, and ADEQ is in Arizona. Other regulatory approvals that may be required include, but are not limited to CDFG, USFWS, USACE and RWQCB. Approval from the Arizona Land Department may also be required for wells drilled in Arizona.

If subsurface work will be involved, follow the following steps:

1) Follow the guidelines of the Southern California Underground Service Alert (USA) agency to mark the edges of the work location as outlined on their web page (http://www.digalert.org). If in Arizona, the Arizona Blue Stake should be contacted for location of buried facilities (www.azbluestake.com). Make sure to:

   - Identify delineated areas with white markings with the requesters company name or logo within the pre-marked zones

   - Delineate the exact area of excavation with white paint through the use of dots or dashes, or a continuous solid line. Limit the size of each dash to approximately 6" in length and 1" width with interval spacing not less that approximately 4 feet. Dots of

approximately 1" diameter are typically used to define arcs or radii and may be placed at closer intervals in lieu of dashes. Limit width of lines to 1".

- For point locations (such as a soil boring or well) mark the exact location in the USA or Blue Stake box with a stake. Make sure the delineated area around the stake is of adequate radius (50 to 100 feet is appropriate for drilling).

2) Call USA at 1-800-227-2600 or Arizona Blue Stake at 1-800-782-5348 at least three working days before the start of work at the identified location and provide them with the information requested on the location request form. Be ready to give the location in terms of feet relative to I-40 and to Park Moabi Road when calling. You will be assigned a Dig Alert Number, file this number until work at the delineated area is complete. (The number does expire after two weeks and a new number may need to be obtained if work has been delayed.)

3) Mark the Dig Alert Number in the delineated area using white paint as soon as possible after calling USA or Arizona Blue Stake.

4) If the location is in a developed area, contact a private utility locator and have them perform a sweep of the delineated work area. Util-Locate at (866) 421-5325 is typically used for this service.

5) In some cases the utility companies may need to be contacted directly by CH2M HILL. If the following companies do not respond to the USA or Blue Stake ticket or if we are working in their easements, use the following contact information and procedures:

Southwest Gas: Main contact is Jim Default/702-365-2097 (The required minimum clearance distance from gas pipelines is 18-inches**.** Potholing may need to be performed in advance of design completion Southwest Gas should be called prior to construction activities). If Southwest Gas does not come to the site after the USA call, contact them at their Bullhead City office at (928) 763-7766

Southern California Gas Co.: Main contact is Frank Castro/818-701-4566; secondary contact is Martin Woodsworth/818-701-4543. If we need to work in their easement, we must provide a letter from BLM giving us permission to be on the property. Southern California Gas Co. also requires advance notification of construction activities. They may also require a copy of the design drawing, potholing activities, and the issuance of a "Non-Interference" letter, if applicable, before work can proceed. One of their representatives may need to be in the field when digging is occurring near their pipeline.

TransWestern Pipeline Co.: Main contacts are Ron Westbrook (ROW Department)/713-345-3067 and Mike Baxter (Operations)/928-757-3620. They may require potholing if proposed construction activities are near their pipelines. Crossing pipeline requires filling out a simple form.

Burlington Northern Santa Fe Railroad: Main contact is Greg Rousseau (BNSF)/909-386-4079. Prior to work in their easements submit the proper application with the $250 fee to the Staubach Company.

City of Needles Utility Dept: Main contact is Ron Myers/760-326-5700 (ext. 7 for the utilities department). Work activities may need to be a minimum of 10 to 15 feet from their utility poles.

6) Do not start subsurface work at the site until the delineated area has been marked or cleared by the appropriate utility agencies.

If the work includes a performing a well installation or abandonment, or drilling a boring in California:

1) Apply for a San Bernardino County well permit two to three weeks before the start of drilling (one permit per well; cost is /$212.00 per well). Obtain a permit application by calling the Environmental Health Services Department at 1-909-387-4666 (open Monday through Friday, 8:00 a.m. to 5:00 p.m. The fee schedule for permits is located at http://www.sbcounty.gov/ dehs/FEESCHEDULE/feeschedule.htm#wateranchor. Fill out the appropriate permit form and provide it to the California-licensed driller contracted to perform the well installation. The driller is expected to review and file the permit with the San Bernardino County Department of Environmental Health Services (Steve Sesler), address below.

Environmental Health Services
385 N. Arrowhead, 2nd Floor
San Bernardino, CA 92415-0160

2) A well permit needs to be obtained from San Bernardino County for well abandonment by the same procedure described in #11. Check the 'destruction' box on the same permit form used for well installation.

3) A permit also needs to be obtained from San Bernardino County for any boring that reaches to or below the water table, even if a well is not actually installed. The permit process is the same as described in #11.

If the work includes a performing a well installation or abandonment, or drilling a boring in Arizona:

1) Apply for an Arizona Department of Water Resources (DWR) well permit two to three weeks before the start of drilling (one permit per well; cost is /$150.00 per well). Obtain a permit application by calling the DWR at 1-(602) 771-8500 (open Monday through Friday, 8:00 a.m. to 5:00 p.m. MST). All ADW permits and instructions can be found at http://www.azwater.gov/dwr/Content/Find_by_Category/Permits_Forms_Applications/default.htm
Fill out the appropriate permit form (55-44A) and provide it to the Arizona-licensed driller contracted to perform the well installation. The driller is expected to review and file the permit with the Arizona Department of Water Resources address below.

Arizona Department of Water Resources
3550 N. Central Avenue
Phoenix, AZ 85012

Upon completion of the well, the driller must submit a Driller Report and Well Log (Form 55-55) to the DWR within 30 days. The form and instructions can be found on the DWR webpage.

2) A well abandonment permit needs to be obtained from the Arizona Department of Water Resources prior to well abandonment (form 55-38). Exploratory wells that are abandoned before the drill rig leaves the site are exempt from the well abandonment permit requirements. The well abandonment form and instructions are included as Attachment 4 and can be found at the ADW webpage . No fee is required for filing this form.

   Within 30 days of well abandonment a Well Abandonment Completion Report (Form 55-58) must be filed with the DWR.

SOP-B15

Volatile Organic Compound (VOC) Soil Sampling
Standard Operating Procedures for PG&E Topock Program

This standard operating procedure (SOP) provides guidance for Volatile Organic Compound (VOC) sample collection from soil. Additional guidance for sample collection, preservation and handling is provided in Section 4.0 of the PG&E Quality Assurance Project Plan (QAPP). SOP-B2 and SOP-B3 *Sampling, Analysis, and Field Procedures Manual, PG&E Topock Program* (CH2M HILL, 2005) provides additional guidance for soil characterization and logging.

Required Documents

1) Event-specific planned sample table (PST).
2) Applicable project work plan or monitoring plan. Refer to the Procedures Manual and QAPP as required.
3) Topock Program Health and Safety Plan (HSP).
4) Previous sampling, drilling, or well construction logs from other boreholes or wells in the vicinity, if available.
5) Field notebook.
6) Database generated sampling logs.

Preparation and Setup

1) Review event-specific PST or event-specific field instructions, previous sampling logs, Procedures Manual, and HSP.
2) Coordinate with the Project Chemist for coolers, sample containers, and courier pickup of the samples.
3) Initiate field logbook for sampling activity.
4) Review sampling procedures and planned sample depths with field crew.
5) Field-check and set up equipment for sampling, decontamination, spill prevention, and health and safety.

Equipment List

- Pre-labeled soil sample containers appropriate for sample analysis and preservation as called for in PST and QAPP (Pre-weighed Vials, glass jars, auger sleeves, etc.)
- Soil sampling equipment (stainless steel trowel, spatula, EnCore™ Sampler, EasyDraw Syringe®, or a disposable plastic syringe with a barrel smaller than the neck of the soil vial with the cap removed from the plunger, etc.)
- Field notebook

- Sediment sampling logs generated from database
- Blue or black waterproof or permanent ink pens
- Trash bags
- Paper towels
- Decontamination equipment (Alconox® solution in spray bottle, brushes, buckets, rinse water spray bottle)
- Water level indicator
- Distilled water
- Coolers with ice
- Protective waterproof gloves (nitrile or latex)

SOIL SAMPLING LOGS DOCUMENTATION

Soil sampling logs or boring logs (SOP-B2 and SOP-B3 *Sampling, Analysis, and Field Procedures Manual, PG&E Topock Program* [CH2M HILL, 2005]) will be completed at the time of sample collection. Items to be documented on the sampling log include:

6) **Sample Interval:** The top and bottom depth of each sample run should be recorded on the log. Sampling includes samples collected for analysis as well as retrieved for logging purposes.

7) **Sample Type and Number:** Enter the sample type and number consistent with the sampling and analysis plan at the correct depth intervals. An "x" should be placed across the vertical interval where the environmental soil, grab groundwater, or geotechnical sample was collected.

8) **Sample Recovery:** Enter the length of retrieved sample to the nearest inch of sample recovered. Record total length and percent of sample recovered.

9) **Sampling:** Sampling difficulties shall be noted. The top of the sample shall be marked on the container.

10) **Water Levels:** Water-level measurements, where groundwater is encountered, are required for each boring. Changes in soil moisture shall be noted and, if there is no water encountered, a note to that effect shall be included on the sediment sampling log. The date and time of water-level measurements shall be documented.

At a minimum, sample identifiers (IDs) should be noted on sampling logs at the depth collected. When time and space allows, a summary of analytical sample information can be included.

VOLATILE ORGANIC COMPOUNDS (VOC) SOIL SAMPLING - COLLECTION OF SAMPLES FOR ANALYSIS

It is recommended (EPA Method 5035A) that VOC soil samples be collected in a coring device to minimize volatilization and soil disturbance to prevent constituent losses. After

collection, the sample shall be immediately transferred to the sample vial (to be used for analysis) and stored for no longer than 48 hours at 4 C ± 2° C prior to analysis. Freezing the samples between -7 and -20° C within 48 hours and maintaining them frozen until analysis allows a 14 day holding time. Chemical preservation techniques are also available as options.

Use either a commercially available sampler (such as the EnCore™ Sampler or EasyDraw Syringe®) or a disposable plastic syringe to collect VOC soil samples. To use a syringe, cut the syringe end of the barrel off and removed the rubber 'cap' from the plunger, prior to sampling (barrel of the syringe needs to be smaller than the neck of the soil vial). One sampler is needed for each sample aliquot to be collected (typically the laboratory will supply the sampler along with the sample vials, but arrangements must be made prior to sampling).

11) Weigh 3 empty samplers and note the weight. Using the same 3 samplers collect several trial samples (try to collect 5.0 ± 0.2g). Weigh each trial sample (total weight – syringe weight = sample weight) and note the length of the soil column in the syringe. Use the data to determine the length of soil in the syringe that corresponds to 5.0 grams. The length of the soil column equal to 5 grams becomes the volume for the project location. Discard each trial sample.

12) The VOC sample collection process should be completed in the least amount of time as possible in order to minimize the loss of VOCs. Sample collection should be done with the least amount of disturbance/disruption as possible. Additional, exposure of the sampling location's surface layers should be considered if the material may have already lost VOCs or if it may have been contaminated by other means. Removal of surface layers can be accomplished by scraping the surface using a clean spatula, scoop, knife, or shovel.

13) Insert a clean coring tool into a freshly exposed surface; do not trap air between the sample and the plunger. For greater ease in pushing into the solid matrix, the front edge of these tools can be sharpened. The optimum diameter of the coring tool depends on the size of the opening of the collection vial (tool should fit inside mouth), the sample characteristics (e.g., particles size, cohesion), and volume of sample required for analysis. After an undisturbed sample has been obtained by pushing the barrel of the coring tool into a freshly exposed surface, quickly wipe the exterior of the barrel with a clean disposable towel. Transfer the sample into a pre-weighted vial by gently pushing the plunger, (use extreme care to ensure none of the preservative is lost if the sample is collected into a pre-preserved vial – water, methanol or NaHSO4), verify the sealing surfaces are clean, and secure the cap (the transfer should take less than 10 seconds). **Note: Samples are collected in pre-weighed and pre-labeled vials provided by the laboratory; no additional labels are to be added to the vials!** Complete the label attached by the laboratory (fill in sample ID-only). All vials from one sample location will be placed into a zip-lock bag and the sample information shall be recorded on a label attached to the bag.

14) As a last resort non-cohesive granular samples (sand, gravel, or a mixture of gravel and fines) that can not be easily obtained or transferred using coring tools, can be quickly sampled using a decontaminated stainless steel spatula or scoop. Decontamination is

covered in section 3.3 of the PG&E Program QAPP and in SOP-B5 *Sampling, Analysis, and Field Procedures Manual, PG&E Topock Program* (CH2M HILL, 2005).

15) As with the collection of aqueous samples for volatiles, collect at least 3 replicate samples. This will allow the laboratory an additional sample for reanalysis, if needed. The replicate samples should be taken from the same soil stratum or the same section of the solid waste being sampled, and within close proximity to the location from which the original sample was collected.

16) In addition, if a VOC sample is the only sample to be collected at a given location, collect at least one additional aliquot for the determination of percent moisture. Trip blanks and equipment blanks should be collected per the PG&E Program QAPP. However, trip blanks do not apply to samples that have been frozen upon collection.

17) Transport the sample at 4^{o} C, to the lab in less than 48 hours or freeze (reagent water preserved samples to between -7 and -20^{o} C) within 48 hours and transport frozen.

18) Complete Soil Sampling Logs and Chain of Custody Logs.

SOP-B16

Field-portable X-Ray Fluorescence Soil Sampling
Standard Operating Procedures for PG&E Topock Program

This Standard Operating Procedure (SOP) describes the analysis of in situ and ex situ soil and debris samples using a field portable x-ray fluorescence (XRF) instrument. SOP-B2 and SOP-B3 in the *Sampling, Analysis, and Field Procedures Manual, PG&E Topock Program* (SAFPM) (CH2M HILL, 2005) provides additional guidance for soil characterization and logging.

Required Documents

1. Event-specific planned sample table (PST).
2. Applicable project work plan or monitoring plan. Refer to the SAFPM and the *PG&E Program Quality Assurance Project Plan, Revision 2, Topock Compressor Station, Needles, California* (CH2M HILL, 2012) as required.
1. Topock Program Health and Safety Plan.
3. Field notebook.
4. Database generated chain-of-custody.
5. XRF Functional Check Log

Preparation and Setup

1. Review event-specific PST or event-specific field instructions, previous sampling logs, SAFPM, and health and safety plan.
2. Coordinate with the project chemist for coolers, sample containers, and courier pickup of the samples.
3. Initiate field logbook for sampling activity.
4. Initiate electronic file for XRF instrument download.
5. Review sampling procedures and planned sample depths with field crew.
6. Field-check and set up equipment for functional checks, sampling, decontamination, spill prevention, and health and safety.

Equipment List

- Niton XRF meter and stand
- Spare battery chargers
- Field notebook
- Trowel for smoothing soil surfaces

- Reusable plastic bags or stainless steel tray
- Disposable sample cups with x-ray film and lids
- X-ray window film (Mylar, Kapton, Spectrolene, polypropylene, or equivalent; 2.5 to 6.0 micrometers thick)
- Disposable scoops, stainless-steel spoons, or other appropriate mixing tools
- Appropriate quality assurance/quality control (QA/QC) standards and blank sand
- Chemwipes
- Decontamination equipment (Alconox solution [or equivalent] in spray bottle, brushes, buckets, rinse water spray bottle) for mixing tools and trowels
- Protective waterproof gloves (nitrile or latex)

XRF Analysis Documentation

The XRF sample results will be recorded by the associated software in an Excel format. The files will be downloaded at the end of each day and emailed to the project chemist for review. Any additional sample logging and sample collection should follow the protocol and procedures found in the appropriate SOP. Detailed notes should be recorded in the sampler's field notebook or in a log generated from the field database. Items to be documented on the sampling log include (include as much of the following information in the XRF software as possible):

1. Record type of boring or excavation equipment and the total boring or excavation depth.
2. If multiple samples are being collected at one location at a variety of depths, record all sample depths.
3. Record date and time of sample collection in addition to the full sample ID that is listed in the PST.
4. Sampling difficulties shall be noted (that is, difficult slope or abnormal debris in sample location).
5. Analysis start time and the source count time (that is, 60, 90, or 120 seconds, etc.) will be documented on sample collection sheet. Analysis and count time are automatically recorded in the XRF software.

Field-portable XRF Soil Sampling, Collection of Samples for Analysis

In Situ Sample Preparation

When the soil moisture is less than 20 percent, the error associated with moisture may be minimal. If areas are encountered where the moisture content is greater than 20 percent (moisture is visible), consult with the project chemist for options available for proceeding with field analysis.

For in situ analysis of soil:

1. Remove large or nonrepresentative debris from the selected location. This debris includes rocks, gravel, vegetation, and concrete.
2. Homogenize the location chosen for analysis by mixing in place an area approximately 4 inches by 4 inches by 3 inches deep using a clean (or decontaminated) stainless-steel or disposable spoon. Smooth and firmly tamp the location to provide as flat and smooth an area as possible.
3. Stretch a section of x-ray window film over the area to be tested to maintain a dust-free environment for the nose of the instrument. (Use in situ analysis for metals-only samples.)
4. To initiate a reading, position the nose of the XRF against the x-ray film, squeeze the shutter release, and firmly press the instrument flat against the surface. Source count times for in situ analysis usually range from 3 to 5 minutes, varying among instruments and depending on requirement detection limits.
5. After the in situ field screening is performed, inspect the nose of the instrument for contamination, which may affect future analysis. If necessary, clean it with a soft cloth or tissue.

For confirmation samples, or where samples for organic analysis are to be collected, the soil samples should be treated as ex situ samples, below.

For in situ analysis of debris:

1. In some cases, the large or nonrepresentative debris removed in Step 1 above may need analysis. The debris for analysis can include rocks, wood, concrete, etc.
2. Analyze debris that is too large or difficult to homogenize by locating multiple locations on the surface of the debris that are as flat and smooth as possible. Scan a minimum of three locations or approximately 10 percent of the surface area (whichever is greater).
3. Stretch a section of x-ray window film over the area to be tested to maintain a dust-free environment for the nose of the instrument. (Use in situ analysis for metals only samples.)
4. To initiate a reading, position the nose of the XRF against the x-ray film, squeeze the shutter release, and firmly press the instrument flat against the surface. Source count times for in situ analysis usually range from 3 to 5 minutes, varying among instruments and depending on requirement detection limits.

After the in situ field screening is performed, inspect the nose of the instrument for contamination, which may affect future analysis. If necessary, clean it with a soft cloth or tissue.

Ex Situ Sample Preparation

For ex situ analysis:

There are several possible correct methods for the ex situ analysis of samples. The area that previously would have been homogenized for the in situ analysis should be scooped out and placed into a clean (or decontaminated) stainless-steel or disposable pan (do not use

plastic if organic analysis will be performed on any of this homogenized sample) using a stainless-steel or disposable spoon or spatula (do not use plastic if organic analysis are associated with the homogenized sample). The sample should then be thoroughly mixed (homogenized) using the same spoon or spatula.

1. The preferred method is to setup the portable field stand in an area where the XRF can be stationed and left in place for the day. Use the Niton software and a laptop computer to setup the method criteria and control the XRF instrument during the soil analysis.

    a. Starting with the previously homogenized sample, use the supplied soil sieves, bowl, and mortar to generate a finely ground well homogenized sample. (Note: This step is not required if the soil sample was passed through a sieve during the homogenization step.)

    b. Transfer the prepared sample into a new sample cup (order replacement supplies from Niton), place the X-ray film over the cup, and snap the lid in place. Place the sample cup in the portable field test stand. The XRF points upward, the sample rests on top of the XRF with the X-ray film directly in contact with the nose of the XRF cup lid facing down.

    c. Using the computer, start the analysis. The source count time should be at least 2 minutes for chromium. Consult previous analysis to determine if multiple scan frequencies are required (or contact the project chemist).

    d. Prepare the next sample while the XRF is analyzing the current sample.

2. An alternative method to using the portable field stand is to identify the sample for XRF analysis and homogenize the sample (as described above).

    a. Transfer the sample to a re-sealable plastic bag and firmly molded into a flat smooth surface.

    b. Use the Niton software and a laptop computer or the included PDA to setup the method criteria.

    c. To start the analysis, position the nose of the XRF against the flat smooth surface of the sample and squeeze the shutter release (or press the start button on the laptop or PDA). Be sure to maintain constant pressure against the sample. If contact is broken, the analysis will need to be restarted. The source count time for ex situ analysis usually range from one to two minutes, depending on the required detection limits (see 1c above for count times).

    d. After the ex situ field screening is performed, inspect the nose of the instrument for contamination, which may affect future analysis. If necessary, clean it with a soft cloth or tissue.

3. Transfer the sample to a labeled glass jar for shipment to the confirmation laboratory (if applicable).

Sample Analysis

In today's modern XRF models:

1. An X-ray source is used for detection. Expose the sample to the X-ray source for a minimum of 1 minute. Longer exposure times may be needed depending on the media that is being analyzed and the required detection levels. The time needed for analysis will be determined in the field by analyzing standards that have concentrations of the metals of concern near the required detection levels. Better detection limits can usually be obtained by homogenizing the sample, increasing the exposure time, and using two or more scan frequencies. Use a minimum of a 2-minute exposure for chromium analysis.
2. When the XRF instrument displays the results they include the analyte, the result, and a percent confidence (displayed as a ± value). The result is displayed as nondetect for analytes that do not meet the percent confidence established in the instrument. The lower the required detection levels, the longer the analysis time required to meet the percent confidence.
3. Download saved data from XRF instrument daily (if data are collected in PDA). Foreword the data files to the project chemist daily.
4. All samples collected for offsite confirmation will also be analyzed using the XRF and will be treated as ex situ samples.

Using older models:

1. Expose the sample to the energy source for a minimum of 1 minute. Longer exposure times may be needed depending on the media that is being analyzed as well as the age of the detector (non X-ray detectors). The time needed for analysis will be determined in the field by analyzing standards that have concentrations of the metals of concern near the required detection levels. Better detection limits can usually be obtained by homogenizing the sample, increasing the exposure time. Use a minimum of a 2-minute exposure for chromium).
2. When the XRF instrument indicates the results for the suite of analyzed elements and their concentrations, it includes a standard deviation for the reported concentrations. An analyte concentration is considered **not detected** if the result value is **less than two times the standard deviation**. The lower the required detection levels, the longer the analysis time required to reduce the result's standard deviation.
3. Record the readings (electronically or documented on the sampling log). Review the standard deviations for the elements of interest and determine if a longer analysis time is needed to reduce the standard deviations, thereby allowing the desired accuracy and precision for the concentrations. The standards will be analyzed using increasingly longer times until the required detection level is achieved.
4. Record values in field notebooks.
5. Download saved data from XRF instrument daily.
6. Samples collected for offsite confirmation will also be analyzed using the XRF and will be treated as ex situ samples.

Calibration

Two forms of calibration are important with XRF testing: an energy calibration and a sample matrix calibration.

Energy Calibration

The Niton XLi 702 automatically re-calibrates the energy scale when powered on. The energy scale can also be re-calibrated by pressing "Reset" on the instrument. The energy calibration should be performed every two hours.

Sample Matrix Calibration

Modern XRF instruments, such as the Niton Xli 702, do not require site specific calibrations to account for sample matrix effects. United States Environmental Protection Agency Method 6200 allows both fundamental parameters and Compton normalization as two techniques to eliminate site specific calibrations. Niton uses the Compton normalization method to automatically correct for sample specific matrix effects. The XRF is calibrated internally at the factory on NIST standard reference soil samples. Ensure the annual factory calibration certification is on file. This internal calibration is used for subsequent field work, without need for adjustment or recalibration at other sites.

Quality Assurance and Quality Control (Functional Checks)

Even though no onsite calibration will be performed, the method does require QA/QC functional check-testing protocols. The QA/QC that will be used to document that the XRF is operating properly will have the following steps:

- A startup operations check
- Analysis of a blank sample (clean sand)
- Analysis of standard sample(s)
- Analysis of duplicate samples
- QA/QC procedures will be compliant with manufacturer's instructions.

1. At the beginning of each day perform QA/QC functional check procedure or when the instrument is turned on after more than 2 hours of down time or if the operating environment changes, such as a temperature change of more than 20 degrees Fahrenheit.

2. Two types of blanks should be analyzed, an instrument blank and a method blank. An instrument blank sample (silicon dioxide, provided by Niton) will be analyzed at the start and end of each day and once every 20 samples, to confirm proper zero calibration of the XRF. The blank will be analyzed following the procedure for the ex situ sample analysis. A method blank is used to monitor for any field induced contamination. The method blank should follow any preparation procedures performed on the samples, such as mixing or ex situ analysis. **A method blank will be analyzed each day**.

3. A set of three to ten QC samples will be collected from the site during the initial field activities. These samples will be well homogenized, and a portion sent to the offsite laboratory for characterization. The remaining sample will be collected in re-sealable bags, labeled, and stored with the XRF for use as standards. Three to five of the on-site standards will be analyzed at the start of each day. The results of the standards will be plotted against the original XRF results and a correlation value will be calculated. A

correlation coefficient of 0.90 or greater must be achieved to meet the project objectives. A running log of all onsite standards analyzed will be maintained. One of the standards will be analyzed after every 20 samples. The readout from the XRF **must be within 20 percent relative percent difference of the known QC sample concentration**.

4. The last QA/QC step will be to analyze duplicate samples (two separate aliquots) at a rate of 1 in 10. These duplicate measurements must be within 35 percent of each other for the analysis to continue. If the sample results are not in agreement, then the reason for this discrepancy must be determined.

5. The Niton XL3t 600 displays both concentration and precision for each sample analyte measurement. The precision displayed by the Niton's 95 percent (2-sigma level) confidence intervals; whereas the precision calculated in EPA method 6200 is at a 68 percent (1-sigma) level. The Niton also calculates and displays detection limits for analytes if the concentration is below three standard deviations. This bypasses the need for replicate measurements on low-level standards.

Note: Volatile organic compounds, semivolatile organic compounds, and other organic samples cannot be collected from the homogenized soil if plastic is used for homogenizing or after XRF analysis, if contacted by plastic.

SOP-B17

Standard Operating Procedure for the Installation of Permanent Soil Gas Sampling Implants

This procedure is recommended as a practical approach for installation of permanent soil gas implants using a hand auger or hydrovac where the intent is to collect shallow soil vapor samples, and continuing with hydrovac and/or hollow-stem auger to collect deeper soil vapor samples. This SOP should be used where its application is consistent with the project's data quality objectives and in conjunction with SOP B18 *Standard Operating Procedure for the Collection of Soil Gas Samples from Soil Gas Probes Using Summa™ Canisters.* Only persons trained in the collection of soil gas samples should attempt this procedure.

1. Implant/Probe System Set-up

1.1 Obtain all necessary equipment for hand auguring or hydrovac to 5 feet below ground surface (BGS), and for hydrovac or hollow stem augering to depth greater than 5 feet BGS.

1.2 This technique can only be used in the vadose zone, not below the water table.

1.3 Several screen lengths are available (3", 6", 14", 21") but for discrete intervals required in Vapor Intrusion investigations, a 6" screen is recommended.

1.4 It is necessary to coordinate the hardware (i.e. size of tubing, fittings, sampling interface assembly, etc.) that mates the soil gas probe sampling line to the sampling system (i.e. Tedlar bags, Summa canisters, etc.). This step is critical to achieve a leak free system. All connections should be inert gas tight compression fittings (i.e. Swagelok® or equal) and all sample transfer lines should be made of Teflon® tubing.

1.5 Prior to installation of implants at a given location a utility survey must be completed, the necessary permits acquired, and in the case of private property - permission granted.

1.6 The drilling system must be decontaminated prior to use. Steam cleaning is the preferred method of decontamination. Once decontaminated, the auger/drill rod must be shown to be free of contaminates. As a minimum, a suitably sensitive organic vapor meter should be used for this purpose. Any probe that does not pass decontamination should not be used.

1.7 Handle and store decontaminated hand augers and drill rods in a manner that prevents contamination.

2. Implant Installation

2.1 Assemble the hand auger and/or other coring device. Auger/hydrovac/drill to the desired depth. Be sure that the final depth of the hole includes extra depth to include length of the screen. (i.e. for 5' BGS with a 6" screen, push the probe to 5'6", for 15' BGS with a 6" screen, push the probe to 15'6").

2.2 Attach the ¼" Teflon tubing to the implant. Use sufficient tubing so that at least 2' will be left above ground. Plug the exposed end of the tubing with a cap.

2.3 Remove the auger/drill rod and put a section of PVC pipe down the hole. The PVC pipe is helpful to help center the implant in the middle of the hole and to be sure that the filter

pack material makes it to the bottom of the hole. Thread the implant and tubing down the inside of the PVC pipe until it reaches the bottom.

2.4 Determine the volume of glass beads or sand (#2/12 or #2/16) needed to fill the space around the implant plus an additional 6″ space above the implant. Pour the sand/beads into the hole as the PVC pipe is slowly removed. Do not pull on the tubing. Remove the PVC pipe from the hole completely once the filter pack material has been set in place.

2.5 Determine the volume of dry bentonite needed to fill the next 1 foot of hole. Pour dry bentonite into the hole until it measures 1 foot above the sand pack.

2.6 Determine the volume of hydrated bentonite needed to fill the hole to 6″ below the upper nested probe. Place hydrated bentonite to the point 6″ below the upper nested probe. Measure the depth to make sure the upper probe will be installed at 5′6″ BGS.

2.7 Follow steps 2.2 through 2.4 for the installation of the upper nested probe.

2.8 Determine the volume of dry bentonite needed to fill the next 1 foot of hole. Pour dry bentonite into the hole until it measures 1 foot above the upper sand pack.

2.9 Determine the amount of hydrated bentonite needed to complete the hole. Pour in granular bentonite and hydrate. Repeat the procedure in 6″ increments to ground level.

2.10 Optional: Enlarge the hole and install the flushmount so that it is flush with the ground surface. Label probe tubing with location and depth. Coil the extra tubing inside the enclosure and cover.

2.11 Wait at least 48 hours before sampling.

2.12 When calculating dead volume, use the internal volume of the Teflon tubing, the internal volume of the implant, and the volume of the glass bead pack (assume 30% porosity).

2.13 The ground surface shall be replaced and repaired to original condition.

SOP-B18

Collection of Soil Gas Samples from Temporary and Permanent Soil Gas Probes using SUMMA Canisters and a Helium Leak Check

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1. Scope and Application

This procedure offers a practical approach for the collection of soil gas samples from soil gas probes from permanently installed vapor points into SUMMA canisters. Soil gas sample integrity is verified by using a real time helium leak checking procedure before taking each sample. This must be done after probe installation and before sampling as well as before each subsequent sample for permanent probes. This standard operating procedure (SOP) should be used in conjunction with CH2M HILL's SOPs: "Soil Gas Probe Installation SOP" or "Soil Gas Implant Installation SOP," and when its application is consistent with the project's data quality objectives. Only persons trained in the collection of soil gas samples should attempt this procedure.

2. Site-Specific Considerations

2.1. Prior to attempting soil gas sampling there should be an understanding of subsurface conditions at the site.

2.1.1. Depth to Groundwater – soil gas samples should be collected in the vadose zone (and above the capillary fringe). Generally, soil gas samples should not be collected at a depth above 5 feet below ground surface (bgs). Sampling at multiple depths should be considered.

2.1.2. Soil permeability **-** It may not be feasible to collect soil gas from tighter grain soils with little pore volume, such as clays; if there are clay layers present in the subsurface, these intervals should be avoided. For sampling in these soils, it is recommended to uses soil gas implants with a wider bore hole. Care should be taken during purging and sampling so that the vacuum in the sampling system never exceeds 7 "Hg (100 "water).

3. Other Considerations

3.1. A utility clearance should be performed prior to mobilization, as with all intrusive site work.

3.2. Soil gas sampling should not be performed until 48 hours after a significant rain event (>1 inch of rainfall).

4. Apparatus and Materials

4.1. The soil gas probes should be installed by a licensed driller.

4.2. Teflon tubing, ¼-inch outer diameter sample tubing.

4.3. Swagelok® ¼-inch nut and ferrule sets for connecting the probe tubing to the sampling manifold.

4.4. The helium leak check equipment, including the enclosure, helium cylinder (high purity helium), and helium detector (Dialectric MGD is preferred). The enclosure may be provided by the driller or can be constructed from polyvinyl chloride (PVC) pipe. The helium detector can be rented from an equipment rental company.

4.5. MultiRae five gas meter. (Optional if onsite atmospheric gas analysis is required)

4.6. Air pump for purging and electric supply for the pump (either generator or power inverter with adapter for car battery). Must be capable of a flow of 200 mls/min and a vacuum of 20 "Hg.

4.7. Sampling manifold consisting of Swagelok® gas tight fittings with three valves and one pressure gauge to attach the probe to the air pump and the sample canister. This manifold must be clean, free of oils, and flushed free of volatile organic compounds (VOCs) prior to use.

4.8. Canister, SUMMA polished, certified clean and evacuated. (Canisters are typically provided by the laboratory.)

4.9. Flow controller or critical orifice, certified clean and set at desired sampling rate. These are typically provided and set by the laboratory.

4.10. Negative pressure gauge, oil-free and clean, to check canister pressure. The pressure gauges are typically provided by the laboratory. The laboratory may either provide one pressure gauge to be used with all of the canisters, or a pressure gauge for each canister to be left on during sample collection. Sometimes the canisters are fitted with built-in pressure gauges that are not removable.

4.11. Shipping container, suitable for protection of canister during shipping. Typically, strong cardboard boxes are used for canister shipment. The canisters should be shipped back to the laboratory in the same shipping container in which they were received.

4.12. Wrenches and screw driver (clean and free of contaminants), various sizes as needed for connecting fittings and making adjustment to the flow controller A 9/16-inch wrench fits the ¼-inch Swagelok® fittings, which most canisters and flow controllers have.

5. System Set-up

5.1. Acquire all the necessary hardware and sampling equipment shown in Figure 1. Be sure to use ¼-inch outside diameter Teflon sample tubing. ***Do not connect the canister at this time***.

5.2. Assemble or obtain the necessary fittings and vacuum gauge to create a soil gas probe and sampling manifold as shown in Figure 1. This manifold must be clean, free of oils, and flushed free of VOCs prior to use. Note: use only gas tight fittings such as Swagelok® or equivalent. Be sure to place the helium leak check enclosure over the probe, and push the sample tubing through the hole in the cap before attaching the sampling manifold.

5.3. Adjust the purge system evacuation pump sampling rate to achieve the desired flow rate of 200 milliliters/min. This should be performed at the outlet of the vacuum pump prior to purging, either by using a suitable flow meter, or determining the amount of time required to fill a 1- liter Tedlar bag.

5.4. Summa canisters are pre-evacuated by the laboratory. The vacuum will need to be verified in the field prior to use with a pressure gauge.

5.5. Flow controllers (if used) should come pre-set by the laboratory to sample at a pre-determined rate based on specific project requirements (see Table 1 for the most common options). In some cases [that is, project-specific quality assurance (QA)], the flow rate will need to be verified in the field prior to use. This is accomplished with a bubble meter, vacuum source, and instructions supplied by the laboratory.

6. System Leak Checking and Purging

6.1. ***Physical Leak Check*** - Perform a leak check of the sample manifold system by:

6.1.1. Make sure the gas probe valve (valve #1) is closed and the sample valve (valve #2) is open.

6.1.2. Open the purge valve (valve #3) and start the purge pump. Verify that the flow is set to 200 milliliters per minute (ml/min).

6.1.3. Close the sample valve (valve #2) and achieve a vacuum gauge reading of approx. 15 inches of mercury ("Hg).

6.1.4. A leak-free system will be evident by closing off the purge valve (valve #3), turning off the purge pump, and observing no loss of vacuum within the sampling manifold system for a period of 30 seconds. Repair any leaks prior to use.

6.1.5. Record the leak check date and time on the field sampling log.

6.2. ***System Purge and Helium Leak Check*** -A purge of the soil gas probe and sampling manifold system is required before taking each sample. The helium leak check procedure is also performed during this step. This leak check will verify the integrity of the implant as well as the probe and ground interface. This is accomplished by:

6.2.1. Where the ground surface is soft, the helium leak check enclosure is pressed down slightly into the ground surface. In situations where the ground surface is hard (for example, asphalt), apply a slight downward pressure to achieve a buildup of helium in the leak check enclosure.

6.2.2. Start the flow of helium under the leak check enclosure at 200 ml/min. Try and position the tube so the helium is directed at the interface of the probe and the ground. Let the helium fill the enclosure for a couple of minutes.

6.2.3. Turn the helium leak detector on and make sure that the detector is not reading any helium before proceeding. Verify that the helium concentration inside the leak check enclosure is >10% by placing the probe of the helium detector into the hole where the sample tubing comes out or under the enclosure wall. It is not necessary to verify that the helium concentration is 100% as this is bad for the detector. Safety factors will be incorporated into measured purge gas helium concentration to verify the probe seal integrity.

6.2.4. Purging is carried out by pulling soil gas through the system at a rate of 200 ml /min for a time period sufficient to achieve a purge volume that equals at 3 dead volumes (internal volume of the in-ground annular space, sample line, and sampling manifold system). When calculating the dead volume, be sure to take into account the inside diameter and length of the Teflon sample tubing, as well as the probe outside diameter and retract distance for the annular space for temporary probes. For permanent probes, calculate the volume of the annular space using a nominal 30% porosity for the sand or glass bead pack. If during the purge (or sampling) the vacuum exceeds 7 "Hg, then reduce the pump flow rate. The system vacuum must stay below this level at all times.

6.2.5. Open the sample valve (valve #2) and the purge valve (valve #3) and start the purge pump. Verify that the flow rate is still 200 ml/min.

6.2.6. To start the soil gas probe purge, open the gas probe valve (valve #1) and close the sample valve (valve #2) at the same time, and start timing.

6.2.7. During the last 5 minutes of the purge (or the entire purge time if less than 5 minutes), attach a Tedlar bag to the purge pump exhaust on open the bag's valve.

6.2.8. If the vacuum gauge reads >7 "Hg during the purge, then close the purge valve (valve #3) and monitor the vacuum in the manifold and probe. If there is no significant change after a minute, then there is an insignificant amount of soil gas and the vacuum is too great to take

a soil gas sample. Several things can cause this. Consult with the project manager and take corrective action.

6.2.8.1. The soil formation is too 'tight' (that is, high clay or moisture content). Try using a lower flow rate. (temporary or permanent probe)

6.2.8.2. The soil formation is too 'tight'. Try a different depth or location. (temporary probe)

6.2.8.3. With a temporary probe system, the expendable tip may not have released when the probe was retracted. Try retracting the probe a little further, or use a long thin rod to poke the tip loose.

6.2.8.4. If water is visible in the flexible soil gas tubing, stop the purging immediately. It is not possible to take a soil gas sample at that depth or location.

6.2.9. At the end of the pre-determined purge time and after the system is verified to be leak free, close the purge valve (valve #3), close the valve to the Tedlar bag, and turn off the pump. Do not open the purge valve again. Doing so will result in loss of the purge integrity and will require re-purging.

6.2.10. Attach the Tedlar bag to the helium detector using a piece of flexible rubber tubing and open the valve. If a helium reading of >0.1%, or 1000 ppmv, is observed, then the probe leak check has failed and corrective action should be taken. This includes first checking the fittings and connections and trying another purge and leak check. It may also be necessary to remove the soil gas probe and re-install it in a nearby location. Using a limit of 0.1 % allows for a 10x safety margin to verify that the leak check was <1% (verify that this limit is consistent with appropriate project-specific agency guidance).

6.2.11. Remove Tedlar bag and turn off the helium leak detector.

6.2.12. Record the purge date, time, purge rate, leak check result, and purge volume on the field sampling log.

6.2.13. Immediately move on to the sampling phase. Little to no delay should occur between purging and sampling.

7. Sample Collection

7.1. 'Clean' sampling protocols must be followed when handling and collecting samples. This requires care in the shipping, storage, and use of sampling equipment. Cleanliness of personnel who come in contact with the sampling equipment is also important: no smoking, no eating, no drinking, no perfumes, no deodorants, no dry cleaned clothing, etc. Canisters should not be transported in vehicles with gas-powered equipment or gasoline cans. Sharpie markers should not be used for labeling or note-taking during sampling.

7.2. The SUMMA canisters are certified clean and evacuated by the laboratory to near absolute zero pressure. Care should be used at all times to prevent inadvertent loss of canister vacuum. ***Never open the canister's valve unless the intent is to collect a sample or check the canister pressure.***

7.3. Verify that the vacuum pressure of the canister is between 28 – 30 inches Hg. Do not use a canister that has an initial pressure less than 28 inches Hg because that canister likely leaked during shipment.

7.3.1. Remove the protective cap from the valve on the canister.

7.3.2. If using an external gauge, attach the gauge to the canister and open the valve. If the pressure gauge has two openings, make sure that the other opening is closed; the canister cap can be used for this. After taking the reading, close the canister and remove the gauge.

7.3.3. If using assigned pressure gauges, attach the pressure gauge to the canister, then attach the flow controller. When sample collection begins, record the initial pressure.

7.4. Attach the canister to the flow controller and then connect the flow controller to the sample valve (valve #2) on the sampling manifold. Open the sample valve (valve #2)

7.5. Before taking the sample, confirm that the sampling system valves are set as follows: 1) the purge valve (valve #3) is confirmed to be closed, gas probe valve (valve #1) is open, and 2) the sample valve is (valve #2) is open.

7.6. Slowly open the canister's valve approximately one full turn.

7.7. After sampling for the appropriate amount of time (determined from project instructions, see Table 1), close the sample valve (valve #2) and the canister's valve. If the canister has a built-in or assigned pressure gauge, allow the canister to fill until the vacuum pressure reaches 0 – 10 inches Hg. Remove the canister from the sampling manifold.

7.8. If using an external vacuum gauge, re-attach it, open the canister valve, and record the final pressure. Close the valve, remove the gauge, and replace and tighten the cap on the canister. Ideal pressure in the canister is between 0-10 inches Hg. More than 10 inches Hg can greatly increase reporting limits. Consult with the project team if this condition is encountered.

7.9. Record the sampling date, time, canister identification (ID), flow controller ID, and any other observation pertinent to the sampling event on the field sampling log. The temperature and barometric pressure should be recorded.

7.10. Fill out all appropriate documentation (sampling forms, sample labels, chain of custody, sample tags, etc.).

7.11. Disassemble the sampling system.

8. Sample Handling and Shipping

8.1. Fill out all appropriate documentation (chain of custody, sample tags) and return canisters and equipment to the laboratory

8.2. The canisters should be shipped back to the laboratory in the same shipping container in which they were received. The samples do not need to be cooled during shipment. DO NOT put ice in the shipping container.

8.3. When packing the canisters for shipment, verify that the valve (just past finger tight) and valve caps are snug (1/4 turn past finger tight), and use sufficient clean packing to prevent the valves from rubbing against any hard surfaces. Never pack the cans with other objects or materials that could cause them to be punctured or damaged.

8.4. Do not place sticky labels or tape on any surface of the canister!

8.5. Place a custody seal over the openings to the shipping container.

8.6. Make sure to insure the package for the value of the sample containers and flow controllers.

8.7. Ship canisters for overnight delivery.

9. Quality Control

9.1. Canister supplied by the laboratory must follow the performance criteria and quality assurance prescribed in U.S. Environmental Protection Agency (EPA) Method TO-14/15 for canister cleaning, certification of cleanliness, and leak checking. SOPs are required.

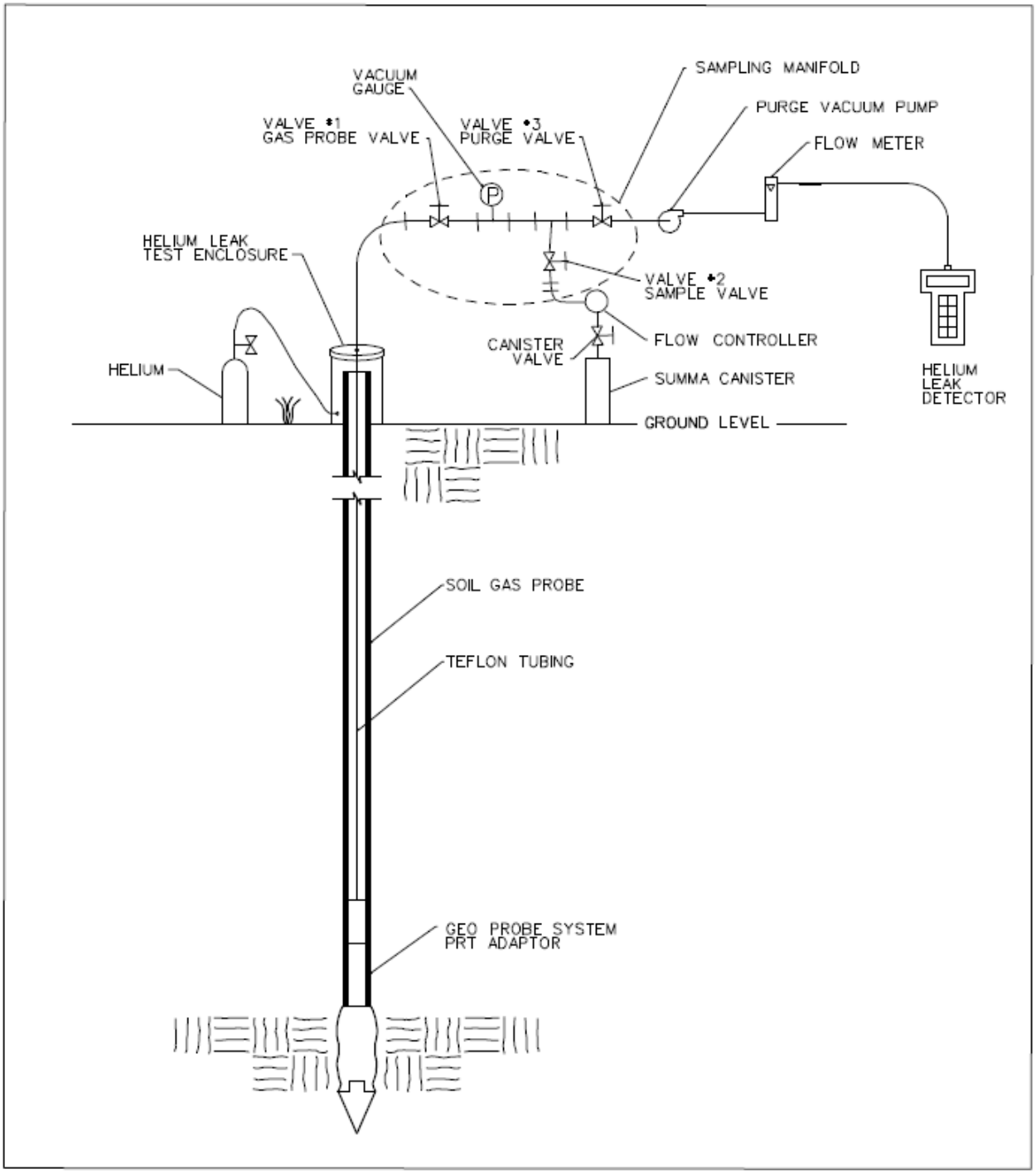
9.2. Flow controllers supplied by the laboratory must follow the performance criteria and QA prescribed in EPA Method TO-14/15 for flow controller cleaning and adjustment. SOPs are required.

Table 1 – Common Sampling Rates for Soil Gas Sampling

Can Size	Length of sampling time	Sampling Flow Rate (ml/min)
6 Liter	1 hour	90
6 Liter	8 hours	11.25
6 Liter	24 hours	3.75
1 Liter	5 minutes	180
1 Liter	1 hour	15
850 ml	5 minutes	150
850 ml	1 hour	12

Figure 1

Soil Gas Sampling System



CH2MHILL *Applied Sciences Laboratory*

Indoor Vapor Intrusion Assessment
Soil Gas Sampling Field Log

Project Info

Project Name: _____ **Project # :** _____

By: _____ **Date:** _____

Structure

Identification: _____

Address: _____

Sample Location type:

☐ concrete slab on grade ☐ Yard or Driveway

☐ concrete footing w/crawl space ☐ other (describe) _____

☐ basement _____

Soil Gas Sampling System

Probe type (describe): _____

_____

Probe to sample interface system (describe): _____

_____

Sample collection type: ☐ Syringe ☐ Tedlar bag ☐ Summa canister

Other info (describe other aspects) _____

_____

Soil Gas Probe Purging & Sampling Log

Sample location (show in diagram)	1	2	3	4
Sample Identification (field ID)				
Time Installed				
Depth of installed probe (feet bgs)				
Leak check, vacuum (probe/sampling interface)				
Calculated dead volume (1 purge volume), cc				
Calculated purge volume (3 purge volume), cc				
Purge rate, cc/min.				
Purge duration, min.				
Purge started (time of day)				
Purge vacuum, " Hg				
Max Helium Leak Check Reading				
Purge completed (time of day)				
Sampling period started (time of day)				
Sampling rate, cc/min				
Sampling vacuum, " Hg				
Sampling period ended (time of day)				

Observations and Comments: _____

_____

_____

_____

_____

Appendix B
Revised Management Protocol for Handling and Disposition of Displaced Site Material

Revised Management Protocol for Handling and Disposition of Displaced Site Material, Topock Remediation Project, Needles, California

PREPARED FOR:	Topock Remediation Project Files
PREPARED BY:	Pacific Gas and Electric Company
DATE:	October 3, 2012 (submitted with 90% Design); rev. 1 July 2015 (submitted as part of 90% Responses to Comments); rev. 2 November 2015 (submitted with Final Design)

This document presents the general approach and management protocol required for the handling and disposition of soil and/or rock (referred to as "material" throughout the document) that is displaced as a result of past (as practical), present, and future activities associated with the Pacific Gas and Electric Company (PG&E) Topock Remediation Project, Needles, California. Specifically, this includes material removed from the Earth (i.e., displaced) as a result of drilling, excavation, sampling, testing, construction, grading, and other remedial activities. The management of material that may be disturbed as a result of remedial activities but not displaced from its natural location, such as soil disturbed by foot or vehicle traffic along a pathway, is not within the scope of this protocol. This protocol is applicable to the handling and disposition of displaced materials only. Further, materials that were not part of the natural site condition (e.g., building materials, equipment, waste, debris, or imported fill[1]) are not included in this protocol.

A draft of this protocol (dated October 3, 2012[2]) was included in the Soil Management Plan associated with the Basis of Design Report/Pre-Final (90%) Design Submittal and Construction/Remediation Action Work Plan (September 8, 2014). Subsequent to agency review of the design submittal, this protocol has been revised per comment from the U.S. Department of the Interior (DOI) (Comment #803, DOI-333 [see Attachment 1]). The October 3, 2012 draft of this protocol included a provision for the long-term storage of material that is determined to be non-hazardous waste but unsuitable for a final disposition decision on-site because contaminants are present above the interim screening level. The 90% design submittal identified an area (located on federal land) for the long-term storage of material that is generated during construction of the final groundwater remedy and is characterized to meet this profile; however, the DOI comment indicates that based on discussions with San Bernardino County, the adjacent lessee of Moabi Regional Park, and internal discussions between the U.S. Bureau of Land Management (BLM) and the DOI, PG&E must find an alternate location for storage. Based on further clarifications from DOI and BLM, PG&E understood that storage of waste soil above screening levels would not be allowed anywhere on federal lands within the project area. The remaining potential storage locations are private properties owned by the Fort Mojave Indian Tribe (FMIT) and PG&E. Given the groundwater remedy facilities already planned to be located on the Topock Compressor Station (TCS) and the TCS's operational needs for the property for natural gas compressor operations, there is space on PG&E property only to temporarily store a small number of soil bins at a time while awaiting analysis prior to final disposition. There is no available space on PG&E property to store waste soil on a longer-term basis. The FMIT did not identify any locations on the Tribe's property within the project area for this purpose. PG&E also contacted treatment storage and disposal facilities (TSDFs) and was told that the TSDFs would accept the waste soil for disposal, but not storage.

[1] For the purpose of this protocol, imported fill is defined as unconsolidated mixtures of sand, silt, and gravel (engineered gradations, or otherwise) that were not originally derived from inside the defined project boundary. Specific examples of imported fill material may include road base material, shading material used in pipeline trenches, or crushed rock used for railroad ballast.

[2] Responses to comments on the May 14, 2012 draft of this protocol (see Attachment 1) were incorporated in the October 2, 2012 draft of the protocol.

Given the above, PG&E determined that there was no available alternate location for the long-term storage of material with concentrations above the interim screening levels. Therefore, this protocol has been revised to exclude this provision.

1.0 Introduction

PG&E carefully plans Topock Remediation Project activities to minimize both the disturbance and displacement of site material. The land and soils are to be handled and managed with care and respect. Therefore, the protocol established in this plan is intended to minimize the amount of displaced material that leaves the site and instead, provide for eventual return, reuse, or restoration of the material onto the lands from which it was displaced. Through the application of this protocol and its incorporation into future work plans involving material displacement, it is anticipated that the goal of careful and respectful handling of soil material will be fulfilled.

In addition to addressing Tribal requests, this protocol was developed to comply with Mitigation Measure CUL-1a-8 as set forth in the certified Environmental Impact Report (EIR) and Mitigation Monitoring and Reporting Plan (MMRP) adopted by the California Department of Toxic Substances Control (DTSC). This measure requires PG&E to develop a Cultural Impact Mitigation Program (CIMP) as part of the final design of the approved groundwater remedy, and specifically subparagraph (g) requires the CIMP to include protocols for handling soil cuttings[3]. DTSC adopted this measure following its determination that the project area is a significant historical resource for California Environmental Quality Act (CEQA) purposes (Final EIR, p. 4.4-57). Similarly, as part of the consultation process for the Programmatic Agreement (PA) under Section 106 of the National Historic Preservation Act (NHPA), BLM determined that a traditional cultural property (TCP) eligible for inclusion on the National Register of Historic Places exists within the Area of Potential Effect (APE). Throughout this document, the term “site” refers to the project area.

2.0 Statement from Fort Mojave Indian Tribe

The following statement was made by the Fort Mojave Indian Tribe regarding the site background and cultural significance:

> *The Topock site and adjacent lands are part of a larger geographical area referred to as a Traditional Cultural Landscape (TCL). The TCL is the ancestral home of the Fort Mojave Indian Tribe and other Native American Tribes including the Hualapai Nation, Colorado River Indian Tribes, Quechan Nation, Cocopah Tribe, and Yavapai-Prescott Nation. This entire TCL is of tribal religious significance. In some areas and at certain times, tribal members carry out various cultural activities and religious ceremonies.*
>
> *The very nature of the remedial activities being performed at the Topock Compressor Station involve disturbance to the TCL. Such activities as drilling, soil sampling, excavation, construction, monitoring, testing, vehicle movement, foot traffic, geophysical and other surveys, emplacement of markers, and discharge of water, solids, and other material disturb the sanctity of the land that is held in the hearts of Native Americans.*
>
> *In particular, the removal and disturbance of soils, both surficially and from the subsurface, is of concern to the Tribes because such actions are regarded as profound disruptions of the sacred landscape. While the nature and significance of this concern is not easily understood by non-Native Americans, perhaps the following excerpt, attributed to the Duwamish Chief Sealth, begins to aid in the understanding:*
>
> > *Every part of this country is sacred to my people. Every hillside, every valley, every plain and grove has been hallowed by some fond memory or some sad experience of my tribe. Even the*

[3] Mitigation Measure CUL-1a-8(g) states the following: Protocols for the repatriation of clean soil cuttings generated during construction activities and during drilling associated with repair/replacement activities during operations and maintenance phases. The soil cuttings shall be managed in compliance with applicable laws and regulations on site.

rocks that seem to lie dumb as they swelter in the sun along the silent seashore in solemn grandeur thrill with memories of past events connected with the fate of my people, and the very dust under your feet responds more lovingly to our footsteps than to yours, because it is the ashes of our ancestors, and our bare feet are conscious of the sympathetic touch, for the soil is rich with the life of our kindred. (Chief Sealth, 1854)

The Pacific Gas & Electric Company (PG&E), in its implementation of the remedial actions required by the United States Department of the Interior (DOI) and the California Department of Toxic Substances Control (DTSC) must commit to performing these actions in a manner that is respectful of Native American values.

3.0 General Protocol for Management of Displaced Material (Mitigation Measure: CUL-1a-8[g])

This section presents each element of the protocol for the management of displaced material, including work planning, handling and short-term storage, contamination assessment, and final disposition. A graphical presentation of key elements of this process, and associated decision points, is presented on Figure 1 at the end of this document.

3.1 Work Planning

PG&E is required to prepare a work plan whenever a field activity is performed at the Topock site in support of a regulatory requirement or action. Through the established federal regulatory review process, these work plans are made available for review by process stakeholders and by the governments of affected Native American Indian Tribes (referred to as "Tribes" throughout this document) via the consultation process set forth in the PA's Consultation Protocol, consistent with Section 106 of the NHPA. In addition to the information describing the scope of work, field logistics and other implementation details, work plans that involve activities that displace site material also describe the process for the management and disposition of the materials. Work plans finalized subsequent to the development of this protocol will include specific description of the process for involving the input of Tribe(s) regarding the management of the material that will be displaced as a result of the work. Key procedural information to be included in the work plan will include, but not be limited to, the following:

- Summary of measures planned to minimize the amount of disturbance that will be incurred.
- Notification procedures to inform the Tribe(s), involved regulatory agencies, and affected land owner(s) regarding the proposed activities that will disturb/displace soil or other materials.
- The location of proposed disturbance activities (e.g. access pathways) and displacement activities (e.g. drilling or sampling locations), including maps.
- Estimation of the volume and type(s) of material that will be displaced.
- The location and methodology for short-term storage of displaced material (see Section 3.2).
- Methods that will be used to assess whether contaminants are present (see Section 3.3).
- Methods that will be used to minimize the volume of material that may be displaced during work including specific measures, such as field screening and material segregation strategies, to try and minimize the volume of material that requires disposal. .
- The anticipated location and methodology for final on- or off-site disposition (see Section 3.5).

3.2 Handling and Short-term Storage

Material that is displaced as a result of Topock Remediation Project activities including drilling, excavation, sample collection, testing, construction, grading, or other activities will be handled on-site in accordance with the project-specific work plan. Displaced material that must be characterized for key chemical properties prior to identifying

the appropriate final disposition method will be stored for the short term. Short-term storage areas and the protocol for handing material in these areas may vary by project. Depending on the type and volume of material displaced, location, land owner considerations, and other pertinent factors, short-term storage methods may include storage devices (e.g. bins) or properly maintained stockpiles that prevent this material from commingling with other areas of the environment. In some cases, short-term storage for characterization may not be necessary. For example, displaced material that is pre-characterized or characterized rapidly as work is conducted will be managed directly for final disposition (see Section 3.4).

Specific material handling and short-term storage details will be defined in the approved work plan for a given activity. Key details to be identified in the work plan include:

- The mode and location of short-term storage.
- The method of transfer from the point of origin to short-term staging area.
- Best management practices/regulatory requirements to prevent releases of the potentially contaminated material during transfer and storage.
- Best management practices to protect the material from weather, erosion, contamination, and vandalism while located in the short-term staging area(s).
- Method for segregation of soils based by location, as practicable and appropriate.

A key element of this handling protocol is the development of an inventory of all material displaced by Topock Remediation Project activities. Key information maintained in this inventory will include:

- Material displacement authorization – Specific work plan under which the work was conducted.
- Material origin – Specific location of the site.
- Material description (e.g., soil, rock, etc.).
- Date(s) of displacement or accumulation.
- Generating activity (e.g., drilling, excavation, etc.).
- Approximate volume of material stored.
- Short-term storage mode and location – Type of storage (including container identification number, as applicable) and location of short-term storage pending material characterization. In some cases, this information may need to be updated as containers are moved between areas of the site.
- Characterization status – Characterization sample information (e.g., date of submittal and laboratory used), date of receipt of results, and the contamination assessment based on comparison to screening criteria (see Section 3.3).
- Final disposition information – Indication of the on-site or off-site final disposition action identified through discussion with Tribe(s), agencies, and the affected land owner(s), as appropriate, based on review of material type and the contamination assessment (see Section 3.4).

Once the displaced material has been managed through final disposition, it will no longer be tracked in the displaced material inventory.

3.3 Contamination Assessment

Key chemical property information will be used to determine the final disposition method, and specifically, whether displaced material is suitable for retention on-site for eventual return, reuse, or replacement, or if the material must be removed from the site for disposal in accordance with applicable State and Federal laws and

regulations. Key information that will be considered to assess whether the material is contaminated, and therefore, whether the material can remain on-site or not, includes:

- Existing information including knowledge of the history of an area, or laboratory analytical results collected during previous phases of work. Use of existing information may preclude the need for additional analytical testing. When available, this information will be included in the work plan.
- Results of characterization samples collected for laboratory analysis, and observation of the physical properties of the material (e.g., white powder, burned material, boulders, etc.), as defined in the approved work plan for a given activity.
- Screening values for various analytes identified for the purpose of determining the appropriate material disposition method. Tables 1 and 2 at the end of this document present a reference list of analytes and associated screening levels that may be applicable for making decisions related to disposition of displaced site materials. The specific analytes applicable for characterization of displaced material will be determined based on the origin of the material and potential disposition locations. Screening values included on Tables 1 and 2 are defined in the following bullets, which will be modified as screening levels are added to these tables:
  - **Interim Screening Levels (Table 1)** – This is predominantly the background value. However, if the background value is not available then the lesser of the DTSC residential Screening Level (HERO's *Human Health Risk Assessment Note 3 – DTSC-modified Screening Levels*)[4] or the ecological comparison value is used. If a DTSC residential screening level is not available, it is the lesser of the United States Environmental Protection Agency (USEPA) residential regional screening level or the ecological comparison value. This value is the most conservative, and it is assumed that the project-specific cleanup goal and/or Tribal screening level will be equal to or greater than this value.
  - **Hazardous Waste Toxicity Characteristic Levels (Table 2) –** These values are used to determine if the material should be classified as a State or Federal hazardous waste. Specifically, total constituent concentrations expressed in milligrams per kilogram (mg/kg) will be compared to the hazardous waste characteristic levels in Table 2, and will be evaluated as follows:
    1. If the total constituent concentration exceeds the total threshold limit concentration (TTLC), the soil represented by the sample will be classified as a non-RCRA California hazardous waste. Additional evaluation of the soluble threshold limit concentration (STLC), as described in step 3 below, will not be performed.
    2. If the total constituent concentration exceeds the numeric value of the RCRA toxicity characteristic (TC) level by about 20 times or more, the toxicity characteristic leaching procedure (TCLP) will be performed. If the constituent concentration in the TCLP leachate exceeds the TC level, the soil represented by the sample will be classified as a RCRA hazardous waste. Additional evaluation of the STLC, as described in step 3 below, will not be performed.
    3. If the sample has not been classified as hazardous waste in steps 1 or 2, the total constituent concentration will be compared to the STLC. If the total constituent concentration exceeds the numeric value of the STLC by about 10 times or more, the California Waste Extraction Test (WET) will be performed. If the constituent concentration in the WET exceeds the STLC, the soil represented by the sample will be classified as a non-RCRA California hazardous waste.
    4. If the sample has not been classified as a hazardous waste in steps 1, 2, or 3, or by other applicable hazardous waste standards, the soil represented by the sample will not be classified or managed as hazardous waste.

[4] California Department of Toxic Substances Control's Human and Ecological Office (HERO). 2015. *Human Health Risk Note 3–DTSC-Modified Screening Levels*. May 3.

These values will be used to determine the final disposition of displaced material by comparing the representative concentration of a given volume of material to the screening values. The methodology for determining the representative concentration will be established in the project-specific work plan and should not be limited to a concentration-by-concentration comparison, but could include statistical estimates or averages based on multiple samples. Material that has a representative concentration that is equal to or below the interim screening level or project-specific cleanup goal (once established) is suitable for return, reuse, or replacement on-site. Material that has a representative concentration that is greater than the interim screening level or project-specific cleanup goal (once established), or is characterized as hazardous waste will be disposed of off-site in accordance with applicable laws and regulations.

The screening levels included in Tables 1 and 2 must be updated as applicable regulations and project-specific decisions are made. PG&E will review this information as remediation work plans are developed and implemented. As changes are determined appropriate, PG&E will submit revisions to the regulatory agencies and Tribe(s) for review and comment. Only agency approved values will be utilized.

3.4 Final Disposition

Final disposition refers to the final action taken on behalf of the Topock Remediation Project as it relates to the management of material displaced during associated activities. This protocol has been designed with the purpose of minimizing the volume of material that is disposed of off-site. Material determined to have a representative concentration that is equal to or less than the interim screening level or project-specific cleanup goal (once established) will be retained on site for return, reuse, and/or restoration. Material determined to have a representative concentration that is greater than this value will be transported off site for disposal in accordance with applicable laws and regulations or treated on site if appropriate based on the selection of the final soil remedy. Material return, reuse, and/or restoration options associated with final disposition on site are discussed in Section 4.

4.0 Return, Reuse, and/or Restoration of Displaced Material

Final on-site disposition alternatives include the return, reuse, and/or restoration of the displaced material. The preferred disposition alternative(s) will be considered on a case-by-case basis with the regulatory agencies, Tribe(s), and affected land owner(s), as suitable material is identified. Material types may differ by physical or chemical properties, and therefore the preferred on-site disposition alternative may also vary. Alternatives that have been preliminarily identified include, but are not limited to:

- Replacement of material into original borings, trenches, or excavations, from which they were removed.
- Replacement of material into borings, trenches, or excavations other than those from which they were removed.
- Creation of topographical or landscape barriers to protect sensitive areas.
- Creation of berms or other structures (e.g., gabions) to prevent erosion.
- On-site road maintenance (this alternative may require sorting the material for different physical sizes).
- Stockpiling in designated areas.

The above list of final on-site disposition alternatives is preliminary, and should not be considered complete. Further, if material is found to contain concentrations of volatile organic compounds it may not be suitable for return, reuse, and/or restoration near buildings where vapor intrusion would be of concern. Coordination with agencies, Tribe(s), and affected land owners is critical in design of the work plan to identify the preferred on-site disposition alternative(s) and communication milestones, so the material can be efficiently managed.

Material displaced as part of past remediation project activities was managed in accordance with project-specific work plans. As a result, some material has been retained at the site because contaminant concentrations were

below the Interim Screening Level. Therefore, previously displaced material is available for the return, reuse, and/or restoration alternatives included in the bullets above, or as additional uses are developed. As of June 2012, the estimated volume of material that has been retained and stockpiled through past remediation project activities is approximately 30 to 35 cubic yards.

TABLE 1
Reference List of Potentially Applicable Analytes and Associated Screening Levels (rev. July 2015)
Management Protocol for Handling and Disposition of Displaced Material
PG&E Topock Compressor Station, Needles, California

Group	Analyte	Interim Screening Level		Interim Screening Level Source	Hazardous Waste Disposal Criteria
Dioxins and Furans (ng/kg)					
	1,2,3,4,6,7,8-HpCDD	NE		Not Established	NE
	1,2,3,4,6,7,8-HpCDF	NE		Not Established	NE
	1,2,3,4,7,8,9-HpCDF	NE		Not Established	NE
	1,2,3,4,7,8-HxCDD	NE		Not Established	NE
	1,2,3,4,7,8-HxCDF	NE		Not Established	NE
	1,2,3,6,7,8-HxCDD	NE		Not Established	NE
	1,2,3,6,7,8-HxCDF	NE		Not Established	NE
	1,2,3,7,8,9-HxCDD	NE		Not Established	NE
	1,2,3,7,8,9-HxCDF	NE		Not Established	NE
	1,2,3,7,8-PeCDD	4.8		EPA Residential RSL	NE
	1,2,3,7,8-PeCDF	NE		Not Established	NE
	2,3,4,6,7,8-HxCDF	NE		Not Established	NE
	2,3,4,7,8-PeCDF	NE		Not Established	NE
	2,3,7,8-TCDD	4.8		EPA Residential RSL	See Table 2
	2,3,7,8-TCDF	NE		Not Established	NE
	OCDD	NE		Not Established	NE
	OCDF	NE		Not Established	NE
	TEQ Avian	16		Soil Ecological Comparison Value (ECV)	NE
	TEQ Human	50		DTSC HHRA Note 2	NE
	TEQ Mammals	1.6		Soil Ecological Comparison Value (ECV)	NE
Metals (mg/kg)					
	Aluminum	16,400		Background Level	NE
	Antimony	0.285		Soil Ecological Comparison Value (ECV)	See Table 2
	Arsenic	11	*	Background Level	See Table 2
	Barium	410	*	Background Level	See Table 2
	Beryllium	0.672		Background Level	See Table 2
	Cadmium	1.1	*	Background Level	See Table 2
	Calcium	66,500		Background Level	NE
	Chromium, Hexavalent	0.83	*	Background Level	See Table 2
	Chromium, total	39.8	*	Background Level	See Table 2
	Cobalt	12.7	*	Background Level	See Table 2
	Copper	16.8		Background Level	See Table 2
	Cyanide	0.9		Soil Ecological Comparison Value (ECV)	NE
	Iron	55,000		EPA Residential RSL	NE
	Lead	8.39	*	Background Level	See Table 2
	Magnesium	12,100		Background Level	NE
	Manganese	402	*	Background Level	NE
	Mercury	0.0125		Soil Ecological Comparison Value (ECV)	See Table 2
	Molybdenum	1.37	*	Background Level	See Table 2
	Nickel	27.3	*	Background Level	See Table 2
	Potassium	4,400		Background Level	NE
	Selenium	1.47	*	Background Level	See Table 2
	Silver	5.15		Soil Ecological Comparison Value (ECV)	See Table 2
	Sodium	2,070		Background Level	NE
	Thallium	0.78		EPA Residential RSL	See Table 2
	Vanadium	52.2	*	Background Level	See Table 2
	Zinc	58	*	Background Level	See Table 2

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Pesticides (µg/kg)				
	4,4-DDD	2.1	Soil Ecological Comparison Value (ECV)	See Table 2
	4,4-DDE	2	EPA Residential RSL	See Table 2
	4,4-DDT	1.9	EPA Residential RSL	See Table 2
	Aldrin	39	EPA Residential RSL	See Table 2
	alpha-BHC	86	EPA Residential RSL	NE
	alpha-Chlordane	470	Soil Ecological Comparison Value (ECV)	See Table 2
	beta-BHC	300	EPA Residential RSL	NE
	delta-BHC	300	EPA Residential RSL	NE
	Dieldrin	5	Soil Ecological Comparison Value (ECV)	See Table 2
	Endo sulfan I	470,000	EPA Residential RSL	NE
	Endo sulfan II	470,000	EPA Residential RSL	NE
	Endosulfan sulfate	470,000	EPA Residential RSL	NE
	Endrin	19,000	EPA Residential RSL	See Table 2
	Endrin aldehyde	19,000	EPA Residential RSL	NE
	Endrin ketone	19,000	EPA Residential RSL	NE
	gamma-BHC (Lindane)	570	EPA Residential RSL	See Table 2
	gamma-Chlordane	0.43	DTSC-Residential SLs	See Table 2
	Heptachlor	130	EPA Residential RSL	See Table 2
	Heptachlor Epoxide	70	EPA Residential RSL	See Table 2
	Methoxychlor	320,000	EPA Residential RSL	See Table 2
	Toxaphene	490	EPA Residential RSL	See Table 2
Polyaromatic Hydrocarbons (µg/kg)				
	1-Methyl naphthalene	18,000	EPA Residential RSL	NE
	2-Methyl naphthalene	240,000	EPA Residential RSL	NE
	Acenaphthene	3,600,000	EPA Residential RSL	NE
	Acenaphthylene	3,600,000	EPA Residential RSL	NE
	Anthracene	18,000,000	EPA Residential RSL	NE
	B(a)P Equivalent	16	EPA Residential RSL	NE
	Benzo (a) anthracene	160	EPA Residential RSL	NE
	Benzo (a) pyrene	16	EPA Residential RSL	NE
	Benzo (b) fluoranthene	160	EPA Residential RSL	NE
	Benzo (ghi) perylene	1,800,000	EPA Residential RSL	NE
	Benzo (k) fluoranthene	0.39	DTSC-Residential SLs	NE
	Chrysene	3.9	DTSC-Residential SLs	NE
	Dibenzo (a,h) anthracene	16	EPA Residential RSL	NE
	Fluoranthene	2,400,000	EPA Residential RSL	NE
	Fluorene	2,400,000	EPA Residential RSL	NE
	Indeno (1,2,3-cd) pyrene	160	EPA Residential RSL	NE
	Naphthalene	3,800	EPA Residential RSL	NE
	PAH High molecular weight	1,160	Soil Ecological Comparison Value (ECV)	NE
	PAH Low molecular weight	10,000	Soil Ecological Comparison Value (ECV)	NE
	Phenanthrene	1,800,000	EPA Residential RSL	NE
	Pyrene	1,800,000	EPA Residential RSL	NE
Polychlorinated Biphenyls (µg/kg)				
	Aroclor 1016	0.23	DTSC-Residential SLs	See Table 2
	Aroclor 1221	170	EPA Residential RSL	See Table 2

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Group	Analyte	Interim Screening Level	Interim Screening Level Source	Hazardous Waste Disposal Criteria
Polychlorinated Biphenyls (µg/kg)				
	Aroclor 1232	170	EPA Residential RSL	See Table 2
	Aroclor 1242	230	EPA Residential RSL	See Table 2
	Aroclor 1248	230	EPA Residential RSL	See Table 2
	Aroclor 1254	240	EPA Residential RSL	See Table 2
	Aroclor 1260	240	EPA Residential RSL	See Table 2
	Aroclor 1262	240	EPA Residential RSL	See Table 2
	Aroclor 1268	240	EPA Residential RSL	See Table 2
	Total PCBs	204	Soil Ecological Comparison Value (ECV)	See Table 2
Semivolatile Organic Compounds (µg/kg)				
	1,1´-Biphenyl	47,000	EPA Residential RSL	NE
	1,2,4,5-Tetrachlorobenzene	23,000	EPA Residential RSL	NE
	1,4-Dioxane	5,300	EPA Residential RSL	NE
	2,3,4,6-Tetrachlorophenol	1,900,000	EPA Residential RSL	NE
	2,4,5-Trichlorophenol	6,300,000	EPA Residential RSL	See Table 2
	2,4,6-Trichlorophenol	7.5	DTSC-Residential SLs	See Table 2
	2,4-Dichlorophenol	190,000	EPA Residential RSL	NE
	2,4-Dimethylphenol	1,300,000	EPA Residential RSL	NE
	2,4-Dinitrophenol	130,000	EPA Residential RSL	NE
	2,4-Dinitrotoluene	1,700	EPA Residential RSL	See Table 2
	2,6-Dinitrotoluene	360	EPA Residential RSL	NE
	2-Chloro naphthalene	4,800,000	EPA Residential RSL	NE
	2-Chlorophenol	390,000	EPA Residential RSL	NE
	2-Methylphenol (o-Cresol)	3,200,000	EPA Residential RSL	See Table 2
	2-Nitroaniline	630,000	EPA Residential RSL	NE
	3,3-Dichlorobenzidene	1,200	EPA Residential RSL	NE
	3-Nitroaniline	630,000	EPA Residential RSL	NE
	4,6-Dinitro-2-methylphenol	5,100	EPA Residential RSL	NE
	4-Chloro-3-methylphenol	6,300,000	EPA Residential RSL	NE
	4-Chloroaniline	2,700	EPA Residential RSL	NE
	4-Methylphenol (p-Cresol)	500	Soil Ecological Comparison Value (ECV)	See Table 2
	4-Nitroaniline	27,000	EPA Residential RSL	NE
	Acetophenone	7,800,000	EPA Residential RSL	NE
	Atrazine	2,400	EPA Residential RSL	NE
	Benzaldehyde	7,800,000	EPA Residential RSL	NE
	Benzoic acid	250,000,000	EPA Residential RSL	NE
	Benzyl alcohol	6,300,000	EPA Residential RSL	NE
	Bis (2-chloroethoxy) methane	190,000	EPA Residential RSL	NE
	Bis (2-ethylhexyl) phthalate	2,870	Soil Ecological Comparison Value (ECV)	NE
	Butyl benzyl phthalate	290,000	EPA Residential RSL	NE
	Caprolactam	31,000,000	EPA Residential RSL	NE
	Carbazole	1,600,000	EPA Residential RSL	NE
	Dibenzofuran	73,000	EPA Residential RSL	NE
	Diethyl phthalate	51,000,000	EPA Residential RSL	NE
	Dimethyl phthalate	51,000,000	EPA Residential RSL	NE
	Di-N-butyl phthalate	46.9	Soil Ecological Comparison Value (ECV)	NE
	Di-N-octyl phthalate	630,000	EPA Residential RSL	NE
	Hexachlorobenzene	210	EPA Residential RSL	See Table 2

TABLE 1
Reference List of Potentially Applicable Analytes and Associated Screening Levels (rev. July 2015)
Management Protocol for Handling and Disposition of Displaced Material
PG&E Topock Compressor Station, Needles, California

Group	Analyte	Interim Screening Level	Interim Screening Level Source	Hazardous Waste Disposal Criteria
Semivolatile Organic Compounds (µg/kg)				
	Hexachloroethane	1,800	EPA Residential RSL	See Table 2
	N-Nitroso-di-n-propylamine	78	EPA Residential RSL	NE
	N-nitrosodiphenylamine	110,000	EPA Residential RSL	NE
	Pentachlorophenol	1,000	EPA Residential RSL	See Table 2
	Phenol	19,000,000	EPA Residential RSL	NE
Total Petroleum Hydrocarbons (mg/kg)				
	TPH as diesel	240	SF RWQCB ESL for direct exposure (2013)	NE
	TPH as gasoline	770	SF RWQCB ESL for direct exposure (2013)	NE
	TPH as motor oil	10,000	SF RWQCB ESL for direct exposure (2013)	NE
Volatile Organic Compounds (µg/kg)				
	1,1,1,2-Tetrachloroethane	550	DTSC-Residential SLs	NE
	1,1,1-Trichloroethane	1,700	DTSC-Residential SLs	NE
	1,1,2,2-Tetrachloroethane	600	EPA Residential RSL	NE
	1,1,2-Trichloroethane	1,100	EPA Residential RSL	NE
	1,1,2-Trichlorotrifluoroethane (Freon 113)	40,000,000	EPA Residential RSL	NE
	1,1-Dichloroethane	1,600	DTSC-Residential SLs	NE
	1,1-Dichloroethene	230,000	EPA Residential RSL	See Table 2
	1,1-Dichloropropene	1,800	EPA Residential RSL	NE
	1,2,3-Trichlorobenzene	63,000	EPA Residential RSL	NE
	1,2,3-Trichloropropane	5.1	EPA Residential RSL	NE
	1,2,4-Trichlorobenzene	24,000	EPA Residential RSL	NE
	1,2,4-Trimethylbenzene	58,000	EPA Residential RSL	NE
	1,2-Dibromo-3-chloropropane	5.3	EPA Residential RSL	NE
	1,2-Dibromoethane	7.2	DTSC-Residential SLs	NE
	1,2-Dichlorobenzene	1,800,000	EPA Residential RSL	NE
	1,2-Dichloroethane	460	EPA Residential RSL	See Table 2
	1,2-Dichloropropane	1,000	EPA Residential RSL	NE
	1,3,5-Trimethylbenzene	210	DTSC-Residential SLs	NE
	1,3-Dichlorobenzene	1,800,000	EPA Residential RSL	NE
	1,3-Dichloropropane	420	DTSC-Residential SLs	NE
	1,4-Dichlorobenzene	2,600	EPA Residential RSL	See Table 2
	2,2-Dichloropropane	1,600,000	EPA Residential RSL	NE
	2-Chlorotoluene	480	DTSC-Residential SLs	NE
	2-Hexanone	200,000	EPA Residential RSL	NE
	4-Isopropyltoluene	1,900,000	EPA Residential RSL	NE
	Acetone	61,000,000	EPA Residential RSL	NE
	Acrolein	140	EPA Residential RSL	NE
	Acrylonitrile	0.068	DTSC-Residential SLs	NE
	Benzene	0.33	DTSC-Residential SLs	See Table 2
	Bis (2-chloroethyl) ether	230	EPA Residential RSL	NE
	Bis (2-chloroisopropyl) ether	4,900	EPA Residential RSL	NE
	Bromobenzene	290,000	EPA Residential RSL	NE
	Bromochloromethane	150,000	EPA Residential RSL	NE
	Bromodichloromethane	280	DTSC-Residential SLs	NE
	Bromoform	19,000	EPA Residential RSL	NE
	Bromomethane	6,800	EPA Residential RSL	NE

TABLE 1
Reference List of Potentially Applicable Analytes and Associated Screening Levels (rev. July 2015)
Management Protocol for Handling and Disposition of Displaced Material
PG&E Topock Compressor Station, Needles, California

Group	Analyte	Interim Screening Level	Interim Screening Level Source	Hazardous Waste Disposal Criteria
Volatile Organic Compounds (µg/kg)				
	Carbon disulfide	770,000	EPA Residential RSL	NE
	Carbon tetrachloride	0.099	DTSC-Residential SLs	See Table 2
	Chlorobenzene	280,000	EPA Residential RSL	See Table 2
	Chloroethane	3.1	DTSC-Residential SLs	NE
	Chloroform	320	EPA Residential RSL	See Table 2
	Chloromethane	110,000	EPA Residential RSL	NE
	cis-1,2-Dichloroethene	19	DTSC-Residential SLs	NE
	cis-1,3-Dichloropropene	1,800	EPA Residential RSL	NE
	Cyclohexane	6,500,000	EPA Residential RSL	NE
	Dibromochloromethane	750	EPA Residential RSL	NE
	Dibromomethane	23,000	EPA Residential RSL	NE
	Dichlorodifluoromethane	87,000	EPA Residential RSL	NE
	Ethylbenzene	5,800	EPA Residential RSL	NE
	Hexachlorobutadiene	1,200	EPA Residential RSL	See Table 2
	Hexachlorocyclopentadiene	1,800	EPA Residential RSL	NE
	Isophorone	570,000	EPA Residential RSL	NE
	Isopropylbenzene	1,900,000	EPA Residential RSL	NE
	m,p-Xylenes	550,000	EPA Residential RSL	NE
	Methyl acetate	24,000	DTSC-Residential SLs	NE
	Methyl ethyl ketone	27,000,000	EPA Residential RSL	See Table 2
	Methyl isobutyl ketone	5,300,000	EPA Residential RSL	NE
	Methyl tert-butyl ether (MTBE)	47,000	EPA Residential RSL	NE
	Methylcyclohexane	6,500,000	EPA Residential RSL	NE
	Methylene chloride	5.5	DTSC-Residential SLs	NE
	N-Butylbenzene	1,200	DTSC-Residential SLs	NE
	Nitrobenzene	5,100	EPA Residential RSL	See Table 2
	N-Propylbenzene	3,800,000	EPA Residential RSL	NE
	o-Xylene	650,000	EPA Residential RSL	NE
	p-Chlorotoluene	440	DTSC-Residential SLs	NE
	sec-Butylbenzene	2,200	DTSC-Residential SLs	NE
	Styrene	6,000,000	EPA Residential RSL	NE
	tert-Butylbenzene	2,200	DTSC-Residential SLs	NE
	Tetrachloroethene	0.6	DTSC-Residential SLs	See Table 2
	Toluene	1,100	DTSC-Residential SLs	NE
	trans-1,2-Dichloroethene	190	DTSC-Residential SLs	NE
	trans-1,3-Dichloropropene	1,800	EPA Residential RSL	NE
	Trichloroethene	940	EPA Residential RSL	See Table 2
	Trichlorofluoromethane (Freon 11)	730,000	EPA Residential RSL	NE
	Vinyl chloride	59	EPA Residential RSL	See Table 2
	Xylenes, total	650,000	EPA Residential RSL	NE

Notes:

This table presents a reference list of analytes and associated screening levels that may be applicable for making decisions related to disposition of displaced site materials. The specific analytes and screening levels applicable for characterization of displaced material will be determined based on the origin of the material and potential disposition locations.

Interim screening level is background value. If background value is not available then the lesser of the DTSC HHRA Note 3 Residential Screening Levels (DTSC Residential SL) or the ecological comparison value is used. If a DTSC Residential SL is not available, it is the lesser of the USEPA residential regional screening level or the ecological comparison value.

Background	"Final Soil Background Investigation at Pacific Gas and Electric Company Topock Compressor Station, Needles, California" (CH2M HIll 2009c)
DTSC-Residential SLs	Human Health Risk Assessment Note 3 – DTSC-Modified Screening Levels, May 2015.
EPA Residential RSL	United States Environmental Protection Agency Residential Soil Regional Screening Level (THQ=1.0), June 2015.
ECV	Ecological Comparison Values; ECV were calculated as needed for constituents detected during the Part A Phase I sampling (Arcadis 2008)
HHRA Note 2	DTSC Human Health Risk Assessment (HHRA) Note 2: Remedial Goals for Dioxins and Dioxin-like Compounds for Consideration at California Hazardous Waste Sites – Interim (May 2009).
SF RWQCB ESL	San Francisco Bay Regional Water Quality Control Board Environmental Screening Levels for residential direct exposure (2013)
*	One or more screening levels (EPA Residential RSL, DTSC-Residential SLs, ECV, or Soil SL) have values lower than the background level.
NE	not established
mg/kg	milligrams per kilogram
ng/kg	nanograms per kilogram
µg/kg	micrograms per kilogram

TABLE 2

Hazardous Waste Toxicity Characteristic Levels

Management Protocol for Handling and Disposition of Displaced Material

PG&E Topock Compressor Station, Needles, California

Group	Analyte	TTLC [a, i]	STLC [b] Screen	RCRA TC [c] Screen	STLC [d, i] (from WET)	RCRA TC [e] (from TCLP)	EPA HW [f]
		mg/kg	mg/kg	mg/kg	mg/L	mg/L	
Asbetos							
	Asbestos	1%	NE	NE	NE	NE	NE
Dioxins and Furans							
	2,3,7,8-TCDD	0.01	0.01	NE	0.001	NE	NE
Metals							
	Antimony	500	150	NE	15	NE	NE
	Arsenic	500	50	100	5	5	D004
[j]	Barium	10,000	1,000	2,000	100	100	D005
	Beryllium	75	7.5	NE	0.75	NE	NE
	Cadmium	100	10	20	1	1	D006
	Chromium, Hexavalent	500	50	NE	5	NE	NE
[k]	Chromium, total	2,500	50	100	5	5	D007
	Cobalt	8,000	800	NE	80	NE	NE
	Copper	2,500	250	NE	25	NE	NE
	Lead	1,000	50	100	5	5	D008
	Mercury	20	2	4	0.2	0.2	D009
[l]	Molybdenum	3,500	3,500	NE	350	NE	NE
	Nickel	2,000	200	NE	20	NE	NE
	Selenium	100	10	20	1	1	D010
	Silver	500	50	100	5	5	D011
	Thallium	700	70	NE	7	NE	NE
	Vanadium	2,400	240	NE	24	NE	NE
	Zinc	5,000	2,500	NE	250	NE	NE
Pesticides							
	4,4-DDD	1	1	NE	0.1	NE	NE
	4,4-DDE	1	1	NE	0.1	NE	NE
	4,4-DDT	1	1	NE	0.1	NE	NE
	Aldrin	1.4	1.4	NE	0.14	NE	NE
	alpha-Chlordane	2.5	2.5	0.6	0.25	0.03	D020
	Dieldrin	8	8	NE	0.8	NE	NE
	Endrin	0.2	0.2	0.4	0.02	0.02	D012
	gamma-BHC (Lindane)	4	4	8	0.4	0.4	D013
	gamma-Chlordane	2.5	2.5	0.6	0.25	0.03	D020
	Heptachlor	4.7	4.7	0.16	0.47	0.008	D031
	Heptachlor Epoxide	4.7	4.7	0.16	0.47	0.008	D031
	Methoxychlor	100	100	200	10	10	D014
	Toxaphene	5	5	10	0.5	0.5	D015
Polychlorinated Biphenyls							
	Aroclor 1016	50	50	NE	5	NE	NE
	Aroclor 1221	50	50	NE	5	NE	NE
	Aroclor 1232	50	50	NE	5	NE	NE
	Aroclor 1242	50	50	NE	5	NE	NE
	Aroclor 1248	50	50	NE	5	NE	NE
	Aroclor 1254	50	50	NE	5	NE	NE
	Aroclor 1260	50	50	NE	5	NE	NE
	Aroclor 1262	50	50	NE	5	NE	NE
	Aroclor 1268	50	50	NE	5	NE	NE

TABLE 2

Hazardous Waste Toxicity Characteristic Levels

Management Protocol for Handling and Disposition of Displaced Material

PG&E Topock Compressor Station, Needles, California

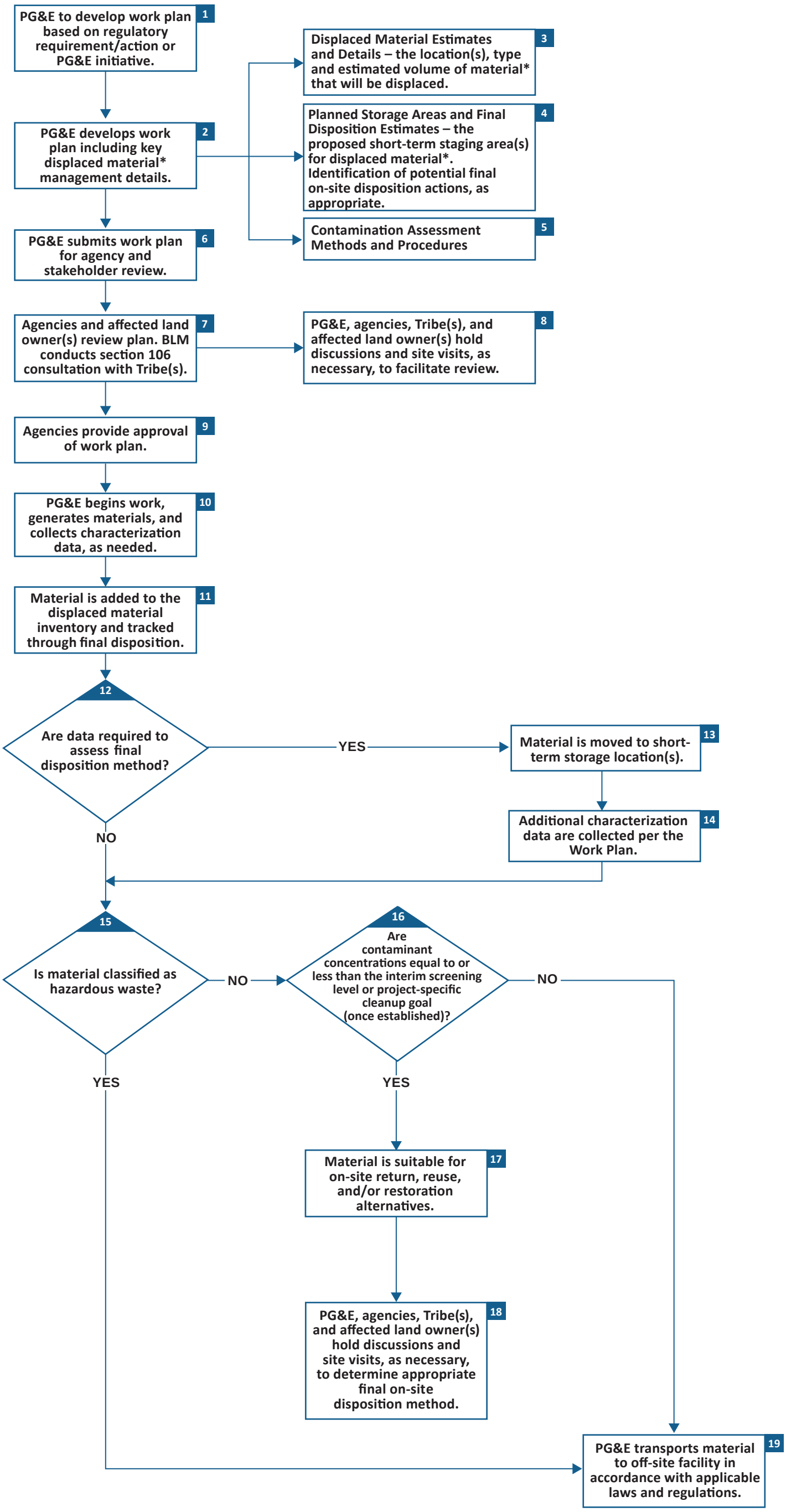
Group	Analyte	TTLC [a, i]	STLC [b] Screen	RCRA TC [c] Screen	STLC [d, i] (from WET)	RCRA TC [e] (from TCLP)	EPA HW [f]
		mg/kg	mg/kg	mg/kg	mg/L	mg/L	
Polychlorinated Biphenyls							
	Total PCBs	50	50	NE	5	NE	NE
Semivolatile Organic Compounds							
	2,4-Dinitrotoluene	NE	NE	2.6	NE	0.13	D030
g	2-Methylphenol (o-Cresol)	NE	NE	4,000	NE	200	D023
g	3-Methylphenol (m-Cresol)	NE	NE	4,000	NE	200	D024
g	4-Methylphenol (p-Cresol)	NE	NE	4,000	NE	200	D025
	Hexachlorobenzene	NE	NE	2.6	NE	0.13	D032
	Hexachloroethane	NE	NE	60	NE	3	D034
	Pentachlorophenol	17	17	2,000	1.7	100	D037
Volatile Organic Compounds							
	1,1-Dichloroethene	NE	NE	14	NE	0.7	D029
	1,2-Dichloroethane	NE	NE	10	NE	0.5	D028
	1,4-Dichlorobenzene	NE	NE	150	NE	7.5	D027
	2,4,5-Trichlorophenol	NE	NE	8,000	NE	400	D041
	2,4,6-Trichlorophenol	NE	NE	40	NE	2	D042
	Benzene	NE	NE	10	NE	0.5	D018
	Carbon tetrachloride	NE	NE	10	NE	0.5	D019
	Chlorobenzene	NE	NE	2,000	NE	100	D021
	Chloroform	NE	NE	120	NE	6	D022
	Hexachlorobutadiene	NE	NE	10	NE	0.5	D033
	Methyl ethyl ketone	NE	NE	4,000	NE	200	D035
	Nitrobenzene	NE	NE	40	NE	2	D036
	Tetrachloroethene	NE	NE	14	NE	0.7	D039
	Trichloroethene	2,040	2,040	10	204	0.5	D040
	Vinyl chloride	NE	NE	4	NE	0.2	D043

Notes:

NE	not established
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
EPA HW	Environmental Protection Agency Hazardous Waste Code
TC	Toxicity Characteristic
TTLC	Total Threshold Limit Concentration
STLC	Soluble Threshold Limit Concentration
RCRA	Resource Conservation and Recovery Act
TCLP	Toxicity Characteristic Leaching Procedure
WET	California Waste Extraction Test

Hazardous waste critiera exist for kepone, 2,4-D, mirex, pyridine, and 2,45-TP (Silvex); however, since they are not contaminants of potential concern at the Topock site, they are excluded from this table.

a	Total Threshold Limit Concentration (TTLC) from 22 CCR 66261.24(a)(2). Calculated based on the concentration of the elements, not the compounds.
b	Screening level is 10x Soluble Threshold Limit Concentraction (STLC). If screening level is exceeded in total analysis, California Waste Extraction Test (WET) should be run to evaluate whether STLC is exceeded.
c	Screening level is 20x RCRA Toxicity Characteristic (TC). If screening level is exceeded in total analysis, Toxicity Characteristic Leaching Procedure (TCLP) should be run to evaluate whether RCRA TC is exceeded.
d	Soluble threshold limit concentration from 22 CCR 66261.24(a)(2), measured using the WET. Calculated based on the concentration of the elements, not the compounds.
e	RCRA TC level from 22 CCR 66261.24(a)(1), measured using the TCLP.
f	A waste is assigned a RCRA waste code for each constituent where the results of the TCLP equal or exceed the RCRA TC level.
g	If o-, m- and p-Cresol concentrations cannot be differentiated, the total cresol (D026) concentration is used. The regulatory level of total cresol is 200 mg/L.
h	This footnote letter skipped intentionally.
i	In the case of asbestos and elemental metals, the specified concentration limits apply only if the substances are in a friable, powdered or finely divided state. Asbestos includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite.
j	TTLC and STLC exclude barite. TTLC excludes barium sulfate.
k	For STLC, if the waste does not exceed the RCRA TC or exhibit another RCRA hazardous characteristic, the STLC is 560 mg/L, not 5 mg/L.
l	For TTLC, excludes molybdenum disulfide.



Notes:

* Throughout this figure the term "material" is defined as soil and rock that may be displaced (i.e., removed from the Earth) as a result of work activities including drilling, excavation, sample collection, testing, construction, grading, or other activities. This does not include materials that were not part of the natural site condition (e.g. building materials, equipment, or imported fill).

Throughout this figure, the term “site” refers to the area within the Area of Potential Effect (APE).

FIGURE 1
General Management Protocol for Handling and Disposition of Displaced Site Material
PG&E Topock Remediation Project
Needles, California

Pacific Gas and Electric Company®

Attachment 1:
Responses to Comments

PG&E TOPOCK COMPRESSOR STATION
COMBINED COMMENTS RECEVIED FROM: DOI, DTSC, FMIT, AND THE TRC
ON THE DRAFT (MAY 14, 2012) "MANAGEMENT PROTOCOL FOR HANDLING AND DISPOSITION OF DISPLACED SITE MATERIAL, TOPOCK REMEDIATION PROJECT, NEEDLES, CALIFORNIA" AND ASSOCIATED PG&E RESPONSES, FOR DISCUSSION

Absolute Comment No.	Agency Comment No.	Comment Location (Page)	Commenter	Reference Text	Comment	PG&E Response and/or Proposed Edits	Comment Status
1	In redline	Page 3, Handling and Short Term Storage First paragraph	DTSC	In some cases, short-term storage for characterization may not be necessary.	List some examples for clarity.	In situations where characterization data is available prior to disturbance, or is made available during disturbance (e.g. field screening or expedited laboratory analysis), short-term storage may not be necessary. Text will be revised to read as follows (changes in bold): "In some cases, short-term storage for characterization may not be necessary. **For example,** displaced material that is pre-characterized **or characterized rapidly as work is conducted** will be managed **directly** for long-term storage or final disposition, as appropriate (see Sections 3.4 and 3.5, respectively).	Resolved.
2	In redline	Page 3, Handling and Short Term Storage First paragraph	DTSC	Displaced material that is pre-characterized **per an agency approved work plan** will be managed for long-term storage or final disposition, as appropriate (see Sections 3.4 and 3.5, respectively)	Strike "per an agency approved work plan". Comment: Data may come from other sources (e.g., opportunistic samples). No need to limit available data.	Text will be deleted. See revised text in response to comment 1.	Resolved.
3	In redline	Page 4, Handling and Short Term Storage Final bullet	DTSC	Final disposition information – Indication of the **on-site** or off-site final disposition action identified through discussion with Tribe(s), agencies, and the affected land owner(s), as appropriate, based on review of material type and the contamination assessment (see Section 3.5).	Comment: Need to define "on-site/site/on site" used throughout the document to clearly understand where soil may end up.	The following statement has been added to the end of the second paragraph in Section 1.0: "Throughout this document, the term "site" refers to the area within the APE."	Resolved.
4	In redline	Page 4, Contamination Assessment First bullet	DTSC	Existing information including knowledge of the history of an area, or laboratory analytical results collected during previous phases of work. Use of existing information may preclude the need for additional analytical testing. When available, this information **should** be included in the work plan.	Replace "should" with "will".	Concur. The change has been incorporated.	Resolved.
5	In redline	Page 5, Contamination Assessment – (bullet) Hazardous Waste Toxicity Characteristic Levels Bullet 2	DTSC	If the total constituent concentration exceeds the numeric value of the RCRA toxicity characteristic (TC) level by **about** 20 times or more, the toxicity characteristic leaching procedure (TCLP) will be performed. If the constituent concentration in the TCLP leachate exceeds the TC level, the soil represented by the sample will be classified as a RCRA hazardous waste. Additional evaluation of the STLC, as described in step 3 below, will not be performed.	Add word "about". Comment: Adding flexibility to conduct leach tests if the dry values are in the neighborhood. Do this due to potential for soil to be heterogeneous.	Concur. The change has been incorporated.	Resolved.

Absolute Comment No.	Agency Comment No.	Comment Location (Page)	Commenter	Reference Text	Comment	PG&E Response and/or Proposed Edits	Comment Status
6	In redline	Page 5, Contamination Assessment – (bullet) Hazardous Waste Toxicity Characteristic Levels Bullet 3	DTSC	If the sample has not been classified as hazardous waste in steps 1 or 2, the total constituent concentration will be compared to the STLC. If the total constituent concentration exceeds the numeric value of the STLC by **about** 10 times or more, the California Waste Extraction Test (WET) will be performed. If the constituent concentration in the WET exceeds the STLC, the soil represented by the sample will be classified as a non-RCRA California hazardous waste.	Add word "about".	Concur. The change has been incorporated.	Resolved.
7	In redline	Page 5, Contamination Assessment Last paragraph, last sentence	DTSC	As changes are determined appropriate, PG&E will submit revisions to the regulatory agencies and Tribe(s) for review **and acceptance. Only agency approved values will be utilized.**	Add text in bold.	Concur. Final text based on discussion with DTSC: As changes are determined appropriate, PG&E will submit revisions to the regulatory agencies and Tribe(s) for review and comment. Only agency approved values will be utilized.	Resolved.
8	1	End of document Table 2	DTSC	None.	The document does not speak to inside the fence line versus outside the fence line. If we use the Interim Screening Levels identified in this document for displaced soils originating from inside the fence line, there is a potential that more soil will be stored unnecessarily as inside the fence line soils would probably exceed background levels.	The management protocol currently addresses all material, regardless of area of origin, in the same way. A screening level specific to material inside the fence line may be established at a later date. As discussed at the end of Section 3.3, this management protocol will be updated as applicable regulations and project-specific decisions are made.	Resolved.
9	2	End of document	DTSC	None.	Will inside the fence line soils versus outside the fence line soils be allowed to move back and forth? How does this tie into the on-site soil management plan (SMP) being developed by PG&E? Discuss components of the SMP in this protocol.	This management protocol will be applied to material displaced as a result of remediation project activities regardless of whether the material originated inside or outside the fence line. Therefore soils may move outside from inside, or potentially vice-versa depending on designated storage areas or reuse options. The SMP will mirror the concepts in this protocol. Because this document is the standard protocol and the SMP will be a standalone document as part of the operations and maintenance manual for the groundwater remedy, the SMP will reference this document and include additional detail, but we do not see a reason to reference the SMP in this protocol. Further, this management protocol will be updated as is determined necessary based on additional details included in the finalized SMP.	**Subsequent DTSC Comment:** The comment should be revised to clarify that the SMP is not limited to groundwater and is intended to ensure potentially contaminated soils are adequately identified and handled at the compressor station (inside the fence line). See absolute comment 154 from the RTC table (June 29, 2012) for the soils work plan. **PG&E Response:** The SMP is part of the final groundwater remedy design document, and therefore, is specific to groundwater. However, details regarding the management of potentially contaminated soils on the compressor station (inside the fence line) will be addressed in the Soil RFI/RI Work Plan (Appendix J – Displaced Soil and Hazardous Waste Management Procedures). Resolved.

PG&E TOPOCK COMPRESSOR STATION
COMBINED COMMENTS RECEVIED FROM: DOI, DTSC, FMIT, AND THE TRC
ON THE DRAFT (MAY 14, 2012) "MANAGEMENT PROTOCOL FOR HANDLING AND DISPOSITION OF DISPLACED SITE MATERIAL, TOPOCK REMEDIATION PROJECT, NEEDLES, CALIFORNIA" AND ASSOCIATED PG&E RESPONSES, FOR DISCUSSION

Absolute Comment No.	Agency Comment No.	Comment Location (Page)	Commenter	Reference Text	Comment	PG&E Response and/or Proposed Edits	Comment Status
10	3	End of document Table 1	DTSC	None.	Interim Screening Level Source: Include soils screening levels for groundwater protection as screening criteria.	The Interim Screening Level represents the most conservative value, and are lower than the soil screening level for groundwater protection, with the exception of hexavalent chromium and molybdenum. The soil screening level for protection to groundwater for hexavalent chromium and molybdenum is below the background concentration for these metals. Final reuse decisions will be based on the more conservative Interim Screening Level or the project-specific clean up goal (or hazardous waste criteria), and therefore inclusion of soil screening levels for groundwater protection would not add a meaningful decision criteria to the protocol.	**Subsequent DTSC Comment:** Table 1 will need to be modified to identify that the soil screening level for molybdenum is below background. **PG&E Response:** Concur. The edit has been made. Resolved.
11	4	End of document Table 1	DTSC	None.	Interim Screening Level: The protocol should address screening criteria for vapor intrusion to indoor air, to ensure that vapor intrusion pathways will not be potentially created (e.g., do not place VOC impacted soil in areas that have, or likely to have enclosed structures such as MW-20 bench).	VOCs have not been detected in soils to date. Therefore there is no need to develop screening levels that are protective of indoor air from vapor intrusion pathways. However, the following statement will be added to second paragraph of Section 4.0: "Further, if material is found to contain concentrations of volatile organic compounds it may not be suitable for return, reuse, and/or restoration near buildings where vapor intrusion would be of concern."	Resolved.
12	5	End of document Table 1 - Notes	DTSC	None.	Include fluoride salts as they are COPC.	The note in Table 2 has been revised as discussed with DTSC.	Resolved.
13	6	End of document Table 2	DTSC	None.	Any listed wastes to be concerned with?	At this time we are not aware of any listed wastes that need to be considered for this management protocol. Additional soil data is pending collection as part of the soil investigation. As discussed at the end of Section 3.3, this management protocol will be updated as applicable regulations and project-specific decisions are made.	Resolved.
14	In redline	Figure 1	DTSC	**Agencies direct** PG&E to develop work plan based on regulatory requirement or action.	Revised text: PG&E to develop work plan based on regulatory requirement/action **or PG&E initiative**.	Concur. The change will be incorporated.	Resolved.
15	In redline	Figure 1	DTSC	PG&E begins work and generates material.	Revised text: PG&E begins work and generates material **and characterization data**.	To clarify, the word "additional" will be deleted from the decision box two levels below the box commented on, and the original box will not be edited.	**Subsequent DTSC Comment:** Edits were not completed as stated in text. Box 10: Add "characterization" in front of "data". Box 12: Delete "additional" as proposed. **PG&E Response:** Concur. The edits have been made. Resolved.
16	In redline	Figure 1	DTSC	Material is suitable for **on-site** return, reuse, and/or restoration alternatives.	Define "on-site".	The following note has been added to the figure: "Throughout this figure, the term "site" refers to the area within the Area of Potential Effect (APE)."	Resolved.

Absolute Comment No.	Agency Comment No.	Comment Location (Page)	Commenter	Reference Text	Comment	PG&E Response and/or Proposed Edits	Comment Status
17	In redline	Page 5, Contamination Assessment Last paragraph, last sentence	DOI	As changes are determined appropriate, PG&E will submit revisions to the regulatory agencies and Tribe(s) for review **and acceptance. Only agency approved values will be utilized.**	It is unclear what is meant by acceptance. (See also comment 7 [DTSC])	See response to comment 7 (DTSC).	Resolved.
18	In redline	Page 6, Long-term Storage First paragraph, second sentence	DOI	Per DOI comment on this protocol (received in February 2012), this material must remain on-site until project-specific cleanup goals are finalized.	For clarification, DOI stated that the material could not be returned to the land until cleanup criteria are finalized in the ROD and may be stored until that time.	To clarify, the text has been revised as follows: "Per DOI comment on this protocol (received in February 2012), this material cannot be returned to the land until cleanup criteria are finalized in the Record of Decision (ROD) and may be stored until that time."	Resolved.
19	1		FMIT	None.	The 5-14-12 draft protocol still does not address the matter of the existing inventory of displaced soils. It only looks forward to activities that will involve soil disturbance as part of future work plans. This comment has been made previously by FMIT, but the issue remains unaddressed. The existing inventory of displaced soils must be addressed in this protocol. It is not anticipated that the handling and disposition of the existing soil inventory would be different from procedures and policies for addressing future displaced soils. A section of this protocol must address disposition of the existing displaced soils inventory.	As stated in the first sentence of the document, the intent is for this management protocol to apply to material that is displaced as a result of past (as practical), present, and future activities associated with the Topock Remediation Project. To speak specifically to the inventory of previously displaced soils at the site, the following text has been added to the end of Section 4.0 (Return, Reuse, and/or Restoration of Displaced Site Material): "Material displaced as part of past remediation project activities was managed in accordance with project-specific work plans. As a result, some material has been retained at the site because contaminant concentrations were below the Interim Screening Level (previously displaced material that has exceeded these levels was disposed off-site in accordance with the work plans). Therefore, previously displaced material is available for the return, reuse, and/or restoration alternatives included in the bullets above, or as additional uses are developed. As of June 2012, the estimated volume of material that has been retained and stockpiled through past remediation project activities is approximately 30 to 35 cubic yards."	
20	2		FMIT	None.	The draft does not address soil disturbances associated with the soils investigation. It appears that only soils displaced as a result of the groundwater remedy activities are explicitly covered. Again, this point has been raised by FMIT but remains largely unaddressed. FMIT realizes the necessity and importance of PG&E's addressing the respective mitigation measure (CUL-1a-8[g]) but that measure does not exclude applying these procedures to all displaced soils. The issue of soil handling was initially raised by FMIT years ago, and was not intended to be limited to the fulfillment of a mitigation measure for, or the implementation of, the groundwater remedy. PG&E has apparently reframed the issue to limit the scope of the protocol, however, the FMIT is concerned with the disturbance and displacement of soils, regardless of the	Based on clarification received from FMIT during the June 15, 2012 call, the tribes want this protocol to be inclusive of all activities at the Topock Compressor Station. This topic has been tabled for future discussion with PG&E, and the protocol will not be modified at this time. DTSC comment from September 18, 2012 letter to FMIT in response to September 7, 2012 letter from FMIT: As indicated in the first paragraph of the Protocol, "*This document presents the general approach and management protocol required for the handling and disposition of soil and/or rock (referred to as "material" throughout the document) that is displaced as a result of past (as practical), present, and future activities*	The Tribe believes that this item has not yet been adequately addressed. The Tribe's position on this item is documented in the letter attached to the RTCs table. The agency response letter is also attached.

Absolute Comment No.	Agency Comment No.	Comment Location (Page)	Commenter	Reference Text	Comment	PG&E Response and/or Proposed Edits	Comment Status
					associated activity or remedial action at the Site, and expects the PG&E and the Agencies to examine and find solutions for the whole of the issue.	*associated with the Pacific Gas and Electric Company (PG&E) Topock Remediation Project, Needles, California. Specifically, this includes material removed from the Earth (i.e., displaced) as a result of drilling, excavation, sampling, testing, construction, grading, and other remedial activities*". As cited, DTSC does not interpret the Protocol to be limited only to soil displaced as a result of groundwater remedy implementation. On the contrary, the scope appears to be sufficiently broad to cover all aspects of the environmental project conducted under the oversight of DTSC and the US Department of the Interior. DTSC is aware, however, that this protocol, once developed, could be submitted by PG&E to comply with a portion of Mitigation Measure CUL-1a-8 of the certified Final Environmental Impact Report where PG&E is to develop a protocol for handling soil cuttings to be included in the Cultural Impact Mitigation Program as part of the final design of the approved groundwater remedy. Currently, DTSC is in the process of conducting a California Environmental Quality Act (CEQA) evaluation for the soil investigation work plan. Based on the results of the soil CEQA evaluation, the same mitigation measure may be found to be appropriate for the soil investigation activities. Note that displaced soils from soil investigation activities will not be generated until after the soil CEQA evaluation is completed and the soil investigation work plan is approved.	
21	3		FMIT	None.	There is no commitment to minimize disturbances that are not associated with the listed activities as a result of incidental or associated activities (e.g., vehicles, etc.). PG&E is directing this primarily at CUL-1a-8[g], however, FMIT again requests that these procedures be a broader statement of policy committing to minimization or disturbance for all Site activities. Other soil disturbing activities that PG&E might perform should also 'voluntarily' follow this protocol.	See response to comment 20 (FMIT). Per Aug-6, 2012 discussion, additional detail was added to the bullets in Section 3.1 regarding areas of disturbance and displacement.	
22	4		FMIT	None.	The application of soil criteria for the determination of reuse needs some additional flexibility. Since there will likely be (or should be) several discrete soil samples with chemical concentrations for a given amount of soil, it is the average of these values for that soil accumulation that should be used. This is justified because exposure occurs over an area and the soil will be further mixed when it is placed back on the site.	The specific process for characterization of displaced site material is an example of a detail that would be included in the project-specific work plan. DTSC comment from September 18, 2012 letter to FMIT in response to September 7, 2012 letter from FMIT: In addition to potential concentration-by-concentration comparison between the disturbed soil and screening criteria, DTSC does not object to considering other alternative methods as long as the methods will yield data that are representative of the material in question, are in accordance with waste classification regulations, and standard practice for classifying materials such as	As of the September 7, 2012 letter, the Tribe believes that this item has not yet been adequately addressed. The Tribe's position on this item is documented in the letter attached to the RTCs table. The agency response letter is also attached. The document has been revised per the direction in the September 18, 2012 letter in response to the September 7, 2012 letter (as detailed in the column to the left).

Absolute Comment No.	Agency Comment No.	Comment Location (Page)	Commenter	Reference Text	Comment	PG&E Response and/or Proposed Edits	Comment Status
						investigation derived soil cuttings for the purposes of determining proper disposal. DTSC concurs with the approach that additional details regarding this issue can be addressed in the individual work plans. PG&E Comment – The sixth paragraph on page 5 has been revised to read as follows (text additions are in **bold**): "These values will be used to determine the final disposition of displaced material **by comparing the representative concentration of a given volume of material to the screening values. The methodology for determining the representative concentration will be established in the project-specific work plan and should not be limited to a concentration-by-concentration comparison, but could include statistical estimates or averages based on multiple samples**. Material that **has a representative concentration that** is equal to or below the interim screening level is suitable for return, reuse, or replacement on-site. Material that is characterized as hazardous waste must be disposed of off-site in accordance with applicable laws and regulations. Material that **has a representative concentration that** is greater than the interim screening level, but not classified as a hazardous waste, will be stored on-site until the project-specific cleanup goals are established. Until these goals are established, material that falls into this intermediate category will be retained on-site for "long-term storage" (see Section 3.4)."	
23	5	Table 1	FMIT		Why is the "Project-specific Cleanup Goal" differentiated from the "Tribal Screening Level"? The Tribal land use scenario is the most appropriate future land use and the calculation of risk-based concentrations is a "Project-specific Cleanup Goal" and not a screening level.	Based on discussion during the June 15, 2012 call, it is premature to have the project-specific cleanup goals and the tribal screening levels included on Table 1 since they have yet to be determined. Therefore, these columns will be deleted from Table 1. As discussed at the end of Section 3.3, this management protocol will be updated as applicable regulations and project-specific decisions are made.	
24	6		FMIT		The overall logic that would set screening criteria according to the location of origin of the soil is flawed. Soil disturbances often involve commingling of soils to various depths, while the potential exposure scenarios usually relate to materials at or near the surface. The depth of soil placement/reuse should be considered in the decision for reuse.	Separation of displaced soil to this level of detail (shallow vs. deeper) greatly increases the level of complexity related to soil testing and management scenarios and could result in a larger storage footprint, but could be accomplished. However, current return, reuse, and/or restoration scenarios are not depth-specific, and deeper reuse scenarios may be limited. Variables like future erosion or change in regulations also complicate two-tier reuse scenarios. The document will be revised as additional screening levels are developed.	The Tribe believes that this item has not yet been adequately addressed. The Tribe's position on this item is documented in the letter attached to the RTCs table. The agency response letter is also attached.

Absolute Comment No.	Agency Comment No.	Comment Location (Page)	Commenter	Reference Text	Comment	PG&E Response and/or Proposed Edits	Comment Status
						DTSC comment from September 18, 2012 letter to FMIT in response to September 7, 2012 letter from FMIT: DTSC supports PG&E’s response in the RTC summary table that separation of displaced soil to this level of detail (shallow vs. deep) greatly increases the level of complexity related to soil testing and management scenarios and could result in a larger storage footprint. The current return, reuse, and/or restoration scenarios are not depth-specific, and deeper reuse scenarios may be limited. Variables like future erosion or change in regulations also complicate two-tier reuse scenarios. More importantly, the decision to reuse soil that is above screening criteria regardless of depth ultimately rests on the respective land owners who own the land where the displaced soil will be reused. If potentially contaminated soils will be reused, the land owner must agree to a land use covenant restricting the use of their land after backfilling. DTSC believes that this issue cannot be managed at a global level since the decision is dependent on location, depth, concentration of material and landowner acceptance, DTSC believes that this issue can be deferred and handled on a case-by-case basis, potentially during the individual work plan, to first determine if there are potential locations that will require deep backfill, and more importantly, the individual land-owners preference on this issue. **PG&E comment – Additional detail regarding potential material reuse scenarios that are specific to a given work plan will be included in the individual work plans, as necessary.**	
25	7	Figure 1	FMIT		We suggest adding a number to each block in the diagram for clarity. In the “second to the last block” it says “Material must be managed offsite.” If contaminant concentrations are less than or equal to (<) project-specific cleanup goal, why couldn’t they be treated onsite if appropriate and feasible?	Numbers will be added to flow chart boxes. The text in the “second to last block” will be modified to read as follows: “Material will be managed off site, or treated on site if appropriate based on the selection of the final soil remedy.” Additional text has also been added to Section 3.5.	
26	1	Page 4, Contamination Assessment	Hualapai / TRC		Key information that will be used in assessing whether the displaced material is contaminated is discussed in Section 3.3 Contamination Assessment. Within this section it is stated that contamination determinations of displaced materials can be based on “existing information including knowledge of the history of an area” and “observation of the physical properties of the material”. It is unclear however, how physical observation or historical knowledge of an area can be used in comparisons against the quantitative interim screening values provided in	Examples of key physical properties have been added to the second bullet in Section 3.3, and now reads as follows: “Results of characterization samples collected for laboratory analysis, and observation of the physical properties of the material (e.g., white powder, burned material, boulders, etc.), as defined in the approved work plan for a given activity.” Regarding “existing information/history of an area”, see response to comment 27 (Hualapai/TRC).	

Absolute Comment No.	Agency Comment No.	Comment Location (Page)	Commenter	Reference Text	Comment	PG&E Response and/or Proposed Edits	Comment Status
					Tables 1 and 2.		
27	2	Page 4, Contamination Assessment Third bullet.	Hualapai / TRC	The specific analytes and interim screening levels applicable for characterization of displaced material will be determined based on the origin of the material and potential disposition locations.	Section 3.3 Contamination Assessment states that "the specific analytes and interim screening levels applicable for characterization of displaced material will be determined based on the origin of the material and potential disposition locations." This statement appears to suggest that the interim soil screening levels that are provided in Tables 1 and 2 are not to be consistently applied to all displaced soils but rather the origin and fate of the displaced soil will dictate which analyte will be evaluated and what interim threshold value is used. This is unclear and could use additional clarification.	The screening levels included on Tables 1 and 2 will be applied uniformly to all analytes included on the table. To clarify, the text "**and screening levels**" will be deleted from the statement. Regarding specific analytes, the protocol provides flexibility such that a subset of analytes included on Table 1 may be used to characterize displaced material, as determined appropriate. For example, material that is generated from an area not suspected of dioxin/furan contamination may not need to be characterized for dioxin/furan concentrations prior determining the appropriate disposition alternative.	
28	3		Hualapai / TRC		Interim screening values should not be based on background values. The use of background is unnecessarily over-conservative, the background data are based on a small yet variable group of samples, and use of the background threshold value will inevitably result in long term stockpiling of soils with no associated risk. Until a Tribal Screening level is developed it can still be safely assumed that the use of a CHHSL interim screening value will be equal to or greater than the Tribal Screening level and should be used in place of the background screening level.	The use of background is purposefully conservative until project-specific cleanup goals are established. While it is correct that this may result in long term storage of soils that are later determined to have no associated risk, agency input and concurrence is required if less conservative values are to be used.	
29	4		Hualapai / TRC		The use of ecological screening values (ECVs) should only occur in situations were displaced soils would be returned to surface locations. Most of the developed ECVs were developed based on exposures to terrestrial receptors which would not come into contact with subsurface soils. Clearly no significant pathway of exposure for ecological receptors exists for soils removed and replaced into deep boreholes. Therefore if ECVs are to be used it is suggested that there use be limited to the screening of only surface related soils.	See response to comment 24 (FMIT) and 28 (Hualapai/TRC).	

Absolute Comment No.	Agency Comment No.	Comment Location (Page)	Commenter	Reference Text	Comment	PG&E Response and/or Proposed Edits	Comment Status
30	5		Hualapai / TRC		It was clearly stated in the Technical Memorandum 3: Ecological Comparison Values for Metals and Polycyclic Aromatic Hydrocarbons in Soil that "the ECVs, while based on information developed during the ecological risk assessment (ERA) scoping, are to be applied only to soil investigation planning in conjunction with background values. Specifically, the ECVs are not intended for use as either cleanup goals or as screening levels to eliminate COPECs." Furthermore within the Revised Addendum to the Revised Human Health and Ecological Risk Assessment Work Plan (August 2008) PG&E states that "ECVs were developed to support the soil investigation data gaps assessment". Therefore it appears that the use of ECVs as interim screening levels for the determination of soil cleanup is outside of the scope of which these values were developed.	ECVs are only included on Table 1 for select analytes as the Interim Screening Level (see notes). However, the Interim Screening Level is not used for the determination of soil clean-up. The Interim Screening Level is used as the most conservative screening level to determine if the material is suitable for on-site return, reuse, and/or restoration alternatives. As presented on Figure 1, if the material contains contaminant concentrations greater than the Interim Screening Level (and below hazardous waste criteria), then it must stored until project-specific clean-up goals are established.	
31	6		Hualapai / TRC		There may be a need for rapid field analyses in order to, for example, place cuttings materials back down a bore hole or to work in very sensitive areas. Selected elements and possible field methods need to be discussed as part of the process to define screening levels.	It is conceivable that rapid field screening or laboratory analytical data may be necessary to make expeditious decisions related to the characterization of displaced material. However, these operational details are deferred to the project-specific work plan, where all details related to the implementation of the scope of work can be fully considered. The reference list of potentially applicable analytes and associated screening levels (Table 1) is being developed based on past operation information available for the Site, and therefore, is inclusive of all analytes of potential concern. However, this list is not dependant on the types of analytical methods (field or fixed-base laboratory) used for characterization of displaced site material.	
32	7		Hualapai / TRC		Other details were not presented in the report. For example, composite samples may be collected and analyzed in order to categorize a batch of soils. A displaced material tracking data base may be necessary in order to catalog the site locations, depths, methods of displacement, etc.	Many operational details, such as the method(s) for characterizing soils that are displaced as a result of Topock Remediation Project activities, are deferred to the project-specific work plan. See also the response to comment 22 (FMIT). Please refer to Section 3.2 (Handling and Short-term Storage) regarding plans to build an inventory of all material displaced by Topock Remediation Project activities.	

HARGIS + ASSOCIATES, INC.
HYDROGEOLOGY • ENGINEERING

1820 East River Road, Suite 220
Tucson, AZ 85718
Phone: 520.881.7300
Fax: 520.529.2141

September 7, 2012

VIA ELECTRONIC MAIL

Mr. Jose Marcos, Geologist
DEPARTMENT OF TOXIC SUBSTANCES CONTROL
5796 Corporate Avenue
Cypress, CA 90630

Re: FMIT Comments on Revised Protocol on Displaced Materials, August 28, 2012

Dear Mr. Marcos:

Hargis + Associates, Inc. (H+A) on behalf of our client, the Fort Mojave Indian Tribe ("the Tribe" or "FMIT"), is hereby providing comments on the above-referenced revision to the Displaced Materials Protocol ("the Protocol"), in response to your email of September 4, 2012.

The Tribe is concerned over the suggestion that this Protocol is nearing finalization, yet there does not appear to be full resolution of Tribal comments. The Tribe agrees that this document has been prepared in a collaborative manner with frequent opportunity to exchange ideas and for the parties to provide input. Nevertheless, our review of the "Response to Comments," (RTC) prepared by the Pacific Gas & Electric Company (PG&E), characterizes the status of various tribal comments as "resolved." However, some of the issues that have been consistently raised by the Tribe during the process in fact remain unresolved. As you know from the correspondence of July 23, 2012, referenced below, the Tribe has concerns with the comment resolution process for the project in general.

The Tribe commented previously on the RTC process for the draft *Soil RCRA Facility Investigation/Remedial Investigation Work Plan (Work Plan), PG&E Topock Compressor Station, Needles, California.* Specifically, the last column of the RTC table identifies the resolution status of individual "Absolute Comments," much like the last column in PG&E's RTC for the displaced soils protocol. The Tribe took issue with the fact that the Agencies, the California Department of Toxic Substances Control (DTSC) and U.S. Department of the Interior (DOI), characterized the resolution status as "resolved," when in fact the Tribe had certain residual issues.

While the Tribe understands that the ultimate decisions for project matters remain the Agencies' responsibility, it is important that dissenting views of Tribes and stakeholders be documented in the record whenever the "resolution" overrides the concerns expressed throughout the process. On August 31, 2012, the Tribe received a letter from DOI and DTSC in response to the Tribe's letter of July 23, 2012, expressing concerns over the RTC process. The Agencies' letter recognized that several of the Tribe's issues in fact remain unresolved and indicated that DOI would request that PG&E remove the "resolved" notation from all Tribal comments. DOI further

indicated its willingness to consult with the Tribe on the matter and procedure for issue resolution.

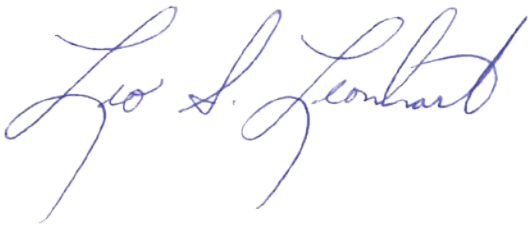
The RTC for the displaced soils protocol is unacceptable to the Tribe for the same reasons: the document seems to state that PG&E, not the Agencies, had made determinations in regard to issue resolution. This function properly belongs to the Agencies and must not be directly or indirectly delegated to a third party. Also, the document does not accurately reflect unresolved issues raised by the Tribe or document why they cannot be accommodated, if that is the case, a key part of meaningful collaboration and consultation. Perhaps finalization of the Protocol can await the Agencies' consideration of this letter and the conclusion any further discussions on this subject with the Tribes.

Accordingly, below, the Tribe hereby is identifying three items where the Tribal issues remain unresolved, and requests that either these issues be resolved jointly with the Tribe(s) or the reasons why these issues cannot be accommodated at this time be identified and documented within the RTC summary. The comments are attached.

Please contact me if you have questions concerning this letter.

Sincerely,

HARGIS + ASSOCIATES, INC.



Leo S. Leonhart, PhD, PG, CHG
Principal Hydrogeologist

Comments attached below

cc: K. Baker, DTSC
J. Bathke, Quechan
D. Bonamici, CRIT
M. Cavaliere, CH2M Hill
C. Coyle
M. Eggers, TRC
R. Escobar, Chemehuevi
W. Fisher-Holt, CRIT

D. Hubbs, Hualapai
P. Innis, DOI
L. Jackson-Kelly, Hualapai
J. McCormick, Cocopah
S. McDonald
N. McDowell-Antone, FMIT
Y. Meeks, PG&E
K. Morton, Cocopah
L. Otero, FMIT
R. Prucha, TRC
E. Rosenblum, TRC
C. Schlinger, TRC
M. Sullivan, CSUN
T. Williams, FMIT
W. Wright, TRC
A. Yue, DTSC

839.07 Displaced Materials

Fort Mojave Indian Tribe Comments on the Draft Soils Reuse Protocol that Remain Unresolved

Comments on the RTC

1. Comment 20 by FMIT.

   There are two separate issues that have been inappropriately combined. The first issue is the Tribe's position that this Protocol should apply to all aspects (*e.g.,* groundwater and soil) of the Topock Remediation Project. The second issue was the request by the Tribe that the Protocol be applied to all soil-related projects. This second issue was potentially addressed by moving it to discussions between PG&E and the Tribes directly. However, this resolution does not address the first issue. Therefore, the Tribe again requests that this Protocol be applied to all aspects of the Topock Remediation Project.

2. Comment 24 by FMIT and 29 by Hualapai/TRC.

   The comment and the comment's final sentence are two separate, but related issues regarding the application of the soil criteria to decide on the disposition of disturbed soils. One issue is that it should be the final location of disturbed soil replacement that determines the applicable criteria, not the source location of the disturbed soil. And second, when the final location of disturbed soil replacement is selected, if the location has deep (*i.e.,* below 2 feet bgs) backfill areas, and if future erosion is unlikely, then this deeper backfill soil may have less stringent acceptance criteria. While it is understood that the Protocol has criteria that are not depth-related, this issue of backfill depth can be used to decrease the amount of soil that must be removed from the site, thereby lessening the impact of the cleanup on the Site.

Comments on the August 30, 2012, Draft Protocol

1. Page 5, paragraph 6.

   FMIT has commented previously that when the Protocol describes a simple comparison between the material *(i.e.,* the disturbed soil) and the criteria, without further discussion, it gives the impression that concentration-by-concentration comparisons will be used. As discussed in the last teleconference, there may be other estimates of 'material concentration' that could be used (*e.g.,* average). While the RTC specifies that the procedure for this comparison will be addressed in specific work plans, the Tribe requests that this paragraph be edited to include the statement "material concentrations will be established for each soil pile in short-term storage. This concentration may include a statistical estimate for that soil pile." (Note: 'pile' may not be the correct word in this context and a substitute can be discussed.)

Department of Toxic Substances Control

Deborah O. Raphael, Director
5796 Corporate Avenue
Cypress, California 90630

Matthew Rodriquez
Secretary for
Environmental Protection

Edmund G. Brown Jr.
Governor

Sent Via Electronic Mail

September 18, 2012

Leo S. Leonhart, PhD, PG, CHG
Principal Hydrogeologist
Hargis + Associates, Inc.
1820 East River Road, Suite 220
Tucson, AZ 85718

RESPONSE TO SEPTEMBER 7, 2012 LETTER ON FMIT COMMENTS REGARDING REVISED PROTOCOL ON DISPLACED MATERIALS, PACIFIC GAS AND ELECTRIC COMPANY (PG&E), TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

Dear Dr. Leonhart:

The Department of Toxic Substances Control (DTSC) is in receipt of your letter dated September 7, 2012, which was sent on behalf of the Fort Mojave Indian Tribe (FMIT) pertaining to the FMIT concerns over the *"Management Protocol for Handling and Disposition of Displaced Site Material, Topock Remediation Project"* (Protocol). DTSC appreciates the FMIT's input as provided in your letter, and believes that they will help greatly in quickly resolving any potentially unresolved issues related to the Protocol.

As you know, it has been nearly one year since your initial draft of what has evolved into the current version of the Protocol. Its development has been a collaborative effort between the various agencies, Tribes, stakeholders and PG&E as part of the displaced soil committee. The parties involved have met multiple times to discuss the details of the document and its implementation strategy. DTSC believes that these meetings throughout the past year demonstrate the commitment of all parties to completing this task and to provide meaningful input into its development.

After reviewing the August 28, 2012 version of the Protocol, DTSC believes that the document has captured the issues and the resolutions suggested during the yearlong dialogues of the committee. However, in your letter, you expressed, on behalf of the FMIT, concern over DTSC's suggestion that the Protocol is nearing completion, and your letter indicates that the response to comments (RTC) summary table does not accurately reflect unresolved issues raised by the Tribes. You specified three

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comments that the FMIT believes remain unresolved and you requested that these issues be resolved jointly with the Tribes or document the reasons why they cannot be accommodated at this time in the RTC summary table.

DTSC notes, however, that the 'resolved' status for comments listed on the RTC table were determined by the committee members during the various meetings after each comment was discussed. Never the less, DTSC will request PG&E to revise the RTC summary table for those three comments to reflect the FMIT's position. DTSC is providing the following discussion to clarify our understanding of the issues raised by the three specific comments. DTSC hopes that the responses adequately address the FMIT's comments so that the Protocol can continue to move forward.

1. Absolute Comment No. 20 by FMIT – According to the FMIT comment, the Protocol does not address soil disturbances associated with the soils investigation, and it appears that only soils displaced as a result of the groundwater remedy activities are explicitly covered. The FMIT requests that the protocol to be applied to all aspects (e.g., groundwater and soil) of the Topock Remediation Project.

As indicated in the first paragraph of the Protocol, *"This document presents the general approach and management protocol required for the handling and disposition of soil and/or rock (referred to as "material" throughout the document) that is displaced as a result of past (as practical), present, and future activities associated with the Pacific Gas and Electric Company (PG&E) Topock Remediation Project, Needles, California. Specifically, this includes material removed from the Earth (i.e., displaced) as a result of drilling, excavation, sampling, testing, construction, grading, and other remedial activities".* As cited, DTSC does not interpret the Protocol to be limited only to soil displaced as a result of groundwater remedy implementation. On the contrary, the scope appears to be sufficiently broad to cover all aspects of the environmental project conducted under the oversight of DTSC and the US Department of the Interior. DTSC is aware, however, that this protocol, once developed, could be submitted by PG&E to comply with a portion of Mitigation Measure CUL-1a-8 of the certified Final Environmental Impact Report where PG&E is to develop a protocol for handling soil cuttings to be included in the Cultural Impact Mitigation Program as part of the final design of the approved groundwater remedy.

Currently, DTSC is in the process of conducting a California Environmental Quality Act (CEQA) evaluation for the soil investigation work plan. Based on the results of the soil CEQA evaluation, the same mitigation measure may be found to be appropriate for the soil investigation activities. Note that displaced soils from soil investigation activities will not be generated until after the soil CEQA evaluation is completed and the soil investigation work plan is approved. DTSC will instruct PG&E to add a statement in the RTC summary table reflecting DTSC's position.

2. Absolute Comments No. 24 by FMIT and 29 by Hualapai/TRC – The Tribes request that the depth of the soil placement/reuse should be considered in the decision for reuse.

DTSC supports PG&E's response in the RTC summary table that separation of displaced soil to this level of detail (shallow vs. deep) greatly increases the level of complexity related to soil testing and management scenarios and could result in a larger storage footprint. The current return, reuse, and/or restoration scenarios are not depth-specific, and deeper reuse scenarios may be limited. Variables like future erosion or change in regulations also complicate two-tier reuse scenarios.

More importantly, the decision to reuse soil that is above screening criteria regardless of depth ultimately rests on the respective land owners who own the land where the displaced soil will be reused. If potentially contaminated soils will be reused, the land owner must agree to a land use covenant restricting the use of their land after backfilling. DTSC believes that this issue cannot be managed at a global level since the decision is dependent on location, depth, concentration of material and landowner acceptance, DTSC believes that this issue can be deferred and handled on a case-by-case basis, potentially during the individual work plan, to first determine if there are potential locations that will require deep backfill, and more importantly, the individual land-owners preference on this issue. DTSC will instruct PG&E to revise the RTC summary table to remove the 'resolved' status for this comment, incorporate DTSC's position, and indicate that additional detail can be included in the individual work plans.

3. FMIT Comment on page 5, paragraph 6 of the August 2012 draft protocol – The FMIT requests the inclusion of the statement, *"material concentrations will be established for each soil pile in short-term storage. This concentration may include a statistical estimate of the soil pile"*. In addition to potential concentration-by-concentration comparison between the disturbed soil and screening criteria, DTSC does not object to considering other alternative methods as long as the methods will yield data that are representative of the material in question, are in accordance with waste classification regulations, and standard practice for classifying materials such as investigation derived soil cuttings for the purposes of determining proper disposal. DTSC concurs with the approach that additional details regarding this issue can be addressed in the individual work plans. DTSC will instruct PG&E to update the Protocol and RTC summary table to incorporate the FMIT's proposed concept as a potential alternative.

Finally, your letter indicated that the FMIT has concerns with the comment resolution process for the project in general. The FMIT expressed similar concerns in a letter dated July 23, 2012. DTSC and the U.S. Department of the Interior provided a response to the FMIT letter on August 31, 2012. If you feel that this letter and the August 31, 2012 letter do not adequately address your general concerns regarding the comment resolution process for the project, we would like to meet with you to discuss any remaining concerns you may have.

DTSC hopes that this letter provided additional clarification and adequately addressed the FMIT's issues related to the Protocol. As always, DTSC appreciates the Tribes and stakeholders continuing involvement on the PG&E Topock project and we look forward to working with you in moving the overall project forward. If you have any questions, please feel free to contact me at (714) 484-5492.

Sincerely,

Jose Marcos, PG
Engineering Geologist
Department of Toxic Substances Control

cc: Ms. Karen Baker, DTSC
Mr. John Bathke, Quechan
Mr. Douglas Bonamici, CRIT
Mr. Mike Cavaliere, CH2MHill for PG&E
Ms. Courtney Ann Coyle, for FMIT
Ms. Margaret Eggers, TRC
Mr. Ron Escobar, Chemehuevi
Ms. Wilene Fisher-Holt, CRIT
Mr. Christopher Guerre, DTSC
Ms. Dawn Hubbs, Hualapai
Ms. Pamela Innis, DOI
Ms. Loretta Jackson-Kelly, Hualapai
Ms. Jill McCormick, Cocopah
Mr. Steven McDonald, for FMIT
Ms. Nora McDowell-Antone, FMIT
Ms. Yvonne Meeks, PG&E
Ms. Kendra Morton, Cocopah
Ms. Linda Otero, FMIT
Mr. Robert Prucha, TRC
Mr. Eric Rosenblum, TRC
Mr. Charlie Schlinger, TRC
Mr. Michael Sullivan, for FMIT
Mr. Timothy Williams, FMIT
Mr. Win Wright, TRC
Mr. Aaron Yue, DTSC

Response to DOI Comment #803 on the 90% Design
Topock Groundwater Remediation Project
PG&E Topock Compressor Station, Needles, California

Comment No.	Unique Comment ID (if applicable)*	Comment Type (Design/ Non-Design)	Comment Category	Section/ Page	Reference Text	90% Design Comment *(Please provide sufficient detail, include specifically what you are looking for)*	PG&E Response	DTSC Response	DOI Response	Tribes Response	Final Resolution
803	DOI-333	Design	Infrastructures	2.1.3/2-6	The soil storage area, also comprising approximately 1.55 acres, will serve as the primary storage area for excavated soils…	Based on discussions with San Bernardino County, the adjacent lessee of Park Moabi Regional Park, and internal discussions between the Bureau of Land Management and the Department of the Interior, PG&E must find an alternate location for storage of waste soil above screening levels.	Based on further clarifications from DOI and BLM, PG&E understands that storage of waste soil above screening levels will not be allowed on federal lands. The remaining potential storage locations are private properties owned by FMIT and PG&E. Given the remedy facilities already planned to be located on the TCS and the Station's own operational needs for the property for its natural gas compressor operations, there is only space on PG&E property to temporarily store soil bins while awaiting analysis prior to final disposition. There is not adequate space on PG&E property to store waste soil on a long term basis. PG&E also contacted local TSDFs and was told that the TSDFs would accept the waste soil for disposal, not for storage. Given the above, at this time, PG&E has not been able to identify an alternate location for storing the waste soil. PG&E defers to the FMIT regarding its views on potential use of the Tribe's property within the project area for this purpose. In the meantime, in response to this comment, PG&E will eliminate the proposed soil storage area at Moabi Regional Park and move the proposed CHQ into that area. Note that displaced soils that are below screening levels may still be stored at the currently proposed soil processing area and the CHQ (subject to space availability). The management protocol for handling and disposition of displaced site materials (Appendix C to the CIMP, Appendix B to the Soil Management Plan) was revised to reflect that the materials above screening levels will be disposed of offsite. The revised protocol was provided in this 90% RTC period and included in **Attachment Q** of the final RTC table.		Resolved.		This RTC was discussed at the July 23, August 19, and August 26 TWG meetings. Comment resolved.

Source: Final Basis of Design Report (Appendix I – Response to Comments on the 90% Design Documents [Basis of Design Report, O&M Manual, Construction/Remedial Action Work Plan]).

Appendix C
Construction and Operations Best Management Practices (BMPs) Plan for Soil Storage

Construction and Operations Best Management Practices (BMPs) Plan for Soil Storage

This Best Management Practices (BMPs) Plan for soil storage during construction and operations of the final groundwater remedy at the Pacific Gas and Electric Company (PG&E) Topock Compressor Station has been prepared as required by the following Environmental Impact Report (EIR)[1] mitigation measures and Applicable or Relevant and Appropriate Requirements (ARARs):

- Mitigation measure AIR-1 requires the implementation of fugitive dust control measures during construction activities.
- Mitigation measure HYDRO-1 requires the implementation of BMPs to meet the substantive criteria of applicable federal, state, and local permit and regulatory requirements for stormwater discharges associated with construction and land disturbance activities.
- ARAR #34 requires the implementation of BMPs for stormwater runoff which comes in contact with construction activities (>1 acre of ground disturbance).

This BMPs Plan has been prepared to meet the above requirements, and in accordance with the substantive criteria of the NPDES General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities Order No. 2009-0009-DWQ, Amended Order No. 2010-014-DWQ, Amended Order No. 2012-0006-DWQ, NPDES No. CAS000002 (California General Permit)[2] for construction activities in San Bernardino County, California, as well as the substantive criteria of the Arizona Pollutant Discharge Elimination System (AZPDES) General Permit AZG2013-001 for Stormwater Discharges associated with Construction Activity to Waters of the United States (General Permit) for construction activities in Mojave County, Arizona.

This BMPs Plan has been prepared by a California Qualified SWPPP Developer (QSD) and will be implemented under the direction of a Qualified SWPPP Practitioner (QSP). A summary of key BMPs identified for soil storage of the project is presented below in Section 1.0; inspection, monitoring, corrective actions, reporting, and recordkeeping information for the BMPs Plan is presented in Section 2.0; and workers training and education in Section 3.0.

The PG&E Topock Site Operations Manager and the Field Team Leader will have control over day-to-day activities, and will implement this BMP Plan under the direction of the QSP (see Section 2.2 for additional details on the BMPs Project Team).

1.0 Project BMPs

This section provides a summary of the Project BMPs. The specific EIR mitigation measures other than HYDRO-1 or project SOPs are referenced for each BMP category where appropriate. Figure C-1 at the end of this appendix shows the site topography and inferred surface water flow for the soil storage area located at Moabi Regional Park. It should be noted that during construction, temporary storage (or staging) of displaced soils will also occur in staging areas near the primary work zones (i.e., construction zones).

1.1 Erosion Control BMPs

Scheduling – In order to reduce the amount and duration of soil exposed by construction activities, a schedule will be established to coordinate construction activities and construction site BMPs while taking local climate into

[1] California Department of Toxic Substances Control (DTSC). 2011. *Final Environmental Impact Report for the Topock Compressor Station Groundwater Remediation Project*. January.

[2] State Water Resources Control Board (SWRCB). 2009. Construction General Permit Fact Sheet. Adopted Order No. 2009-0009-DWQ. Sacramento, CA.

consideration. Construction site BMPs will be installed prior to start of construction and inspected prior to and after anticipated rain or erosion events. Sufficient lag time will be built into the schedule to allow for rain delays.

Preservation of Existing Vegetation – Existing vegetation will be preserved whenever feasible. Preservation of existing vegetation will be incorporated into the schedule prior to the commencement of clearing and grubbing or other soil disturbing activities. In the event that existing vegetation needs to be disturbed, areas that need to be preserved will be identified by a qualified biologist and marked with temporary fencing. All employees and subcontractors will be informed on the limits of disturbance within the construction site and will be instructed to keep clear of delineated areas.

Geotextiles and Mats – A natural (excelsior, straw, coconut, etc.) or synthetic (usually polyethylene) material will be used to reduce soil erosion by wind or water. Stockpiles will be covered and secured.

1.2 Sediment Control BMPs

Silt Fence – Silt fences will be placed below areas where sheet flows discharge from the site. They will also be used as interior controls below disturbed areas where runoff may occur in the form of sheet and rill erosion and around inlets within disturbed areas. Silt fences are most effective when used in combination with erosion controls around temporary spoil areas and stockpiles, and below other small cleared areas.

Fiber Rolls/Sediment Wattles – These consist of aspen wood excelsior, straw, flax, or other similar materials that are rolled and bound into tight tubular rolls and placed on the face of slopes at regular intervals depending on steepness of slopes to intercept runoff and reduce flow velocity. Rolls/wattles will be installed prior to start of construction activities to form a barrier around work areas and stockpiles and will be anchored down with stakes. If the stockpiles are on paved areas, gravel or sand bags are preferred; however, fiber rolls can be used and secured with gravel or sand bags. The fiber rolls/sediment wattles will be inspected prior to forecasted rain events and after rain events to ensure the fiber rolls are working properly. Sediment accumulated by the fiber rolls will be removed periodically to maintain the effectiveness of the fiber rolls.

Gravel Bag Berms – Gravel bag berms can be used as an alternative to fiber rolls and sediment wattles. If used, they will be installed prior to rain events to form a barrier to intercept runoff or reduce its velocity. Gravel bags will also be used, if necessary, during trenching activities when stockpiles are onsite. In the event that gravel bag berms are used as perimeter erosion control, the bags will be placed two bags high. When used to anchor stockpiles, they will be placed one bag high.

Sand Bag Berms – Sand bag berms can also be used as an alternative to fiber rolls and sediment wattles. If used, they will be installed prior to rain events to form a barrier to intercept runoff or reduce its velocity. The purpose is to allow sediment to settle from runoff before water leaves the construction site. Sand bags will also be used, if necessary, during trenching activities when stockpiles are left onsite.

Straw Bale Barriers – Straw bale barriers can also be used as an alternative to fiber rolls, gravel bag berms, and sand bag berms. Straw bale barriers intercept and slow down sheet flow runoff, causing temporary ponding. The temporary ponding provides quiescent conditions allowing sediment to settle. Straw bale barriers also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets, which erode rills, and ultimately gullies, into disturbed, sloped soils. Straw bale barriers will be placed one bag high.

1.3 Stockpile Management Control BMPs

Stockpile management procedures and practices are implemented to reduce or eliminate pollution to the air and stormwater from materials that are stockpiled. Stockpile protection is required year-round. Any stockpiles will be stored in the staging area and outside of the roadway right-of-way. Stockpiles will be located a minimum of 50 feet away from any concentrated flow of stormwater, drainage courses, and inlets. During the rainy season, stockpiles will be covered and anchored down with fiber rolls/sediment wattles, silt fences, gravel bags, sand bags, and/or straw bales. Additional stockpile management BMPs are presented in the subsections below.

Non-RCRA Hazardous Soil. It is anticipated that non-RCRA hazardous soil will be placed in roll-off bins or similar containers. If it is necessary to temporarily stockpile non-RCRA hazardous soil the following BMPs will be followed:

- Stockpiles will be constructed with liners and perimeter berms to prevent release or infiltration of liquids. Minimum 20-mil polyethylene sheeting or equivalent will be used for liners if the stockpile is on a foundation, or minimum 60-mil polyethylene sheeting or equivalent will be used if the stockpile is not on a foundation.
- Wind erosion will be prevented by use of a cover, applying Soiltac® or a similar soil stabilization product, or other suitable means. If a cover is employed it will be minimum 6-mil polyethylene sheeting or equivalent.
- The perimeter berm will be constructed of clean materials (such as hay bales or straw wattle under the liner).
- If a cover is employed, it will extend over the outer edges of the perimeter berm and liner so that rainfall is prevented from entering the stockpile.
- Covers and perimeter berms will be secured in place when not in use and at the end of each workday and as necessary to prevent wind dispersion or runoff from precipitation events.
- Only soil that does not contain free liquids will be stockpiled.
- Liquids that accumulate inside the berm will be pumped from the stockpile to a container or tank for characterization and disposal.
- If the stockpile is outside of a secured area, the stockpile will be demarcated with barricades, orange cones, and/or caution tape until it is removed from the site.
- Erosion control measures will be employed to prevent stockpiled soil from contributing to surface runoff and wind-generated particulate matter.
- The stockpile will be inspected weekly and after storms to verify that controls for windblown dispersion and prevention of runoff and run-on are functioning properly.
- After the stockpile has been removed, the area will be inspected and all residual material will be removed from the underlying and surrounding areas.

The stockpile location will be certified by a California-registered professional engineer for compliance with these requirements, consistent with California Health and Safety Code Section 25123.3(b)(4)(B).

Non-Hazardous Soil Above Interim Screening Levels or Project-Specific Cleanup Goals (once established). It is anticipated that all soil that is above soil screening levels or project-specific cleanup goals will not be stockpiled and will be placed in roll-off bins or similar containers. If it is necessary to temporarily stockpile displaced soil that is non-hazardous, but unsuitable for final disposition onsite because contaminants are present above the interim screening level, the following BMPs will be followed:

- Stockpiles will be constructed with liners and perimeter berms to prevent release or infiltration of liquids. Minimum 20-mil polyethylene sheeting or equivalent will be used for liners.
- Wind erosion will be prevented by use of a cover, applying Soiltac® or a similar soil stabilization product, or other suitable means. If a cover is employed it will be minimum 6-mil polyethylene sheeting or equivalent.
- The perimeter berm will be constructed of clean materials (such as hay bales or straw wattle under the liner).
- If a cover is employed, it will extend over the outer edges of the perimeter berm and liner so that rainfall is prevented from entering the stockpile.
- Covers and perimeter berms will be secured in place when not in use and at the end of each workday and as necessary to prevent wind dispersion or run-off from precipitation events.
- Liquids that accumulate inside the berm will be pumped from the stockpile to a container or tank for characterization and disposal.

- If the stockpile is outside of a secured area, the stockpile will be demarcated with barricades, orange cones, and/or caution tape until it is removed from the site.
- Erosion control measures will be employed to prevent stockpiled soil from contributing to surface runoff and wind-generated particulate matter.
- After the final volume of stockpiled soil has been removed, the area will be inspected for visual contamination due to stockpiling activities, and any remaining residual contaminated material will be removed.

Clean Soil. Stockpiles of displaced soil outside of Soil RFI/RI Investigation Areas that is non-hazardous, clean, and suitable for immediate reuse will be stored following these BMPs:

- Stockpiles will be constructed with liner and perimeter berm to prevent release or infiltration of liquids. Minimum 20-mil polyethylene sheeting or equivalent will be used for liners.
- Wind erosion will be prevented by use of a cover, applying Soiltac® or a similar soil stabilization product, or other suitable means. If a cover is employed it will be minimum 6-mil polyethylene sheeting or equivalent.
- The perimeter berm will be constructed of clean materials (such as hay bales or straw wattle under the liner).
- If a cover is employed, it will extend over the outer edges of the perimeter berm and liner so that rainfall is prevented from entering the stockpile.
- Covers and perimeter berms will be secured in place when not in use and at the end of each workday and as necessary to prevent wind dispersion or run-off from precipitation events.
- If the stockpile is outside of a secured area, the stockpile will be demarcated with barricades, orange cones, and/or caution tape until it is removed from the site.
- Erosion control measures will be employed to prevent stockpiled soil from contributing to surface runoff and wind-generated particulate matter.
- After the stockpile has been removed, all residual material will be removed from the underlying and surrounding areas.

1.4 Wind Erosion Control BMPs

To comply with EIR Mitigation Measures AIR-1a, AIR-1b, AIR-1c, and AIR-1e, wind erosion control will be applied as necessary to prevent nuisance dust and minimize the movement of sediment disturbed during construction. Specifically, the project site will be watered periodically with a water truck for short-term stabilization of disturbed surface areas to minimize visible fugitive dust emissions during dust episodes. A water truck also will be used to control dust on disturbed surfaces during visible dusting episodes. Loaded haul vehicles will be covered on publicly maintained roads. Graded sites will be stabilized using soil binders, as necessary, upon completion of grading when subsequent development is delayed or expected to be delayed more than 30 days, except when such delay is caused by precipitation that dampens the disturbed surface area sufficiently to eliminate visible fugitive dust emissions. Non-essential earth-moving activities will also be curtailed under high wind conditions (winds greater than 25 miles per hour).

1.5 Tracking Control BMPs

Stabilized Construction Entrance/Exit – A temporary construction entrance is defined as a stabilized point of entrance/exit to a construction site to reduce the tracking of mud and dirt onto private or public roads by construction vehicles. A temporary construction entrance will be established in the laydown area to minimize sediment tracking. The temporary construction entrance will be inspected routinely. To comply with EIR Mitigation Measure AIR-1d, project-related track out or spills on publicly maintained paved surfaces will be cleaned up within twenty-four hours.

1.6 Good Housekeeping BMPs

Good housekeeping measures are in addition to the above project-specific BMPs, and will be implemented onsite for the duration of the Project.

- Cover and berm loose stockpiled construction materials that are not actively being used.
- Contain and securely protect stockpiled waste materials from wind and rain at all times unless actively being used.

1.7 Drums/Small Containers

Drums containing soils which are hazardous waste will be stored in a hazardous waste storage area at the Compressor Station and/or the Transwestern Bench and disposed of within 90 days of generation. If needed, drums/small containers that contain soil that may be displaced in the vicinity of the groundwater remedy system that is non-hazardous, but unsuitable for final disposition onsite because contaminants are present above the interim screening level or project-specific cleanup goals, will be staged for offsite transportation following these BMPs:

- Only DOT-specification containers will be used for soil accumulation.
- Empty drums will be inspected and inventoried upon arrival onsite for signs of contamination and/or deterioration.
- Drums and small containers will be transported to the temporary accumulation areas on wood pallets and will be secured together with non-metallic banding.
- Drums will be placed within a bermed and lined area or otherwise will be provided with secondary containment.
- Adequate aisle space (e.g., 36 inches) will be provided for containers such as 55-gallon drums to allow the unobstructed movement of personnel and equipment for inspection purposes. Drums will be placed with no more than two drums per row. The column length must fit within the lined, bermed area.
- Each drum will be provided with its own label, and labels will be visible for inspection purposes.
- Drums will remain closed except when removing or adding soil to the drum. Closed means that the lid and securing ring must be on and securely tightened.

1.8 Roll-off Bins

- All empty roll-off bins will be inspected upon arrival onsite. Any roll-off containers arriving with contents, residual contamination, or deterioration will be rejected. Existing damage (dings, significant paint scratches, broken wheels, etc.), if not significant enough to result in rejection, will be documented upon arrival of the bin using photos and written documentation.
- Roll-off bins will be provided with covers and disposable liners.
- Covers will be properly secured, except when adding or removing soil.
- Old labels will be removed, and each bin will be provided with its own label. Labels will be visible.
- Roll-off bins containing soils that are hazardous waste will be stored in a hazardous waste storage area and disposed of within 90 days of generation.
- Roll-off bins containing clean soil can be stored anywhere on PG&E property or at other properties that have granted permission to PG&E.
- Roll-off bins that contain displaced soil that is non-hazardous, but unsuitable for final disposition onsite because contaminants are present above the interim screening level will be stored at designated locations. The bins will be covered and inspected at a specified frequency (see Section 2.0 for inspection frequencies).

2.0 Visual Inspection, Monitoring for Non-Visual Pollutants, Reporting, Training, and Recordkeeping

This section discusses visual inspections, monitoring for non-visual pollutants, reporting, workers training and education, and recordkeeping.

2.1 Visual Inspection after Qualifying Rain Event

In conformance with the substantive requirements of the Arizona General Permit (Order No. AZG2013-001) and California General Permit (Order No. 2009-0009-DWQ), visual inspections will be implemented to assess the effectiveness of BMPs related to soil storage, and to modify those BMPs, if necessary, to continue to reduce pollutants and impacts on receiving waters. Anticipated activities associated with the inspections include the following:

- Visually inspect BMPs and stormwater discharges at discharge locations within two business days (48 hours) after each qualifying rain event (producing precipitation of one-half inch or more of discharge). The objectives are to 1) identify whether BMPs were adequately designed, implemented, and effective, and 2) identify additional BMPs accordingly.
- Visually inspect the discharge of stored or contained storm water that is derived from and discharged subsequent to a qualifying rain event producing precipitation of ½ inch or more at the time of discharge. Stored or contained storm water that will likely discharge after operating hours due to anticipated precipitation will be observed prior to the discharge during operating hours.
- Record the time, date and rain gauge reading of all qualifying rain events.
- Implement corrective actions as appropriate.

Rain event inspections will occur during working hours when it is safe to do so. In the event of rain over a weekend or during a long holiday the inspection can occur prior to or after the weekend. If the inspection day falls on a Sunday, the inspection may be conducted on the following Monday.

Inspections are not required under adverse conditions. The QSP is not required to inspect areas that, at the time of inspection, are considered unsafe for inspection personnel. Inspections may be postponed when conditions exist such as local flooding, high winds, or electrical storms, or situations that otherwise make inspections unsafe. The inspection must resume as soon as conditions are safe. Results of the inspection and any corrective action perform will be documented and kept onsite. An example Inspection and Corrective Action Report Form, which may be used for both Arizona and California inspections and corrective actions is included in Attachment 1.

2.2 Visual Inspection for Non-Stormwater Discharge

In addition, quarterly visual inspections will be conducted for non-stormwater discharge. The objective is to inspect for the presence of (or indications of prior) unauthorized and authorized non-storm water discharges and their sources. Inspection records will include the personnel performing the visual observation (inspections), the dates and approximate time of the inspection, and the response taken to eliminate unauthorized non-storm water discharges and to reduce or prevent pollutants from contacting non-storm water discharges, if any.

2.3 Monitoring for Non-Visual Pollutants

Monitoring for non-visual pollutants will be conducted to determine whether pollutants that are known to occur on the soil storage sites and that cannot be visually observed or detected in storm water discharges, are being conveyed from the site by storm water.

The QSP will develop and implement the sampling and analysis requirements prior to the start of construction, to monitor for non-visual pollutants associated with soil storage activities. These requirements may be modified as needed to meet the monitoring objectives. Sampling and analysis is only required where the QSP believes pollutants associated with construction activities have the potential to be discharged with storm water runoff due to a spill or in the event there was a breach, malfunction, failure and/or leak of any BMP. If sampling is required as

determined by the QSP, samples will be collected down-gradient from potential discharge locations, in areas which can be safely accessed. In addition, a sample of stormwater that has not come into contact with the disturbed soil or the materials stored or used on-site (uncontaminated sample) will be collected for comparison with the discharge sample. These samples will be collected during the first two hours of discharge from rain events that occur during business and daylight hours and which generate runoff.

Samples will be analyzed for parameters indicating the presence of pollutants identified in the pollutant source assessment required in Section J.2.a.i. of the Construction General Permit (SWPPP Appendix A) which states:

> *"Identify the products used and/or expected to be used and the end products that are produced and/or expected to be produced. This does not include materials and equipment that are designed to be outdoors and exposed to environmental conditions (i.e. poles, equipment pads, cabinets, conductors, insulators, bricks, etc.)."*

2.4 Reporting

Annual reports include a summary and evaluation of all sampling and analysis results, original laboratory reports, and chain of custody forms, a summary of all corrective actions taken during the compliance year, and identification of any compliance activities or corrective actions that were not implemented. Annual reporting is a requirement of permitted SWPPP documents and reports are submitted electronically through SMARTs. Because this is not a permitted SWPPP, the annual reports will not be submitted through SMARTs. The annual reports will be submitted to DTSC (in compliance with mitigation measure HYDRO-1) and DOI.

2.5 Workers Training and Education

Prior to the beginning of construction, construction workers will be trained on the overall storm water management program and more specifically, on proper implementation of this BMPs plan. Persons directly responsible for compliance with the plan, such as inspectors, workers installing and maintaining the erosion control devices, and workers collecting stormwater samples, will receive additional training. New personnel that require stormwater management training after the start of construction will be provided training. Documentation of the training will be kept onsite.

In parallel, Operations staff will be trained on overall storm water management program and more specifically, on the proper implementation of this operations BMPs Plan for soil storage, as well as the Industrial SWPPP included as appendix to the O&M Plan (Volume 1 of the O&M Manual).

2.6 Record Keeping

The following records will be maintained onsite:

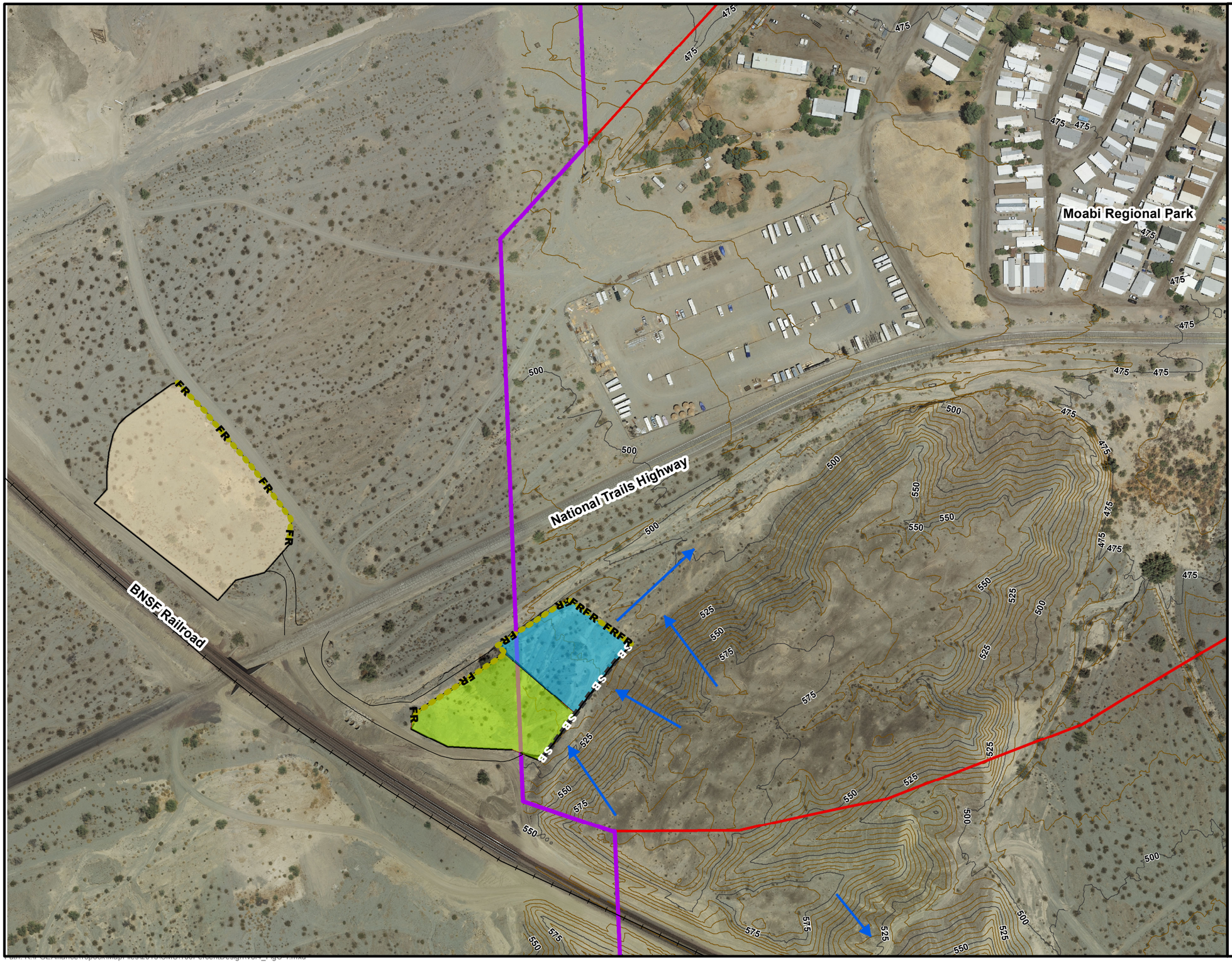
- This BMPs Plan and any updates necessary to reflect current conditions and to maintain accuracy.
- Copies of relevant documents that would affect the provisions or implementation of the BMPs Plan.
- Descriptions and dates of any incidences of significant spills, leaks, or other releases pertaining to soil storage that resulted in discharges of pollutants in stormwater to a regulated municipal separate stormwater systems or to waters of the U.S., the circumstances leading to the release and actions taken in response to the release and measures taken to prevent the recurrence of such releases.
- Documentation of maintenance, including repairs of structural control measures, including the date(s) of discovery of areas in need of repair/replacement, date(s) that the structural control measure(s) returned to full function, and the justification for any extended repair schedules. The maintenance records will include the date(s) of regular maintenance.
- BMP inspection reports and corrective action report forms (see Attachment 1 for an example of a corrective action report form which may be used for both California and Arizona).
- Annual reports.
- Training documentation.

2.7 BMPs Project Team

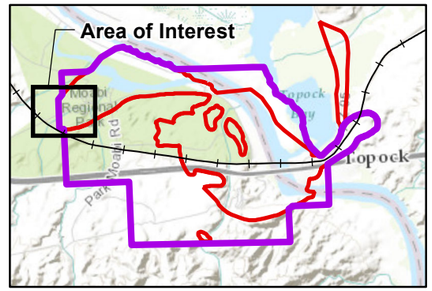
The BMPs Project Team members include:

- PG&E Site Operations Manager, Curt Russell
- PG&E Environmental Inspector, Chris Smith
- PG&E Construction Project Manager, Danielle Starring – Operational control over construction plans and specifications
- QSD, Gino Nguyen (CH2M HILL) – BMPs Plan development
- QSP, to be appointed – Operational control over construction plans and specifications
- Construction Contractors, to be appointed
- Field Team Leader, to be appointed – Responsible for day-to-day activities
- Field Operators, to be appointed – Responsible for day-to-day activities

The BMPs Project team as defined above represents the current project organization. PG&E may reorganize and/or assign other parties to these roles over the course of the construction and O&M of the groundwater remedy to ensure project success.



VICINITY MAP



LEGEND

- Long-term Remedy Support Area (0.8 Acres Approximate)
- Soil Storage/Processing Area (2.56 Acres)
- Temporary Construction Laydown Area (1.05 Acres Approximate)
- Area of Potential Effects (APE)
- EIR Project Area
- Estimated Flow Direction
- Sand Bags (SB)
- Fiber rolls/sediment wattles/ straw bales/silt fence (FR)

Notes:

1. This is a conceptual layout. Locations are approximate. BMPs are not drawn to scale.
2. Descriptions of activities/functions anticipated for the construction support areas are included in the Construction/Remedial Action Work Plan.
3. Descriptions of activities/functions anticipated for the long-term remedy support areas are included in Section 3.5 of the BOD, and the O&M Manual.

N

0 90 180 360 Feet

FIGURE C-1
SOIL STORAGE AREAS AND PROPOSED BEST MANAGEMENT PRACTICES
CONSTRUCTION AND OPERATIONS
BEST MANAGEMENT PRACTICES
PLAN FOR SOIL STORAGE
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

Attachment 1
Inspection and Corrective Action Report Form

2013 Construction General Permit
Inspection & Corrective Action Report Form

ADEQ Arizona Department of Environmental Quality

Section I. General Information (see instructions)

Name of Project		CGP Tracking No.	AZCON – _____	Inspection Date	___ / ___ / _____

☐ **Check box when using this form to inspect an inactive/ unstaffed construction site (this option applies to an entire site only).** See Part 4.2(4) of the permit. Inspect the site immediately before becoming inactive/ unstaffed and every 6 months thereafter and within 24 hours of each storm event of 0.5 inch or greater in 24 hours.

Inspector Name, Title & Contact Information	**Name:** _____ **Title:** _____ **Contact information:** _____
Present Phase of Construction	

Inspection Schedule (all days are calendar days) *(Note: you may be subject to different inspection frequencies in different areas of the site. Check all that apply.)*

Routine Schedule: ☐ Every 7 days ☐ Every 14 days and within 24 hours of a 0.5" storm event

☐ Once per month, but not within 14 days of the previous inspection and within 24 hours of a 0.25" storm event

Reduced Schedule: once per month (but not within 14 days of the previous inspection) and before an anticipated storm event and within 24 hours of the end of each storm event of 0.5 inch or greater in 24 hours.

☐ Once per month (in stabilized areas)

☐ Once per month (where discharges are unlikely based on seasonal rainfall patterns)

☐ Once per month (where winter conditions exist and earth-disturbing activities are being conducted)

Discharge points within 1/4 mile of an impaired water or outstanding Arizona water (OAW): ☐ Every 7 days and within 24 hours of a 0.5" storm event

Was this inspection triggered by either a 0.25" or 0.5" storm event? ☐ Yes ☐ No

If yes, duration of storm event: ☐ < 1 hour ☐ < 6 hrs ☐ > 6 hrs

If yes, how was the storm event determined (either 0.25" or 0.5")?

☐ Rain gauge on site ☐ Weather station representative of site. Specify weather station source: _____

Total rainfall amount that triggered the inspection (in inches)**:** _____

Identify all sources of non-stormwater discharges occurring at the site and the associated control measures in place

sources of non-stormwater discharges:	control measures associated with the non-stormwater discharges:
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
4. _____	4. _____
5. _____	5. _____

Adverse or Unsafe Conditions for Inspection

Did you determine that any portion of the site was unsafe for inspection per CGP Part 4.2(6)? ☐ Yes ☐ No

If "yes", complete the following:

- Describe the conditions that prevented you from conducting the inspection in this location:

- Location(s) where conditions were found:

Note: *Inspections may be postponed when adverse or unsafe conditions exist such as local flooding, high winds, or electrical storms, or situations that otherwise make inspections unsafe. However, the inspection must resume as soon as conditions are safe.*

Section II. Description of Discharges and Condition of the Discharge Locations (CGP Part 4.3(11)) (see instructions)

Discharge Point	Observations *(Note: discharges may not occur at every discharge point on the site after a storm event. Check all that apply.)*
1.	Describe the discharge: ☐ Stormwater ☐ Non-stormwater ☐ None Since the last inspection, do you see any evidence of erosion, sediment accumulation and/ or other pollutants that can be attributed to your discharge? ☐ Yes ☐ No
If yes, describe the characteristics of the discharge (color, odor, clarity, etc.) specify the location(s) of these conditions, and indicate whether modification, maintenance, or corrective action is needed to correct the problem. Also, describe any visible signs of erosion or sediment accumulation.	
2.	Describe the discharge: ☐ Stormwater ☐ Non-stormwater ☐ None Since the last inspection, do you see any evidence of erosion, sediment accumulation and/ or other pollutants that can be attributed to your discharge? ☐ Yes ☐ No
If yes, describe the characteristics of the discharge (color, odor, clarity, etc.) specify the location(s) of these conditions, and indicate whether modification, maintenance, or corrective action is needed to correct the problem. Also, describe any visible signs of erosion or sediment accumulation.	
3.	Describe the discharge: ☐ Stormwater ☐ Non-stormwater ☐ None Since the last inspection, do you see any evidence of erosion, sediment accumulation and/ or other pollutants that can be attributed to your discharge? ☐ Yes ☐ No
If yes, describe the characteristics of the discharge (color, odor, clarity, etc.) specify the location(s) of these conditions, and indicate whether modification, maintenance, or corrective action is needed to correct the problem. Also, describe any visible signs of erosion or sediment accumulation.	

Section II. CONTINUATION SHEET FOR: Description of Discharges and Condition of the Discharge Locations [Print additional sheets as necessary]

Discharge Point	Observations *(Note: discharges may not occur at every discharge point on the site after a storm event. Check all that apply.)*
#___.	Describe the discharge: ☐ Stormwater ☐ Non-stormwater ☐ None Since the last inspection, do you see any evidence of erosion, sediment accumulation and/ or other pollutants that can be attributed to your discharge? ☐ Yes ☐ No
If yes, describe the characteristics of the discharge (color, odor, clarity, etc.) specify the location(s) of these conditions, and indicate whether modification, maintenance, or corrective action is needed to correct the problem. Also, describe any visible signs of erosion or sediment accumulation.	
#___.	Describe the discharge: ☐ Stormwater ☐ Non-stormwater ☐ None Since the last inspection, do you see any evidence of erosion, sediment accumulation and/ or other pollutants that can be attributed to your discharge? ☐ Yes ☐ No
If yes, describe the characteristics of the discharge (color, odor, clarity, etc.) specify the location(s) of these conditions, and indicate whether modification, maintenance, or corrective action is needed to correct the problem. Also, describe any visible signs of erosion or sediment accumulation.	
#___.	Describe the discharge: ☐ Stormwater ☐ Non-stormwater ☐ None Since the last inspection, do you see any evidence of erosion, sediment accumulation and/ or other pollutants that can be attributed to your discharge? ☐ Yes ☐ No
If yes, describe the characteristics of the discharge (color, odor, clarity, etc.) specify the location(s) of these conditions, and indicate whether modification, maintenance, or corrective action is needed to correct the problem. Also, describe any visible signs of erosion or sediment accumulation.	
#___.	Describe the discharge: ☐ Stormwater ☐ Non-stormwater ☐ None Since the last inspection, do you see any evidence of erosion, sediment accumulation and/ or other pollutants that can be attributed to your discharge? ☐ Yes ☐ No
If yes, describe the characteristics of the discharge (color, odor, clarity, etc.) specify the location(s) of these conditions, and indicate whether modification, maintenance, or corrective action is needed to correct the problem. Also, describe any visible signs of erosion or sediment accumulation.	

Section III. Condition and Effectiveness of All On-site Control Measures (Erosion and Sediment (E&S)), Stabilization and Pollution Prevention (P2) Practices (CGP Part 3.1.1 through 3.1.3) (see instructions)					
Description of Control Measures	**Type of Control Measure:** ▪ **Erosion and Sediment (E&S)** ▪ **Stabilization** ▪ **Pollution Prevention (P2)**	**Additional controls required?**	**Repairs or other maintenance needed?[1]**	**Corrective action required?[1, 2]** Date of discovery	**Specify stabilization method** (mulch, rock, planted vegetation, etc.)
1.	☐ E&S ☐ Stabilization ☐ P2	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No ___ / ___ / _____	
Notes (e.g., provide details about needed additional control measures, maintenance performed, etc.)					
Description of Control Measures	**Type of Control Measure:** ▪ **Erosion and Sediment (E&S)** ▪ **Stabilization** ▪ **Pollution Prevention (P2)**	**Additional controls required?**	**Repairs or other maintenance needed?[1]**	**Corrective action required?[1, 2]** Date of discovery	**Specify stabilization method** (mulch, rock, planted vegetation, etc.)
2.	☐ E&S ☐ Stabilization ☐ P2	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No ___ / ___ / _____	
Notes (e.g., provide details about needed additional control measures, maintenance performed, etc.)					

Note 1: The permit differentiates between conditions requiring repairs and maintenance, and those requiring corrective action. The permit requires maintenance in order to keep controls in effective operating condition and requires repairs if controls are not operating as intended. Corrective actions are triggered only for specific, more serious conditions, which include: 1) A necessary stormwater control was never installed, was installed incorrectly, or not in accordance with the requirements in Part 3.1 and/or Part 3.2; 2) One of the prohibited discharges in Part 1.4 is occurring or has occurred; or 3) ADEQ or USEPA determines that modifications to the control measures are necessary to meet the requirements of Part 3.

Note 2: If answering "Yes" (i.e., a site condition that meets one or more of the three criteria in Note 1 above requires a corrective action), you must complete Section IV (Corrective Action Report) below. See Part 5 of the permit for more information.

Section III. CONTINUATION SHEET FOR: Control Measure Condition and Effectiveness [Print additional sheets as necessary]

Description of Control Measures	Type of Control Measure: ▪ Erosion and Sediment (E&S) ▪ Stabilization ▪ Pollution Prevention (P2)	Additional controls required?	Repairs or other maintenance needed?[1]	Corrective action required?[1, 2] Date of discovery	Specify stabilization method (mulch, rock, planted vegetation, etc.)
#___.	☐ E&S ☐ Stabilization ☐ P2	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No ___ / ___ / _____	
Notes (e.g., provide details about needed additional control measures, maintenance performed, etc.)					

Description of Control Measures	Type of Control Measure: ▪ Erosion and Sediment (E&S) ▪ Stabilization ▪ Pollution Prevention (P2)	Additional controls required?	Repairs or other maintenance needed?[1]	Corrective action required?[1, 2] Date of discovery	Specify stabilization method (mulch, rock, planted vegetation, etc.)
#___.	☐ E&S ☐ Stabilization ☐ P2	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No ___ / ___ / _____	
Notes (e.g., provide details about needed additional control measures, maintenance performed, etc.)					

Note 1: The permit differentiates between conditions requiring repairs and maintenance, and those requiring corrective action. The permit requires maintenance in order to keep controls in effective operating condition and requires repairs if controls are not operating as intended. Corrective actions are triggered only for specific, more serious conditions, which include: 1) A necessary stormwater control was never installed, was installed incorrectly, or not in accordance with the requirements in Part 3.1 and/or Part 3.2; 2) One of the prohibited discharges in Part 1.4 is occurring or has occurred; or 3) ADEQ or USEPA determines that modifications to the control measures are necessary to meet the requirements of Part 3.

Note 2: If answering "Yes" (i.e., a site condition that meets one or more of the three criteria in Note 1 above requires a corrective action), you must complete Section IV (Corrective Action Report) below. See Part 5 of the permit for more information.

ADEQ Arizona Department of Environmental Quality

Section IV. Corrective Action Report Form

Section IV.A. – General Information

(Complete this section within 24 hours of discovering the condition that triggered corrective action)

Date/ Time Problem First Discovered	Date: ___ / ___ / _____ Time: _____ ___AM ___PM	Today's Date	___ / ___ / _____

Name and Contact Information of Individual Completing this Form

Name: _____

Contact information: _____

What site conditions triggered the requirement to conduct corrective action? *(Check the box that applies)*

- ☐ A necessary stormwater control was never installed, was installed incorrectly, or not in accordance with the requirements in Part 2 and/or 3
- ☐ A prohibited discharge described in Part 1.4 has occurred or is occurring
- ☐ ADEQ or USEPA has determined that modifications to the control measures are necessary to meet the requirements of Part 3.

Provide a description of the problem: (Provide description of the specific problem that triggered the need for corrective action, and the specific location where it was found. If you have already provided this explanation in an inspection report, you can refer to that report.)

Deadline for completing corrective action:

- ☐ Work will be completed no more than 7 calendar days after the date the problem was discovered (enter date): ____ / ____ / _____
- ☐ It is infeasible to complete work within the first 7 days, therefore, the work will be completed as soon as practicable following the 7th day (enter date): ____ / ____ / _____

If the estimated date of completion falls after the 7-day deadline, document the following: (1) The reason it is infeasible to complete work within 7 days, and (2) The schedule for installing and making the new or modified stormwater control operational in the soonest practicable timeframe.

NOTE: *Any corrective actions that result in changes to any of the stormwater controls or procedures shall be documented in the SWPPP within 7 calendar days of completing the corrective action work.*

Section IV.B. – Stormwater Control Modifications to be Implemented in Response to a Corrective Action Trigger [Print additional sheets as necessary]			
List of stormwater control(s) to be modified or replaced to correct the condition that required the Corrective Action	**Actual or Planned Completion Date**	**SWPPP Update Necessary?** **If yes, specify date SWPPP modified**	**Notes and observations**
1.	___ / ___ / _____	☐ Yes ☐ No ___ / ___ / _____	
2.	___ / ___ / _____	☐ Yes ☐ No ___ / ___ / _____	
3.	___ / ___ / _____	☐ Yes ☐ No ___ / ___ / _____	
4.	___ / ___ / _____	☐ Yes ☐ No ___ / ___ / _____	
5.	___ / ___ / _____	☐ Yes ☐ No ___ / ___ / _____	
6.	___ / ___ / _____	☐ Yes ☐ No ___ / ___ / _____	
7.	___ / ___ / _____	☐ Yes ☐ No ___ / ___ / _____	

Section V. CONTINUATION SHEET for Miscellaneous Items (see instructions) [Print additional sheets as necessary]

Use this space for miscellaneous information or as continuation of items found elsewhere in this report.

Section VI. Certification and Signature (CGP Appendix B. 9.)

Section VI.A. – Certification and Signature by Contractor or Subcontractor performing the inspections (if applicable)

Check one of the following:

- ☐ No instances of non-compliance were discovered during this inspection and the project was in full compliance with the SWPPP and permit.
- ☐ Inspection follow-up is required, in accordance with Parts 4.5(1) and 4.5(2) of the permit.

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Signature of Contractor or Subcontractor: _____ Title: _____

Printed name : _____ Date: _____

Business / Agency: _____ Phone number: _____

Section VI.B. – Certification and Signature by Permittee (permittee / operator or a duly authorized representative is required to sign)

Check one of the following:

- ☐ No instances of non-compliance were discovered during this inspection and the project was in full compliance with the SWPPP and permit.
- ☐ Inspection follow-up is required, in accordance with Parts 4.5(1) and 4.5(2) of the permit.

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Signature of Permittee or
"Duly Authorized Representative": _____ Title: _____

Printed Name: _____ Date: _____

Business / Agency: _____ Phone number: _____

Appendix D
Technical Memorandum 3: Ecological Comparison Values for Metals and Polycyclic Aromatic Hydrocarbons in Soil

Pacific Gas and Electric Company

Yvonne Meeks
Manager

Environmental Remediation
Gas T&D Department

Mailing Address
4325 South Higuera Sreet
San Luis Obispo, CA 93401
Location
6588 Ontario Road
San Luis Obispo, CA 93405
Tel: (805) 234-2257
Email: yjm1@pge.com

May 28, 2008

Dr. J. Michael Eichelberger
Associate Toxicologist
California Department of Toxic Substances Control
Human and Ecological Risk Division
8800 Cal Center Drive
Sacramento, California 95826

Ms. Carrie Marr
Environmental Contaminants Specialist
United States Fish and Wildlife Service
2321 W. Royal Palm Road, Suite 103
Phoenix, Arizona 85021

Subject: Topock Compressor Station – Technical Memorandum 3: Ecological Comparison Values for Metals and Polycyclic Aromatic Hydrocarbons in Soil

Dear Dr. Eichelberger and Ms. Marr:

Enclosed is a technical memorandum prepared as part of the RCRA Facility Investigation/Remedial Investigation (RFI/RI) process to support the soil investigation and site characterization at the Pacific Gas and Electric (PG&E) Topock Compressor Station. This technical memorandum describes the methods used to develop soil ecological comparison values (ECVs) for the currently defined chemicals of potential ecological concern (COPECs) potentially associated with activities at the Topock site. The currently identified COPECs are metals and polycyclic aromatic hydrocarbons (PAHs). The ECVs, while based on information developed during the ecological risk assessment (ERA) scoping, are to be applied only to soil investigation planning in conjunction with background values. Specifically, the ECVs are not intended for use as either cleanup goals or as screening levels to eliminate COPECs. This technical memorandum provides the background and objectives for this effort, the approach used to develop the ECVs, and the recommended ECVs for the current COPECs. Note that the COPEC list may be expanded or contracted based on the results of planned site investigation activities, including the development of soil background levels.

If you have any questions regarding this technical memorandum, please call me at (805) 546-5243.

Sincerely,

Yvonne Meeks
Topock Project Manager

Enclosures: Technical Memorandum 3: Ecological Comparison Values for Metals and Polycyclic Aromatic Hydrocarbons in Soil.

cc: Aaron Yue, DTSC
Karen Baker, DTSC
Kris Doebbler, DOI

ARCADIS
155 Montgomery Street
Suite 1510
San Francisco
California 94104
Tel 415.374.2744
Fax 415.374.2745

MEMO

To:
Yvonne Meeks
4325 South Hiquera,
San Luis Obispo, CA 93401

Copies:
Dave Gilbert
Bob Doss
Curt Russell
Rob Knutson
Drew Page
Robb Kapla
Elidia Dostal
Lisa Kellogg
Janis Lutrick
Bridgette DeShields
Wini Curley

From:
Mala Pattanayek
Kim Walsh

Date:
May 23, 2008

ARCADIS Project No.:
RC000689.0002.00005

Subject:
Technical Memorandum 3: Ecological Comparison Values for Metals and Polycyclic Aromatic Hydrocarbons in Soil

---

The purpose of this technical memorandum is to describe the methods used to develop soil ecological comparison values (ECVs) for the currently defined chemicals of potential ecological concern (COPECs) potentially associated with activities at the Pacific Gas and Electric (PG&E) Topock Compressor Station, located in San Bernardino County, California, 15 miles southeast of Needles (site). The currently identified COPECs are metals and polycyclic aromatic hydrocarbons (PAHs). The ECVs, while based on information developed during the ecological risk assessment (ERA) scoping, are to be applied only to soil investigation planning in conjunction with background values. Specifically, the ECVs are not intended for use as either cleanup goals or as screening levels to eliminate COPECs. The following sections provide the background and objectives for this effort, the approach used to develop the ECVs, and the recommended ECVs for the current COPECs. Note that the COPEC list may be expanded or contracted based on the results of planned site investigation activities, including the development of soil background levels.

Background and Objectives

The Topock Compressor Station began operations in December 1951, compressing natural gas supplied from the southwest United States for transport through pipelines to PG&E's service territory in central and northern California. This site is currently active and will continue operating into the foreseeable future.

PG&E is currently conducting investigative and remedial activities at the site. Historically, chromium was added to cooling water, and from 1951 to 1964, untreated wastewater was discharged to Bat Cave Wash. In 1996, PG&E entered into a Corrective Action Consent Agreement with the California Department of Toxic Substances Control (DTSC) to govern the investigation and remediation of the site. In July 2005, a Consent Agreement was executed with U.S. Department of Interior agencies that outlined the process by which PG&E would comply with the Comprehensive Environmental Response, Compensation, and Liability Act requirements for remediation of the site.

As part of the remedial investigation, soil data are being collected and analyzed for site characterization. The primary objective of soil ECVs, along with background data and Preliminary Remediation Goals (PRGs), is to assist in evaluating the adequacy of the site characterization. The ECVs, PRGs, and background concentrations will be used to evaluate the data collected for the Part A Phase I soil investigation and assist in identifying data gaps that may require Phase II soil sampling. As explained by CH2M HILL (2006a), developing soil ECVs can provide a tool for (1) confirming data adequacy and quality; and (2) evaluating the need for, and designing the sampling and analysis program for, the Part A Phase 2 soil investigation. Procedures for field sampling, chain of custody, laboratory analysis, reporting, and data validation are designed to provide an accurate measure of site characterization. However, technical issues exist that may impair the sampling and analysis process (e.g., typical laboratory-proposed detection limits may be elevated relative to risk-based comparison values). The soil ECVs developed herein can be used for additional soil data quality assessment such as to evaluate the use of appropriate method detection limits. The soil ECVs can also be used to evaluate the data collected to define the extent of the site-related constituents in soil and assess the need for additional site characterization data. Furthermore, the soil ECVs can also be used to optimize the selection of sampling locations to limit disturbing the existing habitat and evaluate the program for additional sampling, if deemed necessary.

The soil ECVs, which are risk-based values, were developed based on conservative exposure and effects assumptions using the standard hazard quotient (HQ) model for assessing risk to ecological receptors (USEPA,1997). The soil ECVs are not strictly site-specific but are relevant to the site. The approach is generic ecological assessment to the extent that off-the-shelf exposure parameters and toxicity values were used. The exposure assumptions and effect levels or toxicity values used in the model were obtained from guidance documents and widely accepted literature sources. The exposure assumptions were based on representative species likely present at the site based on species observation records, habitat, and feeding guilds. The toxicity values were based on endpoints measuring survival, growth, and reproduction to meet the assessment endpoint such as protection of ecological receptor populations. Details of the model are described below.

Approach

In this technical memorandum, soil ECVs were developed for metals and PAHs identified as preliminary COPECs in the *Human Health and Ecological Risk Assessment Work Plan* (RAWP) (ARCADIS, 2008).

The preliminary COPECs include Title 22 metals, hexavalent chromium, manganese, total petroleum hydrocarbons (TPH), and PAHs. Toxicity values are not available for TPH, and therefore, soil ECVs were not developed for TPH. The Title 22 metals include antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc. The PAHs include total low molecular weight (LMW) PAHs and total high molecular weight (HMW) PAHs. The National Oceanic and Atmospheric Administration (NOAA) defines LMW PAHs as PAHs with less than or equal to 3 rings and with molecular weight less than or equal to 192 atomic mass units (amu) (NOAA, 2000). Parent LMW PAHs include naphthalene, acenaphthylene, acenaphthene, fluorene, anthracene, and phenanthrene. HMW PAHs are defined as PAHs with greater than or equal to 4 rings and with molecular weight greater than or equal to 202 amu (NOAA, 2000). Parent HMW PAHs include pyrene, fluoranthene, benz(a)anthracene, chrysene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene, and dibenz(a,h)anthracene.

For the objectives of this memorandum, soil ECVs were calculated for metals and PAHs using both lowest observed adverse effect levels or concentrations (LOAELs or LOAECs) and no-adverse effect levels or concentrations (NOAELs or NOAECs). The soil ECVs selected were based on the target toxicity values (i.e., values below which no unacceptable risk is expected; NOAELs or NOAECs) for the protection of the ecological receptors based on the representative receptors selected for the ecological risk assessment (ARCADIS, 2008) and include:

- Plants
- Invertebrates
- Birds
  - Gambel's Quail (granivore)
  - Cactus Wren (insectivore)
  - Red-Tailed Hawk (carnivore)
- Mammals
  - Desert Shrew (insectivore)
  - Merriam's Kangaroo Rat (granivore)
  - Desert Kit Fox (carnivore).

Soil Ecological Comparison Values Based on Plants and Invertebrates

For plants and invertebrates, although more than one exposure pathway is considered complete, generally route-specific doses are not quantified for plants and invertebrates. Exposures to soil are expressed in milligrams per kilogram (mg/kg), rather than doses, and generally encompass all potential exposure pathways for plants and invertebrates. Therefore, the screening values for the protection of plants and invertebrates discussed in the RAWP (ARCADIS, 2008) were used as soil ECVs, as presented in Table 1. The sources of screening values for plants and soil invertebrates used to develop soil ECVs are listed in order of preference:

- *Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs)* (USEPA, 2008b)

- Oak Ridge National Laboratory (ORNL) documents (Efroymson et al., 1997a,b).

Confidence in certain screening values presented in the ORNL documents is low, as indicated in Table 1. Confidence in plant screening values for antimony, barium, beryllium, hexavalent chromium, mercury, molybdenum, thallium, and vanadium is low due to the low number of studies on which the screening values are based or other factors (Efroymson et al., 1997a). The soil type and test species (typically agricultural) may also vary significantly from site-specific conditions, or the toxic effects may be unspecified in the source study. There may be significant variability in the toxic responses noted. Similarly, confidence in the invertebrate screening values is low for arsenic, hexavalent chromium, and mercury because of the low number of studies on which they are based or other factors (Efroymson et al., 1997b).

In the RAWP, screening values were developed only for metals as presented in Table 1. These values were obtained from the sources listed above and are not discussed in this memorandum. To calculate soil ECVs for PAHs, screening values for plants and invertebrates were developed as described below.

Polycyclic Aromatic Hydrocarbon Screening Values for Plants

Plant screening values are not readily available for PAHs from literature sources, except for acenaphthene (Efroymson et al., 1997a), an LMW PAH, and benzo(a)pyrene (USEPA, 1999), an HMW PAH. Empirical toxicity data for naphthalene, another LMW PAH, are available in the U.S. Environmental Protection Agency (USEPA) ECOTOX database (USEPA, 2008a). A study reporting ecologically relevant adverse effects at the lowest concentration was used to develop plant screening values for naphthalene. Hulzebos et al. (1993) reported a 7-day EC50 of 100 mg/kg for reduced biomass in lettuce. This study tested nearly 40 organic contaminants in both soil and a nutrient solution to determine the relationship between toxicity thresholds in both matrices. In this study, an EC50 (i.e., concentration of a chemical causing an effect to 50 percent of the population) of 100 mg/kg was conservatively assumed to be equivalent to a lowest-observed adverse effects concentration (LOAEC) for more serious adverse effects. Following California Environmental Protection Agency (CalEPA) DTSC guidance (CalEPA, 1996), an uncertainty factor (UF) of

10 was applied to extrapolate to a no-observed adverse effects concentration (NOAEC) resulting in a value of 10 mg/kg, which was used as the plant screening value for naphthalene.

As naphthalene is a more common LMW PAH than acenapthene, the comparison value for total LMW PAHs for protection of plants was based on the NOAEC-based screening value of 10 mg/kg for naphthalene, and the comparison value for total HMW PAHs was based on the screening value of 1.2 mg/kg for benzo(a)pyrene (USEPA, 1999).

Polycyclic Aromatic Hydrocarbon Screening Values for Soil Invertebrates

PAH screening values for soil invertebrates are available in the USEPA's *Guidance for Developing Ecological Soil Screening Levels (EcoSSL)* (USEPA, 2008b). The EcoSSL for LMW PAH is 29 mg/kg and the EcoSSL for HMW PAH is 18 mg/kg (Table 1); these values were selected as comparison values for protection of soil invertebrates.

Soil Ecological Comparison Values Based on Wildlife Protection

For wildlife, soil ECVs were developed using a risk-based approach incorporating exposure pathways for food and soil ingestion, which are considered the most significant pathways for most sites (USEPA, 2008b). The wildlife indicator receptors were selected to represent a cross-section of feeding guilds for each assessment endpoint so that sufficient rates of survival, growth, and reproduction for their representative populations could be evaluated.

For each wildlife receptor (i.e., bird and mammal) listed above, soil ECVs were developed following USEPA guidance (USEPA, 1997; USEPA, 2008b) and were based on a food-web model integrating ecological receptor exposures and effects. The exposure assumptions and effects levels for wildlife described in the RAWP (ARCADIS, 2008) were used to develop soil ECVs. The exposure assumptions that were used to estimate exposure dose for the indicator species such as body weights, food ingestion rates, composition of diet, and bioaccumulation factors (BAFs) were obtained from guidance documents or widely accepted literature sources as described in the RAWP (ARCADIS, 2008). The exposure assumptions used in the soil ECV model for each wildlife receptor are presented in Attachment 1. The effects levels or toxicity reference values (TRVs) that were used in the soil ECV model were also obtained from guidance documents or widely accepted literature sources. A TRV is defined as a daily dose of a chemical expressed in milligrams of chemical per kilogram of body weight per day (mg/kg bw-day) and represents a dose associated with no-effect or lowest-effect at the population level of ecological organization, even if exposure occurs over an extended duration. The TRVs used in the model are presented in Tables 2 and 3 and the details are explained below.

Soil ECVs were developed by re-arranging the standard USEPA (1997) HQ model (Equation 1) to solve for a target HQ of 1, which is considered to be protective of ecological receptors. The model used to solve for ECVs is as follows:

$$HQ = \frac{Dose}{TRV} = \frac{(C_{soil} \times SIR) + (C_{tissue} \times FIR) \times SUF}{TRV \times BW} = \frac{(C_{soil} \times SIR) + (C_{soil} \times BAF \times FIR) \times SUF}{TRV \times BW} = 1$$

Equation 1

Or:

$$ECV = C_{soil} = \frac{HQ \times TRV \times BW}{(SIR + [FIR \times BAF]) \times SUF}$$

Equation 2

Where:

Dose = *exposure dose (mg/kgBW-day)*

HQ = *hazard quotient (unitless); set at a target value of 1*

TRV = *toxicity reference value (milligrams per kilogram body weight per day [mg/kgBW-day])*

C_{soil} = *concentration of constituent in soil (mg/kg soil)*

SIR = *soil ingestion rate (kilogram soil per day [kg soil/day])*

C_{tissue} = *concentration of constituent in biota or tissue (mg/kg tissue)*

FIR = *food or biota ingestion rate (kilograms tissue per day [kg tissue/day])*

BW = *body weight of receptor (kilograms [kgBW])*

BAF = *bioaccumulation factor or regression for media-to-biota uptake (kilogram tissue per kilogram soil [kg soil/kg tissue])*

SUF = *site use factor (unitless); represents the fraction of the exposure area for the receptor represented by the area of contamination generally calculated by dividing the area of contamination by the home or foraging range of the receptor.*

ECV = *ecological comparison value (mg/kg soil)*

Depending on the chemical, tissue concentrations (C_{tissue}) were calculated using different combinations of uptake regressions or uptake factors (referred to as soil-to-biota BAFs in the RAWP [ARCADIS, 2008]). Uptake regressions are linear exponential equations, while UFs are simple multipliers, as shown in Equation 3.

$$C_{tissue} = e^{a} \times \left(C_{soil}\right)^{b} \quad or \quad \ln\left(C_{tissue}\right) = a + b \times \ln\left(C_{soil}\right) \qquad \text{Equation 3}$$

Alternatively:

$$C_{tissue} = UF_{tissue} \times C_{soil}$$

Where:

C_{tissue} = *tissue concentration (mg/kg of tissue)*

C_{soil} = *soil concentration (mg/kg of soil)*

a = *compound specific regression equation constant (unitless)*

b = *compound specific regression equation constant (unitless)*

UF_{tissue} = *uptake factor from soil to tissue (unitless)*

Incorporating uptake regressions in lieu of a simple UF in the dose equation (Equation 2) significantly complicates the overall dose calculation. As the bioaccumulation regression places C_{soil} subject to an exponential term, solving for C_{soil} becomes extremely cumbersome. Because of the challenges associated with back-calculating ECVs with dose equations that rely on exponential regressions for modeling tissue concentrations, a forward-calculation methodology was developed to simplify the calculation steps and reduce the potential for mathematical error. An automated, iterative calculation algorithm was used to combine the dose equation and tissue regression equation(s) into a single forward calculation by using the Microsoft® Solver™ software. Solver™ is an add-on to Microsoft® Excel that finds a solution by iterative trial-and-error that satisfies calculation constraints introduced by having interdependent mathematical equations. In this case, the interdependent equations are the tissue uptake equation(s), which rely on a media concentration and a dose equation that rely on the same media concentration (as the tissue uptake equation) and the solution of the uptake equation(s). The media uptake regression(s) and dose equation were combined using Solver™ and used to calculate ECVs. Figure 1 depicts (as an example) a flowchart

of the iterative process that was followed, and the associated equations that were used to calculate ECV for the desert shrew.

An added benefit of using Solver™ to determine ECV is that it allows instant confirmation of accuracy. The spreadsheet cell representing C_{soil} (the results output from Solver™) is instantaneously fed back through the tissue uptake, dose, and HQ equations to calculate an HQ. As long as the resulting HQ value equals 1 (dose/TRV), it can be confidently concluded that the Solver™-based model performed the calculations correctly and that the resulting C_{soil} is the accurate ECV.

In the RAWP (ARCADIS, 2008), wildlife TRVs and BAFs were developed only for metals. To calculate soil ECVs for PAHs, wildlife TRVs and BAFs for PAHs were also developed as described below.

Bioaccumulation Factors for Polycyclic Aromatic Hydrocarbons

Bioaccumulation in animal tissue or uptake in plants is the process where COPECs in the surrounding media are accumulated within the tissues of ecological receptors, especially to concentrations higher than in the surrounding media. Any COPEC that is excreted or metabolized at a slower rate than its uptake through absorption and ingestion will increase in tissues over time, resulting in bioaccumulation. Constituents with high octanol-water partitioning coefficient (log K_{ow}) are more likely to bioaccumulate in tissues of prey (plants, invertebrates, and mammals) due to their lipophilic nature (USEPA, 2000). Additionally, some metals that are not readily excreted are also known to bioaccumulate (e.g., lead). COPECs that bioaccumulate have the potential to be passed up the food chain.

BAFs are multipliers that are used to estimate concentrations of constituents that can accumulate in tissues through any route of exposure (USEPA, 2000). For plants, the BAF is sometimes referred to as a plant uptake factor. In this memorandum, BAFs were used to estimate concentrations of COPECs in biota and food item tissue (i.e., prey) from soil.

The approach used to develop BAFs for metals in the RAWP (ARCADIS, 2008) was also used to develop soil-to-biota BAFs for PAHs. BAFs for soil-to-plants and soil-to-invertebrates for LMW and HMW PAHs are available in USEPA's EcoSSL guidance (USEPA, 2008b) and are not discussed in this memorandum. According to USEPA EcoSSL guidance, semivolatile organic compounds, including PAHs tend to metabolize rapidly in birds and mammals, and therefore, uptake of these constituents from soil-to-mammal were assumed to be zero (USEPA, 2008b). The BAFs for metals and PAHs used to develop soil ECVs are presented in Table 4.

Toxicity Reference Values

In the RAWP (ARCADIS, 2008), two sets of wildlife TRVs for metals were presented as shown in Tables 2 and 3, and these were:

- Proposed TRVs: these were primarily based on the TRVs used to develop USEPA's EcoSSLs (USEPA, 2008b); other sources included ORNL: Toxicological Benchmarks for Wildlife (Sample et al., 1996) and other published sources (e.g., USEPA Region 6 ERA Guidance [USEPA, 1999]).

- DTSC-recommended TRVs: these were preferably based on the Region 9 Biological Technical Assistance Group (BTAG) TRVs (CalEPA, 2002).

For each set of wildlife TRVs, a range of TRVs were developed to estimate a range of potential risks to wildlife (ARCADIS, 2008). The low TRVs were preferably based on chronic no observable adverse effects levels (NOAELs) and the high TRVs were preferably based on the lowest observed adverse effects levels (LOAELs). In the case of DTSC-recommended TRVs, the low BTAG TRVs are NOAEL-based and the high BTAG TRVs are based on a midpoint of a variety of adverse effects and are not necessarily LOAEL-based (CalEPA, 2002). Some of the TRVs were allometrically adjusted for account for significant difference in body weights between the test species and the representative indicator species based on CalEPA guidance (CalEPA, 1999). For the calculation of soil ECVs, the allometrically adjusted TRVs listed in Table 2 and 3 were used for the representative receptors.

Similarly, following the approach described in the RAWP (ARCADIS, 2008), a range of wildlife TRVs for PAHs were developed as described below.

Bird Toxicity Reference Values for Polycyclic Aromatic Hydrocarbons

The bird TRVs for PAHs used to develop soil ECVs are presented in Table 2 and 3. For birds, there are no TRVs for PAHs reported in the EcoSSL guidance (USEPA, 2007). Published TRVs are available in USEPA Region 6 guidance (USEPA, 1999). However, the study (Brunstrom et al., 1991) was based on egg injection tests that are not considered appropriate for developing TRVs (USEPA, 2008b). Several studies were reviewed, and the most appropriate study was selected to develop bird TRVs for PAHs.

For LMW PAHs, Patton and Dieter's study (1980) evaluating the effect of PAH mixtures on hepatic function in mallard duck livers using a mixture of paraffins and aromatic hydrocarbons was selected. There were visible signs of toxicity, indicated by significant increase in liver weight for the group that were administered 4,000 mg/kg PAH mixture, but livers appeared normal in texture and color. No effects were observed for the 400 mg/kg treatment group. Therefore, 400 mg/kg was selected as the NOAEC and the 4,000 mg/kg was selected as the LOAEC. The NOAEC and the LOAEC were then converted to a NOAEL-based TRV and a LOAEL-based TRV, respectively, using the standard dose equations shown below:

$$TRV_{NOAEL} = \frac{NOAEC \times IR}{BW} = \frac{400\ mg/kg \times 0.059\,kg/day}{1.04\,kgBW} = 22.8\,mg/kgBW - day$$

Equation 4

$$TRV_{LOAEL} = \frac{LOAEC \times IR}{BW} = \frac{4000\,mg/kg \times 0.059\,kg/day}{1.04\,kgBW} = 228\,mg/kgBW - day$$

Equation 5

Where:

TRV_{NOAEL}	*= no-observed adverse effects level based toxicity reference value (milligrams per kilogram body weight per day [mg/kgBW-day])*
TRV_{LOAEL}	*= lowest-observed adverse effects level based toxicity reference value (milligrams per kilogram body weight per day [mg/kgBW-day])*
IR	*= ingestion rate (kilogram soil per day [kg soil/day]); calculated from allometric equation for food ingestion rate in dry weight for all birds (USEPA,1993)*
BW	*= body weight of receptor (kilograms [kgBW]); assuming approximately 1.04 kg for the mallard ducks (from USEPA, 1993)*

For HMW PAHs, a study by Trust et al. (1994) reporting a NOAEL of 10 mg/kg bw-day and a LOAEL of 100 mg/kg bw-day for overt signs of toxicity, such as decreased body mass in European starlings exposed to 7,12-dimethylbenz(a)anthracene, was selected to develop TRVs. Immunosuppression was observed at higher doses. The exposures were via oral gavage, and the study was conducted on nestlings, a sensitive life-stage. No UFs were applied, and therefore, an avian low TRV of 10 mg/kg bw-day and an avian high TRV of 100 mg/kg bw-day were used for HMW PAHs.

There are no BTAG PAH TRVs for birds. Therefore, there are no separate DTSC-recommended PAH TRVs for birds.

Mammal Toxicity Reference Values for Polycyclic Aromatic Hydrocarbons

Mammal TRVs for PAHs are available in the EcoSSL guidance (USEPA, 2007). The NOAEL of 65.6 mg/kg bw-day was selected as the low TRV for LMW PAHs and the LOAEL of 0.6 mg/kg bw-day was selected as the low TRV for HMW PAHs. The EcoSSL guidance (USEPA, 2007; USEPA, 2008b) does not report LOAELs; therefore, LOAELs for PAHs were developed following the approach described in the RAWP (ARCADIS, 2008). For LMW and HMW PAHs, bounded NOAELs were reported as TRVs; therefore, the LOAELs from the same study and endpoint was selected.

BTAG TRVs are available for mammals (CalEPA, 2002). The BTAG TRVs for naphthalene was used for LMW PAHs and the BTAG TRVs for benzo(a)pyrene was used for HMW PAHs.

The mammal TRVs for metals and PAHs used to develop soil ECVs are presented in Table 3 and 4.

Selection of Soil Ecological Comparison Values

The soil ECVs based on plants and invertebrates are presented in Table 1. For wildlife, a range of soil ECVs were developed following the approach described above and presented in tables in Attachment 1. A summary of the soil ECVs developed, based on the proposed wildlife TRVs and the DTSC-recommended TRVs, is presented in Table 5. As discussed earlier, the purpose of this technical memorandum is to develop soil ECVs for data quality assessment and use in evaluating the Part A Phase 1 data and making further site characterization decisions. The ECVs are conservative values but are not intended to be used to screen out COPECs. ECVs are also specifically not intended to be used as cleanup goals.

In order to select the most appropriate soil ECVs for each constituent, the most conservative of all the ecological receptor-based soil ECVs was selected as the final soil ECV unless the screening value or TRVs used to calculate that soil ECV was low in confidence. In such cases, the next less conservative soil ECV was selected as the final (e.g., soil ECV for mercury). The minimum of all the soil ECVs from Table 1 (plants and invertebrates) and Table 5 (wildlife) for each constituent and the selected soil ECVs are presented in Table 6. It should be noted that certain ECVs (e.g. antimony, cadmium, lead, mercury, and selenium) are below the standard reporting limits defined in the *Quality Assurance Project Plan, PG&E Topock Program (*QAPP; CH2M HILL, 2004, 2006b, 2008). Additionally, certain ECVs will likely be lower than final background soil concentrations. In that case, background concentrations would be used to set analytical detection limits and to consider the need for additional characterization.

Tables

1 Soil Ecological Comparison Values Based on Plant and Invertebrate Screening Values

2 Proposed Toxicity Reference Values

3 DTSC-Recommended Toxicity Reference Values

4 Bioaccumulation Factors

5 Summary of Soil Ecological Comparison Values Based on Wildlife

6 Summary of Selected Soil Ecological Comparison Values

Figure

1 Diagram Depicting ECV Derivation Methodology for the Desert Shrew

Attachment

1 Derivation of Wildlife Based Soil ECVs

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ARCADIS

Tables

Table 1
Soil Ecological Comparison Values
Based on Plant and Invertebrate Screening Values

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Constituents	Plant (mg/kg)	Invertebrate (mg/kg)
Antimony	5*	78
Arsenic	18	60**
Barium	500*	330
Beryllium	10*	40
Cadmium	32	140
Chromium, trivalent	NA	NA
Chromium, hexavalent	1*	0.4**
Chromium, total	NA	NA
Cobalt	13	NA
Copper	70	80
Lead	120	1700
Manganese	220	450
Mercury	0.3*	0.1**
Molybdenum	2*	NA
Nickel	38	280
Selenium	0.52	4.1
Silver	560	NA
Thallium	1*	NA
Vanadium	2*	NA
Zinc	160	120
LMW PAHs	10	29
HMW PAHs	1.2	18

Notes:
*Confidence in this benchmark is low due to the low number of studies on which it is based or other factors. The soil type and test species (typically agricultural) may also vary significantly from site-specific conditions, or the toxic effects may be uncertain.
**Confidence in this benchmark is low due to the low number of studies on which it is based or other factors. The tests were conducted with earthworms.

Indicates USEPA EcoSSL
Indicates ORNL Screening Benchmark
Primary sources (see text).

LMW PAHs - low molecular weight polycyclic aromatic hydrocarbons
HMW PAHs - high molecular weight polycyclic aromatic hydrocarbons
mg/kg = milligrams per kilograms
ORNL - Oak Ridge National Laboratory
USEPA - U.S. Environmental Protection Agency

Sources:

Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997a. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision* . Prepared for the Oak Ridge Laboratory. November 1997.

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Table 2
Proposed Toxicity Reference Values

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Constituent	Wildlife TRVs (mg/kgBW-day)							
	Birds				Mammals			
	Low TRV (NOAEL)	Source	High TRV (LOAEL)	Source	Low TRV (NOAEL)	Source	High TRV (LOAEL)	Source
Antimony	NA	--	NA	--	0.059	USEPA, 2005	0.59	USEPA, 2005
Arsenic	2.24	USEPA, 2005	3.55	USEPA, 2005	1.04	USEPA, 2005	1.66	USEPA, 2005
Arsenic (allom adj)[a]	--	--	--	--	1.53	for desert shrew[a]	2.44	for desert shrew[a]
	--	--	--	--	1.46	for kangaroo rat[a]	2.33	for kangaroo rat[a]
Barium	NA	--	NA	--	51.8	USEPA, 2005	82.6	USEPA, 2005
Beryllium	NA	--	NA	--	0.532	USEPA, 2005	0.630	USEPA, 2005
Cadmium	1.47	USEPA, 2005	6.35	USEPA, 2005	0.770	USEPA, 2005	7.7	USEPA, 2005
Chromium	2.66	USEPA, 2005	15.6	USEPA, 2005	2.40	USEPA, 2005	9.62	USEPA, 2005
Hexavalent Chromium	NA	--	NA	--	9.24	USEPA, 2008	38.8	USEPA, 2008
Cobalt	7.61	USEPA, 2005	18.3	USEPA, 2005	7.33	USEPA, 2005	18.8	USEPA, 2005
Copper	4.05	USEPA, 2007	12.1	USEPA, 2007	5.60	USEPA, 2007	9.34	USEPA, 2007
Copper (allom adj)[a]	--	--	--	--	9.43	for desert shrew[a]	15.73	for desert shrew[a]
	--	--	--	--	9.04	for kangaroo rat[a]	15.07	for kangaroo rat[a]
Lead	1.63	USEPA, 2005	3.26	USEPA, 2005	4.70	USEPA, 2005	8.90	USEPA, 2005
Mercury	0.039	CalEPA BTAG, 2002	0.2	CalEPA BTAG, 2002	0.25	CalEPA BTAG,	4	CalEPA BTAG,
Molybdenum	3.5	Sample et al., 1996	35.3	Sample et al., 1996	0.26	Sample et al., 1996	2.6	Sample et al., 1996
Nickel	6.71	USEPA, 2007	18.6	USEPA, 2007	1.70	USEPA, 2007	3.40	USEPA, 2007
Selenium	0.290	USEPA, 2007	0.579	USEPA, 2007	0.143	USEPA, 2007	0.215	USEPA, 2007
Selenium (allom adj)[a]	--	--	--	--	0.23	for desert shrew[a]	0.35	for desert shrew[a]
	--	--	--	--	0.21	for kangaroo rat[a]	0.31	for kangaroo rat[a]
Silver	2.02	USEPA, 2006	20.2	USEPA, 2006	6.02	USEPA, 2006	60.2	USEPA, 2006
Silver (allom adj)[a]	--	--	--	--	8.77	for desert shrew[a]	87.68	for desert shrew[a]
	--	--	--	--	8.40	for kangaroo rat[a]	84.01	for kangaroo rat[a]
Thallium	0.35	USEPA, 1999	3.5	USEPA, 1999	0.48	CalEPA BTAG,	1.43	CalEPA BTAG,
Vanadium	0.344	USEPA, 2005	0.688	USEPA, 2005	4.16	USEPA, 2005	8.31	USEPA, 2005
Zinc	66.1	USEPA, 2007	171	USEPA, 2007	75.4	USEPA, 2007	298	USEPA, 2007
Total LMW PAHs	22.8	1980	228	1980	65.6	USEPA, 2007	328	USEPA, 2007
Total HMW PAHs	10	Trust et al., 1994	100	Trust et al., 1994	0.6	USEPA, 2007	3	USEPA, 2007

Table 2
Proposed Toxicity Reference Values

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Notes:
TRVs for metals presented in the *Human Health and Ecological Risk Assessment Work Plan* (RAWP; ARCADIS, 2008).
TRVs updated in guidance since the RAWP was submitted.
TRVs developed for this technical memorandum.

a. TRVs allometrically adjusted significant difference in body weights using the following equation (Sample and Arenal, 1999):

Aw - At * (BWt/BWw)^1-b

where:

Aw - toxicity value of wildlife species
At - toxicity value of test species (TRV)
BWt - body weight of test species
BWw - body weight of wildlife species
b - allometric scaling factor (1.2 for birds, 0.94 for mammals)

-- - not applicable
BTAG - Biological Technical Assistance Group
CalEPA - California Environmental Protection Agency
LOAEL - lowest observed adverse effects level
mg/kgBW-day - milligrams per kilogram of body weight per day
NA - not available
NOAEL - no observed adverse effects level
TRV - toxicity reference value
USEPA - U.S. Environmental Protection Agency

Sources:

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Table 3
DTSC-Recommended Toxicity Reference Values

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

	Wildlife TRVs (mg/kgBW-day)							
	Birds				Mammals			
Constituent	Low TRV (NOAEL)	Source	High TRV (LOAEL)	Source	Low TRV (NOAEL)	Source	High TRV (LOAEL)	Source
Antimony	NA	--	NA	--	0.059	USEPA, 2005	0.59	USEPA, 2005
Arsenic	5.5	CalEPA BTAG, 2002	22.0	CalEPA BTAG, 2002	0.32	CalEPA BTAG, 2002	4.7	CalEPA BTAG, 2002
Barium	NA	--	NA	--	51.8	USEPA, 2005	82.6	USEPA, 2005
Beryllium	NA	--	NA	--	0.532	USEPA, 2005	0.630	USEPA, 2005
Cadmium	0.08	CalEPA BTAG, 2002	10.4	CalEPA BTAG, 2002	0.060	CalEPA BTAG, 2002	2.64	CalEPA BTAG, 2002
Chromium	2.66	USEPA, 2005	15.6	USEPA, 2005	2.40	USEPA, 2005	9.62	USEPA, 2005
Hexavalent Chromium	NA	--	NA	--	9.24	USEPA, 2008	38.8	USEPA, 2008
Cobalt	7.61	USEPA, 2005	18.3	USEPA, 2005	1.2	CalEPA BTAG, 2002	20	CalEPA BTAG, 2002
Copper	2.30	CalEPA BTAG, 2002	52.3	CalEPA BTAG, 2002	2.67	CalEPA BTAG, 2002	632	CalEPA BTAG, 2002
Lead	0.014	CalEPA BTAG, 2002	8.75	CalEPA BTAG, 2002	1.0	CalEPA BTAG, 2002	241	CalEPA BTAG, 2002
Mercury	0.039	2002	0.18	CalEPA BTAG, 2002	0.25	CalEPA BTAG, 2002	4	2002
Molybdenum	3.5	Sample et al., 1996	35.3	Sample et al., 1996	0.26	Sample et al., 1996	2.6	Sample et al., 1996
Nickel	1.38	CalEPA BTAG, 2002	56.3	CalEPA BTAG, 2002	0.133	CalEPA BTAG, 2002	31.6	CalEPA BTAG, 2002
Selenium	0.23	2002	0.93	CalEPA BTAG, 2002	0.05	CalEPA BTAG, 2002	1.21	2002
Silver	2.02	USEPA, 2006	20.2	USEPA, 2006	6.02	USEPA, 2006	60.2	USEPA, 2006
Silver (allom adj)[a]	--	--	--	--	8.77	for desert shrew[a]	87.68	for desert shrew[a]
	--	--	--	--	8.40	for kangaroo rat[a]	84.01	for kangaroo rat[a]
Thallium	0.35	USEPA, 1999b	3.5	USEPA, 1999b	0.48	CalEPA BTAG, 2002	1.43	2002
Vanadium	0.344	USEPA, 2005	0.688	USEPA, 2005	4.16	USEPA, 2005	8.31	USEPA, 2005
Zinc	17.2	2002	172	CalEPA BTAG, 2002	9.60	CalEPA BTAG, 2002	411	2002
LMW PAHs	NA	--	NA	--	50	CalEPA BTAG, 2002	150	2002
HMW PAHs	NA	--	NA	--	1.31	CalEPA BTAG, 2002	32.8	CalEPA BTAG,

Table 3
DTSC-Recommended Toxicity Reference Values

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Notes:
TRVs for metals presented in the *Human Health and Ecological Risk Assessment Work Plan* (ARCADIS, 2008).
TRVs updated in guidance since the RAWP was submitted.
TRVs developed for this technical memorandum.

a. TRVs allometrically adjusted significant difference in body weights using the following equation (Sample and Arenal, 1999):

Aw - At * (BWt/BWw)^1-b

where:

Aw - toxicity value of wildlife species
At - toxicity value of test species (TRV)
BWt - body weight of test species
BWw - body weight of wildlife species
b - allometric scaling factor (1.2 for birds, 0.94 for mammals)

-- - not applicable
BTAG - Biological Technical Assistance Group
CalEPA - California Environmental Protection Agency
DTSC - Department of Toxic Substances Control
kg - kilograms
LOAEL - lowest observable adverse effects level
mg/kgBW-day - milligram(s) per kilogram body weight per day
NA - not available
NOAEL - no observable adverse effects level
TRV - toxicity reference value
UF - uncertainty factor
USEPA - U.S. Environmental Protection Agency

Sources:

CalEPA 2002. *Currently Recommended U.S. Environmental Protection Agency Region 9 Biological Technical Assistance Group (BTAG) Mammalian and Avian Toxicity Reference Values (TRVs)*. Department of Toxic Substances Control: Human and Ecological Risk Division.

Sample, B.E., D.M. Opresko, and G.W. Suter II. 1996. *Toxicological Benchmarks for Wildlife: 1996 Revision*. Oak Ridge National Laboratory, Oak Ridge, TN. 227 pp. ES/ER/TM-86/R3.

Sample, B.E. and C.A. Arenal. 1999. *Allometric Models for Interspecies Extrapolation of Wildlife Toxicity Data*. Bull. Environ. Contam. Toxicol. (1999) 62: 653-663.

USEPA 1999. *Region 6 Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities: Appendix E Toxicity Reference Values*. August.

USEPA 2005 -2008. *Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs)*. OSWER Directive 9285.7-55. United States Environmental Protection Agency Office of Solid Waste and Emergency Response. Washington, DC. November 2003, revised March, 2007

Table 4
Bioaccumulation Factors

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Constituent	Soil-to-Biota Bioaccumulation Factors[a]		
	BAF_{plant} (dw) (kg soil/kg tissue)	BAF_{invert} (dw) (kg soil/kg tissue)	BAF_{mammal} (dw) (kg soil/kg tissue)
Antimony	$\ln(C_p) = 0.938 * \ln(C_s) - 3.233$	1.00	$0.05 * C_d$
Arsenic	0.03752	$\ln(C_i) = 0.706 * \ln(C_s) - 1.421$	$\ln(C_m) = 0.8188 * \ln(C_s) - 4.8471$
Barium	0.156	0.091	$0.0075 * C_d$
Beryllium	$\ln(C_p) = 0.7345 * \ln(C_s) - 0.5361$	0.045	$0.05 * C_d$
Cadmium	$\ln(C_p) = 0.546 * \ln(C_s) - 0.475$	$\ln(C_i) = 0.795 * \ln(C_s) + 2.114$	$\ln(C_m) = 0.4723 * \ln(C_s) - 1.2571$
Chromium, total	0.041	0.306	$\ln(C_m) = 0.7338 * \ln(C_s) - 1.4599$
Chromium, hexavalent	0.041	0.306	$\ln(C_m) = 0.7338 * \ln(C_s) - 1.4599$
Cobalt	0.0075	0.122	$\ln(C_m) = 1.307 * \ln(C_s) - 4.4669$
Copper	$\ln(C_p) = 0.394 * \ln(C_s) + 0.668$	0.515	$\ln(C_m) = 0.1444 * \ln(C_s) + 2.042$
Lead	$\ln(C_p) = 0.561 * \ln(C_s) - 1.328$	$\ln(C_i) = 0.807 * \ln(C_s) - 0.218$	$\ln(C_m) = 0.4422 * \ln(C_s) + 0.0761$
Mercury	$\ln(C_p) = 0.544 * \ln(C_s) - 0.996$	$\ln(C_i) = 0.3369 * \ln(C_s) - 0.078$	0.192
Molybdenum	0.25	5.50E-01	$\ln(C_m) = 0.006 * 50 * C_d$ [b]
Nickel	$\ln(C_p) = 0.748 * \ln(C_s) - 2.223$	1.059	$\ln(C_m) = 0.4658 * \ln(C_s) - 0.2462$
Selenium	$\ln(C_p) = 1.104 * \ln(C_s) - 0.677$	$\ln(C_i) = 0.733 * \ln(C_s) - 0.075$	$\ln(C_m) = 0.3764 * \ln(C_s) - 0.4158$
Silver	0.014	2.045	0.004
Thallium	0.004	5.50E-01	0.112
Vanadium	0.00485	0.042	0.0123
Zinc	$\ln(C_p) = 0.554 * \ln(C_s) + 1.575$	$\ln(C_i) = 0.328 * \ln(C_s) + 4.449$	$\ln(C_m) = 0.0706 * \ln(C_s) + 4.3632$
Total LMW PAH	ln(Cp) = 0.4544 * ln(Cs)-1.3205	3.04	0.0
Total HMW PAH	ln(Cp) = 0.9469 * ln(Cs)-1.7026	2.6	0.0

Notes:
BAFs for metals presented in the *Human Health and Ecological Risk Assessment Work Plan* (ARCADIS, 2008).
BAFs developed for this technical memorandum.

a. All BAFs from USEPA's Guidance for Developing Ecological Soil Screening Levels (EcoSSLs). U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington D.C. 2005 Revision, updated December 2006. 85 pp. http://www.epa.gov/ecotox/ecossl., except as otherwise noted.

b. Baes, C.F., R. Sharp, A. Sjoreen and R. Shor. 1984. A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture. Prepared by Oak Ridge National Laboratory for U.S. Dept. of Energy. 150 pp.

BAF - bioaccumulation factor
BAF_{invert} - soil-to-invertebrate uptake bioaccumulation factor (unitless)
BAF_{plant} - soil-to-plant uptake bioaccumulation factor (unitless)
C_p - constituent concentration in plants
C_i - constituent concentration in invertebrates
C_s - constituent concentration in soil
C_m - constituent concentration in mammals
C_d - concentration in diet
dw - dry weight
HMW PAHs - high molecular weight polycyclic aromatic hydrocarbons
In - natural log
LMW PAHs - low molecular weight polycyclic aromatic hydrocarbons
USEPA - U.S. Environmental Protection Agency

Table 5
Summary of Soil Ecological Comparison Values
Based on Wildlife

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Ecological Receptor	Based on:	Antimony		Arsenic		Arsenic (Allometrically Adjusted)[e]		Barium		Beryllium		Cadmium	
		Soil ECVs (mg/kg dw)		Soil ECVs (mg/kg dw)		Soil ECVs (mg/kg dw)		Soil ECVs (mg/kg dw)		Soil ECVs (mg/kg dw)		Soil ECVs (mg/kg dw)	
		Low[c]	High[d]	Low[c]	High[d]	High[d]	Low[c]	Low[c]	High[d]	High[d]	Low[c]	Low[c]	High[d]
Gambel's Quail	Proposed TRVs[a]	NA	NA	4.13E+02	6.54E+02	NA	NA	NA	NA	NA	NA	2.48E+02	1.29E+03
Cactus Wren		NA	NA	7.61E+01	1.28E+02	NA	NA	NA	NA	NA	NA	9.47E-01	5.93E+00
Red-tailed Hawk		NA	NA	1.76E+03	2.82E+03	NA	NA	NA	NA	NA	NA	8.37E+02	4.63E+03
Desert Shrew		2.85E-01	2.85E+00	NA	NA	8.90E+01	1.62E+02	2.30E+03	3.67E+03	4.03E+01	4.77E+01	3.74E-01	6.75E+00
Merriam's Kangaroo Rat		1.24E+01	1.35E+02	NA	NA	2.89E+02	4.62E+02	3.50E+03	5.58E+03	2.33E+01	2.91E+01	8.93E+01	2.18E+03
Desert Kit Fox		2.14E+01	2.14E+02	9.72E+02	1.56E+03	NA	NA	5.11E+04	8.14E+04	4.97E+02	5.89E+02	5.74E+02	7.11E+03
Gambel's Quail	DTSC-Recommended TRVs[b]	NA	NA	1.01E+03	4.06E+03	NA	NA	NA	NA	NA	NA	5.26E+00	2.21E+03
Cactus Wren		NA	NA	2.10E+02	9.60E+02	NA	NA	NA	NA	NA	NA	2.45E-02	1.10E+01
Red-tailed Hawk		NA	NA	4.41E+03	1.81E+04	NA	NA	NA	NA	NA	NA	1.05E+01	7.96E+03
Desert Shrew		2.85E-01	2.85E+00	1.14E+01	3.71E+02	NA	NA	2.30E+03	3.67E+03	4.03E+01	4.77E+01	1.51E-02	1.76E+00
Merriam's Kangaroo Rat		1.24E+01	1.35E+02	6.33E+01	9.29E+02	NA	NA	3.50E+03	5.58E+03	2.33E+01	2.92E+01	1.24E+00	5.37E+02
Desert Kit Fox		2.14E+01	2.14E+02	2.94E+02	4.47E+03	NA	NA	4.13E+04	6.58E+04	1.93E+02	2.28E+02	1.94E+01	2.27E+03

Table 5
Summary of Soil Ecological Comparison Values
Based on Wildlife

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Ecological Receptor	Based on:	Total Chromium		Hexavalent Chromium		Cobalt		Copper		Copper (Allometrically Adjusted)[e]		Lead	
		Soil ECVs (mg/kg dw)		Soil ECVs (mg/kg dw)		Soil ECVs (mg/kg dw)		Soil ECVs (mg/kg dw)		Soil ECVs (mg/kg dw)		Soil ECVs (mg/kg dw)	
		High[d]	Low[c]	Low[c]	High[d]	High[d]	Low[c]	Low[c]	High[d]	High[d]	Low[c]	Low[c]	High[d]
Gambel's Quail	Proposed TRVs[a]	4.79E+02	2.81E+03	NA	NA	1.78E+03	4.28E+03	7.60E+02	2.62E+03	NA	NA	3.42E+02	7.16E+02
Cactus Wren		3.64E+01	2.13E+02	NA	NA	1.93E+02	4.64E+02	3.63E+01	1.09E+02	NA	NA	1.57E+01	3.59E+01
Red-tailed Hawk		5.95E+02	5.21E+03	NA	NA	9.00E+02	1.80E+03	2.00E+03	8.86E+03	NA	NA	3.90E+02	1.18E+03
Desert Shrew		3.63E+01	1.45E+02	1.40E+02	5.86E+02	2.54E+02	6.52E+02	NA	NA	8.69E+01	1.45E+02	6.02E+01	1.31E+02
Merriam's Kangaroo Rat		4.49E+02	1.80E+03	1.73E+03	7.26E+03	2.83E+03	7.26E+03	NA	NA	2.74E+03	5.26E+03	1.67E+03	3.45E+03
Desert Kit Fox		1.05E+03	5.26E+03	5.02E+03	2.51E+04	1.52E+03	3.22E+03	4.72E+03	8.42E+03	NA	NA	3.35E+03	7.05E+03
Gambel's Quail	DTSC-Recommended TRVs[b]	4.79E+02	2.81E+03	NA	NA	1.78E+03	4.28E+03	3.82E+02	1.24E+04	NA	NA	9.85E-01	2.01E+03
Cactus Wren		3.64E+01	2.13E+02	NA	NA	1.93E+02	4.64E+02	2.06E+01	4.69E+02	NA	NA	5.00E-02	1.15E+02
Red-tailed Hawk		5.95E+02	5.21E+03	NA	NA	9.00E+02	1.80E+03	6.65E+02	4.45E+04	NA	NA	1.66E-02	4.66E+03
Desert Shrew		3.63E+01	1.45E+02	1.40E+02	5.86E+02	4.16E+01	6.94E+02	2.46E+01	5.82E+03	NA	NA	9.02E+00	7.20E+03
Merriam's Kangaroo Rat		4.49E+02	1.80E+03	1.73E+03	7.26E+03	4.63E+02	7.72E+03	4.51E+02	3.08E+05	NA	NA	2.58E+02	1.15E+05
Desert Kit Fox		1.05E+03	5.26E+03	5.02E+03	2.51E+04	3.49E+02	3.38E+03	1.88E+03	6.36E+05	NA	NA	4.41E+02	2.34E+05

Table 5
Summary of Soil Ecological Comparison Values
Based on Wildlife

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Ecological Receptor	Based on:	Mercury		Molybdenum		Nickel		Selenium		Selenium (Allomterically Adjusted)[e]		Silver	
		Soil ECVs (mg/kg dw)		Soil ECVs (mg/kg dw)		Soil ECVs (mg/kg dw)		Soil ECVs (mg/kg dw)		Soil ECVs (mg/kg dw)		Soil ECVs (mg/kg dw)	
		High[d]	Low[c]	Low[c]	High[d]	High[d]	Low[c]	Low[c]	High[d]	High[d]	Low[c]	Low[c]	High[d]
Gambel's Quail	Proposed TRVs[a]	3.15E+00	2.48E+01	2.58E+02	2.60E+03	1.44E+03	4.14E+03	1.01E+01	1.90E+01	NA	NA	4.47E+02	4.47E+03
Cactus Wren		1.25E-02	9.13E-01	2.97E+01	3.00E+02	3.18E+01	8.81E+01	1.78E+00	4.40E+00	NA	NA	5.15E+00	5.15E+01
Red-tailed Hawk		2.39E+00	1.10E+01	2.47E+02	2.49E+03	3.54E+03	1.23E+04	5.23E+01	1.85E+02	NA	NA	1.42E+03	1.42E+04
Desert Shrew		2.11E+00	5.89E+02	2.25E+00	2.25E+01	7.76E+00	1.55E+01	NA	NA	1.29E+00	2.17E+00	NA	NA
Merriam's Kangaroo Rat		2.96E+01	1.27E+03	1.15E+01	1.15E+02	4.36E+02	9.57E+02	NA	NA	4.13E+00	5.98E+00	NA	NA
Desert Kit Fox		3.21E+01	5.14E+02	3.81E+01	3.81E+02	1.01E+03	2.39E+03	4.54E+01	8.93E+01	NA	NA	5.32E+03	5.32E+04
Gambel's Quail	DTSC-Recommended TRVs[b]	3.15E+00	2.48E+01	2.58E+02	2.60E+03	2.76E+02	1.29E+04	8.15E+00	2.94E+01	NA	NA	4.47E+02	4.47E+03
Cactus Wren		1.25E-02	9.13E-01	2.97E+01	3.00E+02	6.54E+00	2.67E+02	1.31E+00	8.15E+00	NA	NA	5.15E+00	5.15E+01
Red-tailed Hawk		2.39E+00	1.10E+01	1.41E+02	1.42E+03	3.68E+02	4.27E+04	3.25E+01	3.92E+02	NA	NA	1.42E+03	1.42E+04
Desert Shrew		2.11E+00	5.89E+02	2.25E+00	2.25E+01	6.07E-01	1.44E+02	1.77E-01	1.06E+01	NA	NA	1.44E+01	1.44E+02
Merriam's Kangaroo Rat		2.96E+01	1.27E+03	1.15E+01	1.15E+02	2.19E+01	1.12E+04	1.13E+00	2.05E+01	NA	NA	1.93E+03	1.93E+04
Desert Kit Fox		3.21E+01	5.14E+02	2.24E+01	2.24E+02	2.04E+01	2.86E+04	5.56E+00	9.15E+02	NA	NA	5.32E+03	5.32E+04

Table 5
Summary of Soil Ecological Comparison Values
Based on Wildlife

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
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Ecological Receptor	Based on:	Silver (Allomterically Adjusted)[e]		Thallium		Vanadium		Zinc		LMW PAHs		HMW PAHs	
		Soil ECVs (mg/kg dw)		Soil ECVs (mg/kg dw)		Soil ECVs (mg/kg dw)		Soil ECVs (mg/kg dw)		Soil ECVs (mg/kg dw)		Soil ECVs (mg/kg dw)	
		High[d]	Low[c]	Low[c]	High[d]	High[d]	Low[c]	Low[c]	High[d]	High[d]	Low[c]	Low[c]	High[d]
Gambel's Quail	Proposed TRVs[a]	NA	NA	8.45E+01	8.45E+02	8.24E+01	1.65E+02	9.26E+03	2.92E+04	5.59E+03	5.68E+04	1.14E+03	1.22E+04
Cactus Wren		NA	NA	2.97E+00	2.97E+01	1.39E+01	2.78E+01	7.57E+01	1.05E+03	3.97E+01	3.97E+02	2.03E+01	2.03E+02
Red-tailed Hawk		NA	NA	3.50E+01	3.50E+02	1.65E+02	3.30E+02	4.76E+04	1.42E+05	2.05E+04	2.05E+05	9.01E+03	9.01E+04
Desert Shrew		2.09E+01	2.09E+02	2.32E+00	6.91E+00	3.31E+02	6.60E+02	8.67E+01	4.72E+03	1.06E+02	5.28E+02	1.16E+00	5.77E+00
Merriam's Kangaroo Rat		2.69E+03	2.69E+04	2.09E+02	6.21E+02	1.75E+03	3.50E+03	8.32E+03	6.08E+04	3.20E+04	1.64E+05	4.32E+01	2.33E+02
Desert Kit Fox		NA	NA	9.69E+01	2.89E+02	2.92E+03	5.83E+03	7.00E+04	2.94E+05	6.62E+04	3.31E+05	6.21E+02	3.10E+03
Gambel's Quail	DTSC-Recommended TRVs[b]	NA	NA	8.45E+01	8.45E+02	8.24E+01	1.65E+02	1.57E+03	2.93E+04	5.59E+03	5.68E+04	1.14E+03	1.22E+04
Cactus Wren		NA	NA	2.97E+00	2.97E+01	1.39E+01	2.78E+01	1.32E+00	1.06E+03	3.97E+01	3.97E+02	2.03E+01	2.03E+02
Red-tailed Hawk		NA	NA	3.50E+01	3.50E+02	1.65E+02	3.30E+02	5.23E+03	1.42E+05	2.05E+04	2.05E+05	9.01E+03	9.01E+04
Desert Shrew		2.09E+01	2.09E+02	4.15E+00	1.24E+01	3.31E+02	6.60E+02	1.64E-01	1.09E+04	8.05E+01	2.41E+02	2.46E+00	6.17E+01
Merriam's Kangaroo Rat		2.69E+03	2.69E+04	2.09E+02	6.21E+02	1.75E+03	3.50E+03	2.82E+02	9.39E+04	2.42E+04	7.42E+04	9.54E+01	2.78E+03
Desert Kit Fox		NA	NA	9.69E+01	2.89E+02	2.92E+03	5.83E+03	4.61E+03	4.08E+05	5.05E+04	1.51E+05	1.32E+03	3.31E+04

Notes:
Selected Final Soil ECV (see Table 6).

[1] Proposed TRVs based primarily on USEPA's EcoSSLs (USEPA, 2008b); from the *Human Health and Ecological Risk Assessment Work Plan* (ARCADIS, 2008).
[2] DTSC-recommended TRVs based primarily on Region 9 Biological Technical Assistance Group (BTAG) TRVs (CalEPA, 2002); from the Risk Assessment Work Plan (ARCADIS, 2008).
[3] Low ECVs based on low TRVs or no-observed adverse effects level (NOAEL) TRVs.
[4] High ECVs based on high TRVs or lowest-observed adverse effects level (LOAEL) TRVs.
[5] TRVs allometrically adjusted for representative receptors (ARCADIS, 2008).

CalEPA - California Environmental Protection Agency
DTSC - Department of Toxic Substance Control
ECV - ecological comparison value
HMW PAHs - high molecular weight polycyclic aromatic hydrocarbons
LMW PAHs - low molecular weight polycyclic aromatic hydrocarbons
mg/kg dw - milligrams per kilogram dry weight
NA - not available
TRV - toxocity reference values
USEPA - U.S. Environmental Protection Agency

Table 6
Summary of Selected Soil Ecological Comparison Values

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Constituent	Lowest Wildlife ECV (mg/kg)	Based On	Lowest Plant/Invertebrate ECV (mg/kg)	Based On	Selected Final Soil ECV[a] (mg/kg)	Based On
Antimony	0.285	Desert Shrew	5	Plant*	0.285	Desert Shrew
Arsenic	11.4	Desert Shrew	18	Plant	11.4	Desert Shrew
Barium	2,299	Desert Shrew	330	Invertebrate	330	Invertebrate
Beryllium	23.3	Merriam's Kangaroo Rat	10	Plant*	23.3	Merriam's Kangaroo Rat
Cadmium	0.0151	Desert Shrew	32	Plant	0.0151	Desert Shrew
Trivalent Chromium	NA	NA	NA	NA	NA	NA
Hexavalent Chromiu	139.6	Desert Shrew	0.4	Invertebrate**	139.6	Desert Shrew
Total Chromium	36.3	Desert Shrew	NA	NA	36.3	Desert Shrew
Cobalt	41.6	Desert Shrew	13	Plant	13	Plant
Copper	20.6	Cactus Wren	70	Plant	20.6	Cactus Wren
Lead	0.0166	Red-tailed Hawk	120	Plant	0.0166	Red-tailed Hawk
Manganese	NA	NA	220	Plant	220	Plant
Mercury	0.0125	Cactus Wren	0.1	Invertebrate**	0.0125	Cactus Wren
Molybdenum	2.25	Desert Shrew	2	Plant*	2.25	Desert Shrew
Nickel	0.607	Desert Shrew	38	Plant	0.607	Desert Shrew
Selenium	0.177	Desert Shrew	0.52	Plant	0.177	Desert Shrew
Silver	5.15	Cactus Wren	560	Plant	5.15	Cactus Wren
Thallium	2.32	Desert Shrew	1	Plant*	2.32	Desert Shrew
Vanadium	13.9	Cactus Wren	2	Plant	13.9	Cactus Wren
Zinc	0.164	Desert Shrew	120	Invertebrate	0.164	Desert Shrew
LMW PAHs	39.7	Cactus Wren	10	Plant	10	Plant
HMW PAHs	1.16	Desert Shrew	1.2	Plant	1.16	Desert Shrew

Notes:

*Confidence in this benchmark is low due to the low number of studies on which it is based or other factors. The soil type and test species (typically agricultural) may also vary significantly from site-specific conditions, or the toxic effects may be uncertain.

**Confidence in this benchmark is low due to the low number of studies on which it is based or other factors. The tests were conducted with earthworms.

a. The final soil ECV selected based on minimum of soil ECVs based on plants and invertebrates and wildlife. If the minimum soil ECV was based toxicity valu low confidence, then the next minimum soil ECV was selected.

ECV - ecological comparison value
HMW PAHs - high molecular weight polycyclic aromatic hydrocarbons
LMW PAHs - low molecular weight polycyclic aromatic hydrocarbons
mg/kg dw - miligrams per kilogram dry weight
NA - not available

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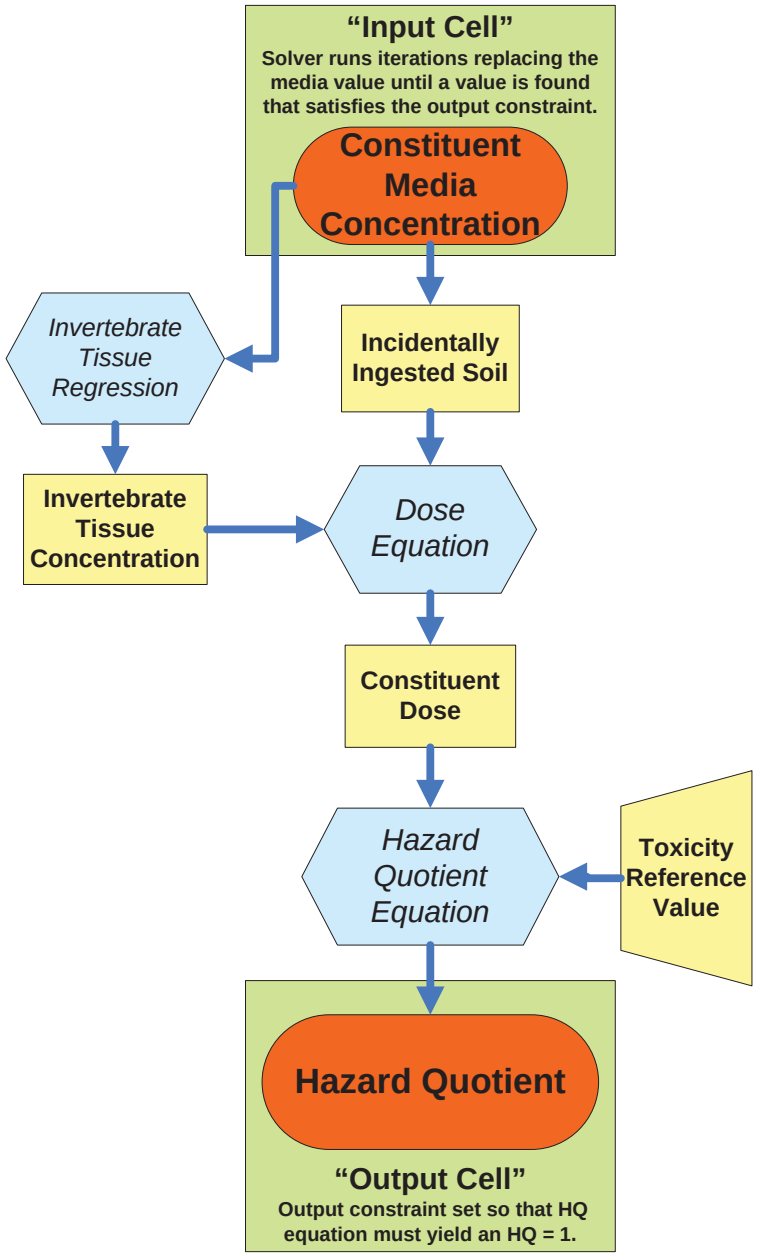
Figures

Figure 1. Diagram Depicting ECV Derivation Methodology for the Desert Shrew



Formulae and Variables Description

Invertebrate Tissue Regression Equation

$$\ln(C_{tissue}) = a + b[\ln(C_{soil})] \quad \therefore \quad C_{tissue} = e^{a} \times (C_{soil})^{b}$$

Dose Equation

$$Dose = \frac{((C_{soil} \times SIR) + (C_{soil} \times BAF \times FIR)) \times SUF}{BW}$$

Hazard Quotient Equation

$$HQ = \frac{Dose}{TRV}$$

ECV Equation

$$ECV = C_{Soil} = \frac{HQ \times TRV \times BW}{(SIR + [FIR \times BAF]) \times SUF}$$

Where:

C_{tissue}	= concentration of constituent in biota or tissue (milligrams of constituent per kilogram tissue [mg/kg tissue])
a	= compound specific regression equation constant (unitless)
b	= compound specific regression equation constant (unitless)
C_{soil}	= concentration of constituent in exposure soil (mg/kg soil)
Dose	= daily exposure dose of constituent resulting from ingestion of media and invertebrates (milligrams per kilogram body weight per day [mg/kgBW-day])
SIR	= soil ingestion rate (kilograms soil per day [kg soil/day])
BAF	= bioaccumulation factor (kg soil/kg tissue)
FIR	= food or biota ingestion rate (kilograms tissue per day [kg tissue/ day])
SUF	= site use factor (unitless)
BW	= body weight of receptor (kilograms [kgBW])
HQ	= hazard quotient (unitless); set at target of 1
TRV	= toxicity reference value (milligrams per kilogram body weight per day)
ECV	= ecological comparison value (mg/kg soil)

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Attachment 1

Table A-1
Ecological Comparison Values Based on Gambel's Quail and Proposed TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Antimony mg/kg (dw)		Arsenic mg/kg (dw)		Barium mg/kg (dw)		Beryllium mg/kg (dw)		Cadmium mg/kg (dw)		Chromium mg/kg (dw)		Hexavalent Chromium mg/kg (dw)	
	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]
Sitewide ECVs														
Soil	NA	NA	4.1E+02	6.5E+02	NA	NA	NA	NA	2.5E+02	1.3E+03	4.8E+02	2.8E+03	NA	NA
Plant tissue	NA	NA	1.5E+01	2.5E+01	NA	NA	NA	NA	1.3E+01	3.1E+01	2.0E+01	1.2E+02	NA	NA
Invertebrate tissue	NA	NA	0.0E+00	0.0E+00	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	NA	NA
Prey (mammal) tissue	NA	NA	0.0E+00	0.0E+00	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	NA	NA
Bioaccumulation Factors (BAFs)[1]														
Soil-to-Plants	ln(Cp) = 0.938 * ln(Cs) - 3.233		3.8E-02		1.6E-01		ln(Cp) = 0.7345 * ln(Cs) - 0.5361		ln(Cp) = 0.546 * ln(Cs) - 0.475		4.1E-02		4.1E-02	
Soil-to-Invertebrates	--		--		--		--		--		--		--	
Soil-to-Mammals	--		--		--		--		--		--		--	
Dose Calulations for Target Hazard Quotients (HQs)[2]														
	Low	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Dose = TRV	NA	NA	2.2E+00	3.5E+00	NA	NA	NA	NA	1.5E+00	6.4E+00	2.7E+00	1.6E+01	NA	NA
HQ	NA	NA	1.0E+00	1.0E+00	NA	NA	NA	NA	1.0E+00	1.0E+00	1.0E+00	1.0E+00	NA	NA

Exposure Paramater[3]	value	units
Food Ingestion Rate (FIR	0.00649	kg tissue/day
Soil Ingestion Rate (SIR)	0.0006750	kg soil/day
Plant Ingestion Fraction (F_{food})	100%	Percent
Invertebrate Ingestion Fraction (F_{food})	0%	Percent
Mammal Ingestion Fraction (F_{food})	0%	Percent
Home Range	35.7	Acres
Site Use Factor (SUF)	1.00	Unitless
Body Weight (BW)	0.1693	kgBW

Microsoft Solver used to calculate ECVs based one re-arranging the standard HQ equation (USEPA, 1997) below:

$$ECV = \frac{HQ \times TRV}{Dose} = \left(\frac{1 \times TRV \times BW}{SIR + (FIR \times BAF) \times SUF} \right)$$

Notes:

soil ECV.

1 bioaccumulation factors (BAFs; kilograms soil per kilogram tissue [kg soil/kg tissue]); from Table 2.

2 exposure parameters from Table 6-3 of the *Human Health and Ecological Risk Assessment Work Plan* (ARCADIS, 2008).

3 dose caluated for a target HQ of 1 (NOAEL and LOAEL based).

4 Low and High ECVs based on low and high TRVs (from Table 3), respectively.

ECV	ecological comparison value for soil.
dw	dry weight.
High	lowest-observed adverse effects level (LOAEL).
HMW PAHs	high molecular weight polycyclic aromatic hydrocarbons.
kg	kilograms.
kg/day	kilograms per day.
LMW PAHs	low molecular weight polycyclic aromatic hydrocarbons.
Low	no-observed adverse effects level (NOAEL).
mg/kg	milligrams per kilogram.
mg/kgBW-day	milligrams per kilogram body weight per day.
NA	not available or not applicable.

Table A-1
Ecological Comparison Values Based on Gambel's Quail and Proposed TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Cobalt mg/kg (dw)		Copper mg/kg (dw)		Lead mg/kg (dw)		Mercury mg/kg (dw)		Molybdenum mg/kg (dw)		Nickel mg/kg (dw)		Selenium mg/kg (dw)	
	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]
Sitewide ECVs														
Soil	1.8E+03	4.3E+03	7.6E+02	2.6E+03	3.4E+02	7.2E+02	3.2E+00	2.5E+01	2.6E+02	2.6E+03	1.4E+03	4.1E+03	1.0E+01	1.9E+01
Plant tissue	1.3E+01	3.2E+01	2.7E+01	4.3E+01	7.0E+00	1.1E+01	6.9E-01	2.1E+00	6.4E+01	6.5E+02	2.5E+01	5.5E+01	6.5E+00	1.3E+01
Invertebrate tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Prey (mammal) tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bioaccumulation Factors (BAFs)[1]														
Soil-to-Plants	7.5E-03		ln(Cp) = 0.394 * ln(Cs) + 0.668		ln(Cp) = 0.561 * ln(Cs) - 1.328		ln(Cp) = 0.544 * ln(Cs) - 0.996		2.5E-01		ln(Cp) = 0.748 * ln(Cs) - 2.223		ln(Cp) = 1.104 * ln(Cs) - 0.677	
Soil-to-Invertebrates	--		--		--		--		--		--		--	
Soil-to-Mammals	--		--		--		--		--		--		--	
Dose Calulations for Target Hazard Quotients (HQs)[2]														
	Low	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Dose = TRV	7.6E+00	1.8E+01	4.1E+00	1.2E+01	1.6E+00	3.3E+00	3.9E-02	1.8E-01	3.5E+00	3.5E+01	6.7E+00	1.9E+01	2.9E-01	5.8E-01
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Table A-1
Ecological Comparison Values Based on Gambel's Quail and Proposed TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Silver mg/kg (dw)		Thallium mg/kg (dw)		Vanadium mg/kg (dw)		Zinc mg/kg (dw)		LMW PAHs mg/kg (dw)		HMW PAHs mg/kg (dw)	
	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]
Sitewide ECVs												
Soil	4.5E+02	4.5E+03	8.5E+01	8.5E+02	8.2E+01	1.6E+02	9.3E+03	2.9E+04	5.6E+03	5.7E+04	1.1E+03	1.2E+04
Plant tissue	6.3E+00	6.3E+01	3.4E-01	3.4E+00	4.0E-01	8.0E-01	7.6E+02	1.4E+03	1.3E+01	3.9E+01	1.4E+02	1.3E+03
Invertebrate tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Prey (mammal) tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bioaccumulation Factors (BAFs)[1]												
Soil-to-Plants	1.4E-02		4.0E-03		4.9E-03		ln(Cp) = 0.554 * ln(Cs) + 1.575		ln(Cp) = 0.4544 * ln(Cs)-1.3205		ln(Cp) = 0.9469 * ln(Cs)-1.7026	
Soil-to-Invertebrates	--		--		--		--		--		--	
Soil-to-Mammals	--		--		--		--		--		--	
Dose Calulations for Target Hazard Quotients (HQs)[2]												
	Low	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Dose = TRV	2.0E+00	2.0E+01	3.5E-01	3.5E+00	3.4E-01	6.9E-01	6.6E+01	1.7E+02	2.3E+01	2.3E+02	1.0E+01	1.0E+02
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Table A-2
Ecological Comparison Values Based on the Cactus Wren and Proposed TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Antimony mg/kg (dw)		Arsenic mg/kg (dw)		Barium mg/kg (dw)		Beryllium mg/kg (dw)		Cadmium mg/kg (dw)		Chromium mg/kg (dw)		Hexavalent Chromium mg/kg (dw)	
	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]
Sitewide ECVs														
Soil	NA	NA	7.6E+01	1.3E+02	NA	NA	NA	NA	9.5E-01	5.9E+00	3.6E+01	2.1E+02	NA	NA
Plant tissue	NA	NA	0.0E+00	0.0E+00	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	NA	NA
Invertebrate tissue	NA	NA	5.1E+00	7.4E+00	NA	NA	NA	NA	7.9E+00	3.4E+01	1.1E+01	6.5E+01	NA	NA
Prey (mammal) tissue	NA	NA	0.0E+00	0.0E+00	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	NA	NA
Bioaccumulation Factors (BAFs)[1]														
Soil-to-Plants	--		--		--		--		--		--		--	
Soil-to-Invertebrates	1.0E+00		ln(Ci) = 0.706 * ln(Cs) - 1.421		9.1E-02		4.5E-02		ln(Ci) = 0.795 * ln(Cs) + 2.114		3.1E-01		3.1E-01	
Soil-to-Mammals	--		--		--		--		--		--		--	
Dose Calulations for Target Hazard Quotients (HQs)[2]														
	Low	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Dose = TRV	NA	NA	2.2E+00	3.6E+00	NA	NA	NA	NA	1.5E+00	6.4E+00	2.7E+00	1.6E+01	NA	NA
HQ	NA	NA	1.0E+00	1.0E+00	NA	NA	NA	NA	1.0E+00	1.0E+00	1.0E+00	1.0E+00	NA	NA

Exposure Paramater[3]	value	units
Food Ingestion Rate (FIR	0.00713	kg tissue/day
Soil Ingestion Rate (SIR)	0.0006631	kg soil/day
Plant Ingestion Fraction (F_{food})	0%	Percent
Invertebrate Ingestion Fraction (F_{food})	100%	Percent
Mammal Ingestion Fraction (F_{food})	0%	Percent
Home Range	4.8	Acres
Site Use Factor (SUF)	1.00	Unitless
Body Weight (BW)	0.0389	kgBW

Microsoft Solver used to calculate ECVs based one re-arranging the standard HQ equation (USEPA, 1997) below:

$$ECV = \frac{HQ \times TRV}{Dose} = \left(\frac{1 \times TRV \times BW}{SIR + (FIR \times BAF) \times SUF} \right)$$

Notes:

soil ECV.

1 bioaccumulation factors (BAFs; kilograms soil per kilogram tissue [kg soil/kg tissue]); from Table 2.

2 exposure parameters from Table 6-3 of the *Human Health and Ecological Risk Assessment Work Plan* (ARCADIS, 2008).

3 dose caluated for a target HQ of 1 (NOAEL and LOAEL based).

4 Low and High ECVs based on low and high TRVs (from Table 3), respectively.

ECV	ecological comparison value for soil.
dw	dry weight.
High	lowest-observed adverse effects level (LOAEL).
HMW PAHs	high molecular weight polycyclic aromatic hydrocarbons.
kg	kilograms.
kg/day	kilograms per day.
LMW PAHs	low molecular weight polycyclic aromatic hydrocarbons.
Low	no-observed adverse effects level (NOAEL).
mg/kg	milligrams per kilogram.
mg/kgBW-day	milligrams per kilogram body weight per day.
NA	not available or not applicable.

Table A-2
Ecological Comparison Values Based on the Cactus Wren and Proposed TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Cobalt mg/kg (dw)		Copper mg/kg (dw)		Lead mg/kg (dw)		Mercury mg/kg (dw)		Molybdenum mg/kg (dw)		Nickel mg/kg (dw)		Selenium mg/kg (dw)	
	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]
Sitewide ECVs														
Soil	1.9E+02	4.6E+02	3.6E+01	1.1E+02	1.6E+01	3.6E+01	1.3E-02	9.1E-01	3.0E+01	3.0E+02	3.2E+01	8.8E+01	1.8E+00	4.4E+00
Plant tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Invertebrate tissue	2.4E+01	5.7E+01	1.9E+01	5.6E+01	7.4E+00	1.4E+01	2.1E-01	9.0E-01	1.6E+01	1.6E+02	3.4E+01	9.3E+01	1.4E+00	2.7E+00
Prey (mammal) tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bioaccumulation Factors (BAFs)[1]														
Soil-to-Plants	--		--		--		--		--		--		--	
Soil-to-Invertebrates	1.2E-01		5.2E-01		ln(Ci) = 0.807 * ln(Cs) - 0.218		ln(Ci) = 0.3369 * ln(Cs) - 0.078		5.5E-01		1.1E+00		ln(Ci) = 0.733 * ln(Cs) - 0.075	
Soil-to-Mammals	--		--		--		--		--		--		--	
Dose Calulations for Target Hazard Quotients (HQs)[2]														
	Low	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Dose = TRV	7.6E+00	1.8E+01	4.0E+00	1.2E+01	1.6E+00	3.3E+00	3.9E-02	1.8E-01	3.5E+00	3.5E+01	6.7E+00	1.9E+01	2.9E-01	5.8E-01
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Table A-2
Ecological Comparison Values Based on the Cactus Wren and Proposed TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Silver mg/kg (dw)		Thallium mg/kg (dw)		Vanadium mg/kg (dw)		Zinc mg/kg (dw)		LMW PAHs mg/kg (dw)		HMW PAHs mg/kg (dw)	
	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]
Sitewide ECVs												
Soil	5.2E+00	5.2E+01	3.0E+00	3.0E+01	1.4E+01	2.8E+01	7.6E+01	1.0E+03	4.0E+01	4.0E+02	2.0E+01	2.0E+02
Plant tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Invertebrate tissue	1.1E+01	1.1E+02	1.6E+00	1.6E+01	5.8E-01	1.2E+00	3.5E+02	8.4E+02	1.2E+02	1.2E+03	5.3E+01	5.3E+02
Prey (mammal) tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bioaccumulation Factors (BAFs)[1]												
Soil-to-Plants	--		--		--		--		--		--	
Soil-to-Invertebrates	2.0E+00		5.5E-01		4.2E-02		ln(Ci) = 0.328 * ln(Cs) + 4.449		3.0E+00		2.6E+00	
Soil-to-Mammals	--		--		--		--		--		--	
Dose Calulations for Target Hazard Quotients (HQs)[2]												
	Low	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Dose = TRV	2.0E+00	2.0E+01	3.5E-01	3.5E+00	3.4E-01	6.9E-01	6.6E+01	1.7E+02	2.3E+01	2.3E+02	1.0E+01	1.0E+02
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Table A-3
Ecological Comparison Values Based on Red Tailed Hawk and Proposed TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Antimony mg/kg (dw)		Arsenic mg/kg (dw)		Barium mg/kg (dw)		Beryllium mg/kg (dw)		Cadmium mg/kg (dw)		Chromium mg/kg (dw)		Hexavalent Chromium mg/kg (dw)	
	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]
Sitewide ECVs														
Soil	NA	NA	1.8E+03	2.8E+03	NA	NA	NA	NA	8.4E+02	4.6E+03	5.9E+02	5.2E+03	NA	NA
Plant tissue	NA	NA	0.0E+00	0.0E+00	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	NA	NA
Invertebrate tissue	NA	NA	0.0E+00	0.0E+00	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	NA	NA
Prey (mammal) tissue	NA	NA	3.6E+00	5.3E+00	NA	NA	NA	NA	6.8E+00	1.5E+01	2.5E+01	1.2E+02	NA	NA
Bioaccumulation Factors (BAFs)[1]														
Soil-to-Plants	--		--		--		--		--		--		--	
Soil-to-Invertebrates	--		--		--		--		--		--		--	
Soil-to-Mammals	0.05 * Cd		ln(Cm) = 0.8188 * ln(Cs) -4.8471		0.0075 * Cd		0.05 * Cd		ln(Cm) = 0.4723 * ln(Cs) - 1.2571		ln(Cm) = 0.7338 * ln(Cs) - 1.4599		ln(Cm) = 0.7338 * ln(Cs) - 1.4599	
Dose Calulations for Target Hazard Quotients (HQs)[2]														
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Dose = TRV	NA	NA	2.2E+00	3.6E+00	NA	NA	NA	NA	1.5E+00	6.4E+00	2.7E+00	1.6E+01	NA	NA
HQ	NA	NA	1.0E+00	1.0E+00	NA	NA	NA	NA	1.0E+00	1.0E+00	1.0E+00	1.0E+00	NA	NA

Exposure Paramater[3]	value	units
Food Ingestion Rate (FIR	0.08990	kg tissue/day
Soil Ingestion Rate (SIR)	0.0012586	kg soil/day
Plant Ingestion Fraction (F_{food})	0%	Percent
Invertebrate Ingestion Fraction (F_{food})	0%	Percent
Mammal Ingestion Fraction (F_{food})	100%	Percent
Home Range	2471	Acres
Site Use Factor (SUF)	1.00	Unitless
Body Weight (BW)	1.134	kgBW

Microsoft Solver used to calculate ECVs based one re-arranging the standard HQ equation (USEPA, 1997) below:

$$ECV = \frac{HQ \times TRV}{Dose} = \left(\frac{1 \times TRV \times BW}{SIR + (FIR \times BAF) \times SUF} \right)$$

Notes:

soil ECV.

1 bioaccumulation factors (BAFs; kilograms soil per kilogram tissue [kg soil/kg tissue]); from Table 2.

2 exposure parameters from Table 6-3 of the *Human Health and Ecological Risk Assessment Work Plan* (ARCADIS, 2008).

3 dose caluated for a target HQ of 1 (NOAEL and LOAEL based).

4 Low and High ECVs based on low and high TRVs (from Table 3), respectively.

ECV	ecological comparison value for soil.
dw	dry weight.
High	lowest-observed adverse effects level (LOAEL).
HMW PAHs	high molecular weight polycyclic aromatic hydrocarbons.
kg	kilograms.
kg/day	kilograms per day.
LMW PAHs	low molecular weight polycyclic aromatic hydrocarbons.
Low	no-observed adverse effects level (NOAEL).
mg/kg	milligrams per kilogram.
mg/kgBW-day	milligrams per kilogram body weight per day.
NA	not available or not applicable.

Table A-3
Ecological Comparison Values Based on Red Tailed Hawk and Proposed TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Cobalt mg/kg (dw)		Copper mg/kg (dw)		Lead mg/kg (dw)		Mercury mg/kg (dw)		Molybdenum[4] mg/kg (dw)		Nickel mg/kg (dw)		Selenium mg/kg (dw)	
	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]
Sitewide ECVs														
Soil	9.0E+02	1.8E+03	2.0E+03	8.9E+03	3.9E+02	1.2E+03	2.4E+00	1.1E+01	2.5E+02	2.5E+03	3.5E+03	1.2E+04	5.2E+01	1.9E+02
Plant tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Invertebrate tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Prey (mammal) tissue	8.3E+01	2.1E+02	2.3E+01	2.9E+01	1.5E+01	2.5E+01	4.6E-01	2.1E+00	4.1E+01	4.1E+02	3.5E+01	6.3E+01	2.9E+00	4.7E+00
Bioaccumulation Factors (BAFs)[1]														
Soil-to-Plants	--		--		--		--		--		--		--	
Soil-to-Invertebrates	--		--		--		--		--		--		--	
Soil-to-Mammals	ln(Cm) = 1.307 * ln(Cs) - 4.4669		ln(Cm) = 0.1444 * ln(Cs) + 2.042		n(Cm) = 0.4422 * ln(Cs) + 0.0761		1.9E-01		0.006 * 50 * Cd		ln(Cm) = 0.4658 * ln(Cs) - 0.2462		n(Cm) = 0.3764 * ln(Cs) - 0.415	
Dose Calulations for Target Hazard Quotients (HQs)[2]					**0.0E+00**									
	Low	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Dose = TRV	7.6E+00	1.8E+01	4.1E+00	1.2E+01	1.6E+00	3.3E+00	3.9E-02	1.8E-01	3.5E+00	3.5E+01	6.7E+00	1.9E+01	2.9E-01	5.8E-01
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Table A-3
Ecological Comparison Values Based on Red Tailed Hawk and Proposed TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Silver mg/kg (dw)		Thallium mg/kg (dw)		Vanadium mg/kg (dw)		Zinc mg/kg (dw)		LMW PAHs mg/kg (dw)		HMW PAHs mg/kg (dw)	
	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]
Sitewide ECVs												
Soil	1.4E+03	1.4E+04	3.5E+01	3.5E+02	1.6E+02	3.3E+02	4.8E+04	1.4E+05	2.1E+04	2.1E+05	9.0E+03	9.0E+04
Plant tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Invertebrate tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Prey (mammal) tissue	5.7E+00	5.7E+01	3.9E+00	3.9E+01	2.0E+00	4.1E+00	1.7E+02	1.8E+02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bioaccumulation Factors (BAFs)[1]												
Soil-to-Plants	--		--		--		--		--		--	
Soil-to-Invertebrates	--		--		--		--		--		--	
Soil-to-Mammals	4.0E-03		1.1E-01		1.2E-02		ln(Cm) = 0.0706 * ln(Cs) + 4.3632		0.0E+00		0.0E+00	
Dose Calulations for Target Hazard Quotients (HQs)[2]												
	Low	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Dose = TRV	2.0E+00	2.0E+01	3.5E-01	3.5E+00	3.4E-01	6.9E-01	6.6E+01	1.7E+02	2.3E+01	2.3E+02	1.0E+01	1.0E+02
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Table A-4
Ecological Comparison Values Based on Desert Shrew and Proposed TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Antimony mg/kg (dw)		Arsenic mg/kg (dw)		Barium mg/kg (dw)		Beryllium mg/kg (dw)		Cadmium mg/kg (dw)		Chromium mg/kg (dw)		Hexavalent Chromium mg/kg (dw)	
	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]
Sitewide ECVs														
Soil	2.8E-01	2.8E+00	8.9E+01	1.6E+02	2.3E+03	3.7E+03	4.0E+01	4.8E+01	3.7E-01	6.8E+00	3.6E+01	1.5E+02	1.4E+02	5.9E+02
Plant tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.8E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Invertebrate tissue	2.8E-01	2.8E+00	5.7E+00	8.8E+00	2.1E+02	3.3E+02	1.8E+00	2.1E+00	3.8E+00	3.8E+01	1.1E+01	4.4E+01	42.724563	1.8E+02
Prey (mammal) tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bioaccumulation Factors (BAFs)[1]														
Soil-to-Plants	--		--		--		--		--		--		--	
Soil-to-Invertebrates	1.0E+00		ln(Ci) = 0.706 * ln(Cs) - 1.421		9.1E-02		4.5E-02		ln(Ci) = 0.795 * ln(Cs) + 2.114		3.1E-01		3.1E-01	
Soil-to-Mammals	--		--		--		--		--		--		--	
Dose Calulations for Target Hazard Quotients (HQs)[2]														
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Dose = TRV	5.9E-02	5.9E-01	1.5E+00	2.4E+00	5.2E+01	8.3E+01	5.3E-01	6.3E-01	7.7E-01	7.7E+00	2.4E+00	9.6E+00	9.2E+00	3.9E+01
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Exposure Paramater[3]	value	units
Food Ingestion Rate (FIR)	0.00102	kg tissue/day
Soil Ingestion Rate (SIR)	0.0000203	kg soil/day
Plant Ingestion Fraction (F_{food})	0%	Percent
Invertebrate Ingestion Fraction (F_{food})	100%	Percent
Mammal Ingestion Fraction (F_{food})	0%	Percent
Home Range	0.1	Acres
Site Use Factor (SUF)	1.00	Unitless
Body Weight (BW)	0.005	kgBW

Microsoft Solver used to calculate ECVs based one re-arranging the standard HQ equation (USEPA, 1997) below:

$$ECV = \frac{HQ \times TRV}{Dose} = \left(\frac{1 \times TRV \times BW}{SIR + (FIR \times BAF) \times SUF} \right)$$

Notes:

soil ECV.

1 bioaccumulation factors (BAFs; kilograms soil per kilogram tissue [kg soil/kg tissue]); from Table 2.

2 exposure parameters from Table 6-3 of the *Human Health and Ecological Risk Assessment Work Plan* (ARCADIS, 2008).

3 dose caluated for a target HQ of 1 (NOAEL and LOAEL based).

4 Low and High ECVs based on low and high TRVs (from Table 3), respectively.

ECV	ecological comparison value for soil.
dw	dry weight.
High	lowest-observed adverse effects level (LOAEL).
HMW PAHs	high molecular weight polycyclic aromatic hydrocarbons.
kg	kilograms.
kg/day	kilograms per day.
LMW PAHs	low molecular weight polycyclic aromatic hydrocarbons.
Low	no-observed adverse effects level (NOAEL).
mg/kg	milligrams per kilogram.
mg/kgBW-day	milligrams per kilogram body weight per day.
NA	not available or not applicable.

Table A-4
Ecological Comparison Values Based on Desert Shrew and Proposed TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Cobalt mg/kg (dw)		Copper mg/kg (dw)		Lead mg/kg (dw)		Mercury mg/kg (dw)		Molybdenum mg/kg (dw)		Nickel mg/kg (dw)	
	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]
Sitewide ECVs												
Soil	2.5E+02	6.5E+02	8.7E+01	1.4E+02	6.0E+01	1.3E+02	2.1E+00	5.9E+02	2.2E+00	2.2E+01	7.8E+00	1.6E+01
Plant tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Invertebrate tissue	3.1E+01	8.0E+01	4.5E+01	7.5E+01	2.2E+01	4.1E+01	1.2E+00	7.9E+00	1.2E+00	1.2E+01	8.2E+00	1.6E+01
Prey (mammal) tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bioaccumulation Factors (BAFs)[1]												
Soil-to-Plants	--		--		--		--		--		--	
Soil-to-Invertebrates	1.2E-01		5.2E-01		ln(Ci) = 0.807 * ln(Cs) - 0.218		ln(Ci) = 0.3369 * ln(Cs) - 0.078		5.5E-01		1.1E+00	
Soil-to-Mammals	--		--		--		--		--		--	
Dose Calulations for Target Hazard Quotients (HQs)[2]												
	Low	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Dose = TRV	7.3E+00	1.9E+01	9.4E+00	1.6E+01	4.7E+00	8.9E+00	2.5E-01	4.0E+00	2.6E-01	2.6E+00	1.7E+00	3.4E+00
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Table A-4
Ecological Comparison Values Based on Desert Shrew and Proposed TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Selenium mg/kg (dw)		Silver mg/kg (dw)		Thallium mg/kg (dw)		Vanadium mg/kg (dw)		Zinc mg/kg (dw)		LMW PAHs mg/kg (dw)		HMW PAHs mg/kg (dw)	
	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]
Sitewide ECVs														
Soil	1.3E+00	2.2E+00	2.1E+01	2.1E+02	2.3E+00	6.9E+00	3.3E+02	6.6E+02	8.7E+01	4.7E+03	1.1E+02	5.3E+02	1.2E+00	5.8E+00
Plant tissue	6.7E-01	1.2E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.1E-01	9.6E-01
Invertebrate tissue	1.1E+00	1.7E+00	4.3E+01	4.3E+02	2.3E+00	6.9E+00	1.4E+01	2.8E+01	3.7E+02	1.4E+03	3.2E+02	1.6E+03	3.0E+00	1.5E+01
Prey (mammal) tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bioaccumulation Factors (BAFs)[1]														
Soil-to-Plants	--		--		--		--		--		--		--	
Soil-to-Invertebrates	ln(Ci) = 0.733 * ln(Cs) - 0.075		2.0E+00		5.5E-01		4.2E-02		ln(Ci) = 0.328 * ln(Cs) + 4.449		3.0E+00		2.6E+00	
Soil-to-Mammals	--		--		--		--		--		--		--	
Dose Calulations for Target Hazard Quotients (HQs)[2]														
	Low	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Dose = TRV	2.3E-01	3.5E-01	8.8E+00	8.8E+01	4.8E-01	1.4E+00	4.2E+00	8.3E+00	7.5E+01	3.0E+02	6.6E+01	3.3E+02	6.1E-01	3.1E+00
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Table A-5
Ecological Comparison Values Based on Kangaroo Rat and Proposed TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Antimony mg/kg (dw)		Arsenic mg/kg (dw)		Barium mg/kg (dw)		Beryllium mg/kg (dw)		Cadmium mg/kg (dw)		Chromium mg/kg (dw)		Hexavalent Chromium mg/kg (dw)	
	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]
Sitewide ECVs														
Soil	1.2E+01	1.4E+02	2.9E+02	4.6E+02	3.5E+03	5.6E+03	2.3E+01	2.9E+01	8.9E+01	2.2E+03	4.5E+02	1.8E+03	1.7E+03	7.3E+03
Plant tissue	4.2E-01	3.9E+00	1.1E+01	1.7E+01	5.5E+02	8.7E+02	5.9E+00	7.0E+00	7.2E+00	4.1E+01	1.8E+01	7.4E+01	7.1E+01	3.0E+02
Invertebrate tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Prey (mammal) tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bioaccumulation Factors (BAFs)[1]														
Soil-to-Plants	ln(Cp) = 0.938 * ln(Cs) - 3.233		3.8E-02		1.6E-01		ln(Cp) = 0.7345 * ln(Cs) - 0.5361		ln(Cp) = 0.546 * ln(Cs) - 0.475		4.1E-02		4.1E-02	
Soil-to-Invertebrates	--		--		--		--		--		--		--	
Soil-to-Mammals	--		--		--		--		--		--		--	
Dose Calulations for Target Hazard Quotients (HQs)[2]														
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Dose = TRV	5.9E-02	5.9E-01	1.5E+00	2.3E+00	5.2E+01	8.3E+01	5.3E-01	6.3E-01	7.7E-01	7.7E+00	2.4E+00	9.6E+00	9.2E+00	3.9E+01
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Exposure Paramater[3]	value	units
Food Ingestion Rate (FIR	0.00282	kg tissue/day
Soil Ingestion Rate (SIR)	0.0000677	kg soil/day
Plant Ingestion Fraction (F_{food})	100%	Percent
Invertebrate Ingestion Fraction (F_{food})	0%	Percent
Mammal Ingestion Fraction (F_{food})	0%	Percent
Home Range	0.13	Acres
Site Use Factor (SUF)	1.00	Unitless
Body Weight (BW)	0.0343	kgBW

Microsoft Solver used to calculate ECVs based one re-arranging the standard HQ equation (USEPA, 1997) below:

$$ECV = \frac{HQ \times TRV}{Dose} = \left(\frac{1 \times TRV \times BW}{SIR + (FIR \times BAF) \times SUF} \right)$$

Notes:

soil ECV.

1 bioaccumulation factors (BAFs; kilograms soil per kilogram tissue [kg soil/kg tissue]); from Table 2.

2 exposure parameters from Table 6-3 of the *Human Health and Ecological Risk Assessment Work Plan* (ARCADIS, 2008).

3 dose caluated for a target HQ of 1 (NOAEL and LOAEL based).

4 Low and High ECVs based on low and high TRVs (from Table 3), respectively.

ECV	ecological comparison value for soil.
dw	dry weight.
High	lowest-observed adverse effects level (LOAEL).
HMW PAHs	high molecular weight polycyclic aromatic hydrocarbons.
kg	kilograms.
kg/day	kilograms per day.
LMW PAHs	low molecular weight polycyclic aromatic hydrocarbons.
Low	no-observed adverse effects level (NOAEL).
mg/kg	milligrams per kilogram.
mg/kgBW-day	milligrams per kilogram body weight per day.
NA	not available or not applicable.

Table A-5
Ecological Comparison Values Based on Kangaroo Rat and Proposed TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Cobalt mg/kg (dw)		Copper mg/kg (dw)		Lead mg/kg (dw)		Mercury mg/kg (dw)		Molybdenum mg/kg (dw)		Nickel mg/kg (dw)	
	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]
Sitewide ECVs												
Soil	2.8E+03	7.3E+03	2.7E+03	5.3E+03	1.7E+03	3.4E+03	3.0E+01	1.3E+03	1.2E+01	1.2E+02	4.4E+02	9.6E+02
Plant tissue	2.1E+01	5.4E+01	4.4E+01	5.7E+01	1.7E+01	2.6E+01	2.3E+00	1.8E+01	2.9E+00	2.9E+01	1.0E+01	1.8E+01
Invertebrate tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Prey (mammal) tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bioaccumulation Factors (BAFs)[1]												
Soil-to-Plants	7.5E-03		ln(Cp) = 0.394 * ln(Cs) + 0.668		ln(Cp) = 0.561 * ln(Cs) - 1.328		ln(Cp) = 0.544 * ln(Cs) - 0.996		2.5E-01		ln(Cp) = 0.748 * ln(Cs) - 2.223	
Soil-to-Invertebrates	--		--		--		--		--		--	
Soil-to-Mammals	--		--		--		--		--		--	
Dose Calulations for Target Hazard Quotients (HQs)[2]												
	Low	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Dose = TRV	7.3E+00	1.9E+01	9.0E+00	1.5E+01	4.7E+00	8.9E+00	2.5E-01	4.0E+00	2.6E-01	2.6E+00	1.7E+00	3.4E+00
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Table A-5
Ecological Comparison Values Based on Kangaroo Rat and Proposed TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Selenium mg/kg (dw)		Silver mg/kg (dw)		Thallium mg/kg (dw)		Vanadium mg/kg (dw)		Zinc mg/kg (dw)		LMW PAHs mg/kg (dw)		HMW PAHs mg/kg (dw)	
	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]
Sitewide ECVs														
Soil	4.1E+00	6.0E+00	2.7E+03	2.7E+04	2.1E+02	6.2E+02	1.8E+03	3.5E+03	8.3E+03	6.1E+04	3.2E+04	1.6E+05	4.3E+01	2.3E+02
Plant tissue	2.4E+00	3.7E+00	3.8E+01	3.8E+02	8.3E-01	2.5E+00	8.5E+00	1.7E+01	7.2E+02	2.2E+03	3.0E+01	6.2E+01	6.4E+00	3.2E+01
Invertebrate tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Prey (mammal) tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bioaccumulation Factors (BAFs)[1]														
Soil-to-Plants	ln(Cp) = 1.104 * ln(Cs) - 0.677		1.4E-02		4.0E-03		4.9E-03		n(Cp) = 0.554 * ln(Cs) + 1.575		ln(Cp) = 0.4544 * ln(Cs)-1.3205		ln(Cp) = 0.9469 * ln(Cs)-1.7026	
Soil-to-Invertebrates	--		--		--		--		--		--		--	
Soil-to-Mammals	--		--		--		--		--		--		--	
Dose Calulations for Target Hazard Quotients (HQs)[2]														
	Low	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Dose = TRV	2.1E-01	3.1E-01	8.4E+00	8.4E+01	4.8E-01	1.4E+00	4.2E+00	8.3E+00	7.5E+01	3.0E+02	6.6E+01	3.3E+02	6.2E-01	3.1E+00
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Table A-6
Ecological Comparison Values Based on Desert Kit Fox and Proposed TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Antimony[4] mg/kg (dw)		Arsenic mg/kg (dw)		Barium[4] mg/kg (dw)		Beryllium[4] mg/kg (dw)		Cadmium mg/kg (dw)		Chromium mg/kg (dw)		Hexavalent Chromium mg/kg (dw)	
	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]
Sitewide ECVs														
Soil	2.1E+01	2.1E+02	9.7E+02	1.6E+03	5.1E+04	8.1E+04	5.0E+02	5.9E+02	5.7E+02	7.1E+03	1.1E+03	5.3E+03	5.0E+03	2.5E+04
Plant tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Invertebrate tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Prey (mammal) tissue	1.1E+00	1.1E+01	2.2E+00	3.2E+00	3.5E+01	5.6E+01	1.1E+00	1.3E+00	5.7E+00	1.9E+01	3.8E+01	1.2E+02	1.2E+02	3.9E+02
Bioaccumulation Factors (BAFs)[1]														
Soil-to-Plants	--		--		--		--		--		--		--	
Soil-to-Invertebrates	--		--		--		--		--		--		--	
Soil-to-Mammals	0.05 * Cd		ln(Cm) = 0.8188 * ln(Cs) -8.4471		0.0075 * Cd		0.05 * Cd		ln(Cm) = 0.4723 * ln(Cs) - 1.2571		ln(Cm) = 0.7338 * ln(Cs) - 1.4599		ln(Cm) = 0.7338 * ln(Cs) - 1.4599	
Dose Calulations for Target Hazard Quotients (HQs)[2]														
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Dose = TRV	5.9E-02	5.9E-01	1.0E+00	1.7E+00	5.2E+01	8.3E+01	5.3E-01	6.3E-01	7.7E-01	7.7E+00	2.4E+00	9.6E+00	9.2E+00	3.9E+01
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Exposure Paramater[3]	value	units
Food Ingestion Rate (FIR	0.07020	kg tissue/day
Soil Ingestion Rate (SIR)	0.0019656	kg soil/day
Plant Ingestion Fraction (F_{food})	0%	Percent
Invertebrate Ingestion Fraction (F_{food})	0%	Percent
Mammal Ingestion Fraction (F_{food})	100%	Percent
Home Range	3039	Acres
Site Use Factor (SUF)	1.00	Unitless
Body Weight (BW)	1.985	kgBW

Microsoft Solver used to calculate ECVs based one re-arranging the standard HQ equation (USEPA, 1997) below:

$$ECV = \frac{HQ \times TRV}{Dose} = \left(\frac{1 \times TRV \times BW}{SIR + (FIR \times BAF) \times SUF} \right)$$

Notes:

soil ECV.

1 bioaccumulation factors (BAFs; kilograms soil per kilogram tissue [kg soil/kg tissue]); from Table 2.

2 exposure parameters from Table 6-3 of the *Human Health and Ecological Risk Assessment Work Plan* (ARCADIS, 2008).

3 dose caluated for a target HQ of 1 (NOAEL and LOAEL based).

4 Low and High ECVs based on low and high TRVs (from Table 3), respectively.

ECV	ecological comparison value for soil.
dw	dry weight.
High	lowest-observed adverse effects level (LOAEL).
HMW PAHs	high molecular weight polycyclic aromatic hydrocarbons.
kg	kilograms.
kg/day	kilograms per day.
LMW PAHs	low molecular weight polycyclic aromatic hydrocarbons.
Low	no-observed adverse effects level (NOAEL).
mg/kg	milligrams per kilogram.
mg/kgBW-day	milligrams per kilogram body weight per day.
NA	not available or not applicable.

Table A-6
Ecological Comparison Values Based on Desert Kit Fox and Proposed TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Cobalt mg/kg (dw)		Copper mg/kg (dw)		Lead mg/kg (dw)		Mercury mg/kg (dw)		Molybdenum[4] mg/kg (dw)		Nickel mg/kg (dw)	
	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]
Sitewide ECVs												
Soil	1.5E+03	3.2E+03	4.7E+03	8.4E+03	3.4E+03	7.0E+03	3.2E+01	5.1E+02	3.8E+01	3.8E+02	1.0E+03	2.4E+03
Plant tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Invertebrate tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Prey (mammal) tissue	1.6E+02	4.4E+02	2.6E+01	2.8E+01	3.9E+01	5.4E+01	6.2E+00	9.9E+01	6.3E+00	6.3E+01	2.0E+01	2.9E+01
Bioaccumulation Factors (BAFs)[1]												
Soil-to-Plants	--		--		--		--		--		--	
Soil-to-Invertebrates	--		--		--		--		--		--	
Soil-to-Mammals	ln(Cm) = 1.307 * ln(Cs) - 4.4669		ln(Cm) = 0.1444 * ln(Cs) + 2.042		ln(Cm) = 0.4422 * ln(Cs) + 0.0761		1.9E-01		0.006 * 50 * Cd		ln(Cm) = 0.4658 * ln(Cs) - 0.2462	
Dose Calulations for Target Hazard Quotients (HQs)[2]					**0.0E+00**							
	Low	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Dose = TRV	7.3E+00	1.9E+01	5.6E+00	9.3E+00	4.7E+00	8.9E+00	2.5E-01	4.0E+00	2.6E-01	2.6E+00	1.7E+00	3.4E+00
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Table A-6
Ecological Comparison Values Based on Desert Kit Fox and Proposed TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Selenium mg/kg (dw)		Silver mg/kg (dw)		Thallium mg/kg (dw)		Vanadium mg/kg (dw)		Zinc mg/kg (dw)		LMW PAHs mg/kg (dw)		HMW PAHs mg/kg (dw)	
	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]
Sitewide ECVs														
Soil	4.5E+01	8.9E+01	5.3E+03	5.3E+04	9.7E+01	2.9E+02	2.9E+03	5.8E+03	7.0E+04	2.9E+05	6.6E+04	3.3E+05	6.2E+02	3.1E+03
Plant tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Invertebrate tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Prey (mammal) tissue	2.8E+00	3.6E+00	2.1E+01	2.1E+02	1.1E+01	3.2E+01	3.6E+01	7.2E+01	1.7E+02	1.9E+02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bioaccumulation Factors (BAFs)[1]														
Soil-to-Plants	--		--		--		--		--		--		--	
Soil-to-Invertebrates	--		--		--		--		--		--		--	
Soil-to-Mammals	ln(Cm) = 0.3764 * ln(Cs) - 0.4158		4.0E-03		1.1E-01		1.2E-02		ln(Cm) = 0.0706 * ln(Cs) + 4.3632		0.0E+00		0.0E+00	
Dose Calulations for Target Hazard Quotients (HQs)[2]														
	Low	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Dose = TRV	1.4E-01	2.2E-01	6.0E+00	6.0E+01	4.8E-01	1.4E+00	4.2E+00	8.3E+00	7.5E+01	3.0E+02	6.6E+01	3.3E+02	6.2E-01	3.1E+00
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Table A-7
Ecological Comparison Values Based on the Gambel's Quail and DTSC-Recommended TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Antimony mg/kg (dw)		Arsenic mg/kg (dw)		Barium mg/kg (dw)		Beryllium mg/kg (dw)		Cadmium mg/kg (dw)		Chromium mg/kg (dw)		Hexavalent Chromium mg/kg (dw)	
	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]
Sitewide ECVs														
Soil	NA	NA	1.0E+03	4.1E+03	NA	NA	NA	NA	5.3E+00	2.2E+03	4.8E+02	2.8E+03	NA	NA
Plant tissue	NA	NA	3.8E+01	1.5E+02	NA	NA	NA	NA	1.5E+00	4.2E+01	2.0E+01	1.2E+02	NA	NA
Invertebrate tissue	NA	NA	0.0E+00	0.0E+00	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	NA	NA
Prey (mammal) tissue	NA	NA	0.0E+00	0.0E+00	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	NA	NA
Bioaccumulation Factors (BAFs)[1]														
Soil-to-Plants	ln(Cp) = 0.938 * ln(Cs) - 3.233		3.8E-02		1.6E-01		ln(Cp) = 0.7345 * ln(Cs) - 0.5361		ln(Cp) = 0.546 * ln(Cs) - 0.475		4.1E-02		4.1E-02	
Soil-to-Invertebrates	--		--		--		--		--		--		--	
Soil-to-Mammals	--		--		--		--		--		--		--	
Dose Calulations for Target Hazard Quotients (HQs)[2]														
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Dose = TRV	NA	NA	5.5E+00	2.2E+01	NA	NA	NA	NA	8.0E-02	1.0E+01	2.7E+00	1.6E+01	NA	NA
HQ	NA	NA	1.0E+00	1.0E+00	NA	NA	NA	NA	1.0E+00	1.0E+00	1.0E+00	1.0E+00	NA	NA

Exposure Paramater[3]	value	units
Food Ingestion Rate (FIR	0.00649	kg tissue/day
Soil Ingestion Rate (SIR)	0.0006750	kg soil/day
Plant Ingestion Fraction (F_{food})	100%	Percent
Invertebrate Ingestion Fraction (F_{food})	0%	Percent
Mammal Ingestion Fraction (F_{food})	0%	Percent
Home Range	35.7	Acres
Site Use Factor (SUF)	1.00	Unitless
Body Weight (BW)	0.1693	kgBW

Microsoft Solver used to calculate ECVs based one re-arranging the standard HQ equation (USEPA, 1997) below:

$$ECV = \frac{HQ \times TRV}{Dose} = \left(\frac{1 \times TRV \times BW}{SIR + (FIR \times BAF) \times SUF} \right)$$

Notes:

soil ECV.

1 bioaccumulation factors (BAFs; kilograms soil per kilogram tissue [kg soil/kg tissue]); from Table 2.

2 exposure parameters from Table 6-3 of the *Human Health and Ecological Risk Assessment Work Plan* (ARCADIS, 2008).

3 dose caluated for a target HQ of 1 (NOAEL and LOAEL based).

4 Low and High ECVs based on low and high TRVs (from Table 4), respectively.

ECV	ecological comparison value for soil.
DTSC	Department of Toxic Substances Control.
dw	dry weight.
High	lowest-observed adverse effects level (LOAEL).
HMW PAHs	high molecular weight polycyclic aromatic hydrocarbons.
kg	kilograms.
kg/day	kilograms per day.
LMW PAHs	low molecular weight polycyclic aromatic hydrocarbons.
Low	no-observed adverse effects level (NOAEL).
mg/kg	milligrams per kilogram.
mg/kg-bw/day	milligrams per kilogram body weight per day.
NA	not available or not applicable.

Table A-7
Ecological Comparison Values Based on the Gambel's Quail and DTSC-Recommended TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Cobalt mg/kg (dw)		Copper mg/kg (dw)		Lead mg/kg (dw)		Mercury mg/kg (dw)		Molybdenum mg/kg (dw)		Nickel mg/kg (dw)		Selenium mg/kg (dw)	
	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]
Sitewide ECVs														
Soil	1.8E+03	4.3E+03	3.8E+02	1.2E+04	9.8E-01	2.0E+03	3.2E+00	2.5E+01	2.6E+02	2.6E+03	2.8E+02	1.3E+04	8.2E+00	2.9E+01
Plant tissue	1.3E+01	3.2E+01	2.0E+01	8.0E+01	2.6E-01	1.9E+01	6.9E-01	2.1E+00	6.4E+01	6.5E+02	7.3E+00	1.3E+02	5.2E+00	2.1E+01
Invertebrate tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Prey (mammal) tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bioaccumulation Factors (BAFs)[1]														
Soil-to-Plants	7.5E-03		ln(Cp) = 0.394 * ln(Cs) + 0.668		ln(Cp) = 0.561 * ln(Cs) - 1.328		ln(Cp) = 0.544 * ln(Cs) - 0.996		2.5E-01		ln(Cp) = 0.748 * ln(Cs) - 2.223		ln(Cp) = 1.104 * ln(Cs) - 0.677	
Soil-to-Invertebrates	--		--		--		--		--		--		--	
Soil-to-Mammals	--		--		--		--		--		--		--	
Dose Calulations for Target Hazard Quotients (HQs)[2]														
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Dose = TRV	7.6E+00	1.8E+01	2.3E+00	5.2E+01	1.4E-02	8.8E+00	3.9E-02	1.8E-01	3.5E+00	3.5E+01	1.4E+00	5.6E+01	2.3E-01	9.3E-01
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Table A-7
Ecological Comparison Values Based on the Gambel's Quail and DTSC-Recommended TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Silver mg/kg (dw)		Thallium mg/kg (dw)		Vanadium mg/kg (dw)		Zinc mg/kg (dw)		LMW PAHs mg/kg (dw)		HMW PAHs mg/kg (dw)	
	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]
Sitewide ECVs												
Soil	4.5E+02	4.5E+03	8.5E+01	8.5E+02	8.2E+01	1.6E+02	1.6E+03	2.9E+04	5.6E+03	5.7E+04	1.1E+03	1.2E+04
Plant tissue	6.3E+00	6.3E+01	3.4E-01	3.4E+00	4.0E-01	8.0E-01	2.9E+02	1.4E+03	1.3E+01	3.9E+01	1.4E+02	1.3E+03
Invertebrate tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Prey (mammal) tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bioaccumulation Factors (BAFs)[1]												
Soil-to-Plants	1.4E-02		4.0E-03		4.9E-03		ln(Cp) = 0.554 * ln(Cs) + 1.575		ln(Cp) = 0.4544 * ln(Cs)-1.3205		ln(Cp) = 0.9469 * ln(Cs)-1.7026	
Soil-to-Invertebrates	--		--		--		--		--		--	
Soil-to-Mammals	--		--		--		--		--		--	
Dose Calulations for Target Hazard Quotients (HQs)[2]												
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Dose = TRV	2.0E+00	2.0E+01	3.5E-01	3.5E+00	3.4E-01	6.9E-01	1.7E+01	1.7E+02	2.3E+01	2.3E+02	1.0E+01	1.0E+02
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Table A-8
Ecological Comparison Values Based on the Cactus Wren and DTSC-Recommended TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Antimony mg/kg (dw)		Arsenic mg/kg (dw)		Barium mg/kg (dw)		Beryllium mg/kg (dw)		Cadmium mg/kg (dw)		Chromium mg/kg (dw)		Hexavalent Chromium mg/kg (dw)	
	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]
Sitewide ECVs														
Soil	NA	NA	2.1E+02	9.6E+02	NA	NA	NA	NA	2.5E-02	1.1E+01	3.6E+01	2.1E+02	NA	NA
Plant tissue	NA	NA	0.0E+00	0.0E+00	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	NA	NA
Invertebrate tissue	NA	NA	1.1E+01	3.1E+01	NA	NA	NA	NA	4.3E-01	5.6E+01	1.1E+01	6.5E+01	NA	NA
Prey (mammal) tissue	NA	NA	0.0E+00	0.0E+00	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	NA	NA
Bioaccumulation Factors (BAFs)[1]														
Soil-to-Plants	--		--		--		--		--		--		--	
Soil-to-Invertebrates	1.0E+00		ln(Ci) = 0.706 * ln(Cs) - 1.421		9.1E-02		4.5E-02		ln(Ci) = 0.795 * ln(Cs) + 2.114		3.1E-01		3.1E-01	
Soil-to-Mammals	--		--		--		--		--		--		--	
Dose Calulations for Target Hazard Quotients (HQs)[2]														
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Dose = TRV	NA	NA	5.5E+00	2.2E+01	NA	NA	NA	NA	8.0E-02	1.0E+01	2.7E+00	1.6E+01	NA	NA
HQ	NA	NA	1.0E+00	1.0E+00	NA	NA	NA	NA	1.0E+00	1.0E+00	1.0E+00	1.0E+00	NA	NA

Exposure Paramater[3]	value	units
Food Ingestion Rate (FIR	0.00713	kg tissue/day
Soil Ingestion Rate (SIR)	0.0006631	kg soil/day
Plant Ingestion Fraction (F_{food})	0%	Percent
Invertebrate Ingestion Fraction (F_{food})	100%	Percent
Mammal Ingestion Fraction (F_{food})	0%	Percent
Home Range	4.8	Acres
Site Use Factor (SUF)	1.00	Unitless
Body Weight (BW)	0.0389	kgBW

Microsoft Solver used to calculate ECVs based one re-arranging the standard HQ equation (USEPA, 1997) below:

$$ECV = \frac{HQ \times TRV}{Dose} = \left(\frac{1 \times TRV \times BW}{SIR + (FIR \times BAF) \times SUF} \right)$$

Notes:

soil ECV.

1 bioaccumulation factors (BAFs; kilograms soil per kilogram tissue [kg soil/kg tissue]); from Table 2.

2 exposure parameters from Table 6-3 of the *Human Health and Ecological Risk Assessment Work Plan* (ARCADIS, 2008).

3 dose caluated for a target HQ of 1 (NOAEL and LOAEL based).

4 Low and High ECVs based on low and high TRVs (from Table 4), respectively.

ECV	ecological comparison value for soil.
DTSC	Department of Toxic Substances Control.
dw	dry weight.
High	lowest-observed adverse effects level (LOAEL).
HMW PAHs	high molecular weight polycyclic aromatic hydrocarbons.
kg	kilograms.
kg/day	kilograms per day.
LMW PAHs	low molecular weight polycyclic aromatic hydrocarbons.
Low	no-observed adverse effects level (NOAEL).
mg/kg	milligrams per kilogram.
mg/kg-bw/day	milligrams per kilogram body weight per day.
NA	not available or not applicable.

Table A-8
Ecological Comparison Values Based on the Cactus Wren and DTSC-Recommended TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Cobalt mg/kg (dw)		Copper mg/kg (dw)		Lead mg/kg (dw)		Mercury mg/kg (dw)		Molybdenum mg/kg (dw)		Nickel mg/kg (dw)		Selenium mg/kg (dw)	
	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]
Sitewide ECVs														
Soil	1.9E+02	4.6E+02	2.1E+01	4.7E+02	5.0E-02	1.2E+02	1.3E-02	9.1E-01	3.0E+01	3.0E+02	6.5E+00	2.7E+02	1.3E+00	8.1E+00
Plant tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Invertebrate tissue	2.4E+01	5.7E+01	1.1E+01	2.4E+02	7.2E-02	3.7E+01	2.1E-01	9.0E-01	1.6E+01	1.6E+02	6.9E+00	2.8E+02	1.1E+00	4.3E+00
Prey (mammal) tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bioaccumulation Factors (BAFs)[1]														
Soil-to-Plants	--		--		--		--		--		--		--	
Soil-to-Invertebrates	1.2E-01		5.2E-01		ln(Ci) = 0.807 * ln(Cs) - 0.218		ln(Ci) = 0.3369 * ln(Cs) - 0.078		5.5E-01		1.1E+00		ln(Ci) = 0.733 * ln(Cs) - 0.075	
Soil-to-Mammals	--		--		--		--		--		--		--	
Dose Calulations for Target Hazard Quotients (HQs)[2]														
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Dose = TRV	7.6E+00	1.8E+01	2.3E+00	5.2E+01	1.4E-02	8.8E+00	3.9E-02	1.8E-01	3.5E+00	3.5E+01	1.4E+00	5.6E+01	2.3E-01	9.3E-01
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Table A-8
Ecological Comparison Values Based on the Cactus Wren and DTSC-Recommended TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Silver mg/kg (dw)		Thallium mg/kg (dw)		Vanadium mg/kg (dw)		Zinc mg/kg (dw)		LMW PAHs mg/kg (dw)		HMW PAHs mg/kg (dw)	
	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]
Sitewide ECVs												
Soil	5.2E+00	5.2E+01	3.0E+00	3.0E+01	1.4E+01	2.8E+01	1.3E+00	1.1E+03	4.0E+01	4.0E+02	2.0E+01	2.0E+02
Plant tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Invertebrate tissue	1.1E+01	1.1E+02	1.6E+00	1.6E+01	5.8E-01	1.2E+00	9.4E+01	8.4E+02	1.2E+02	1.2E+03	5.3E+01	5.3E+02
Prey (mammal) tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bioaccumulation Factors (BAFs)[1]												
Soil-to-Plants	--		--		--		--		--		--	
Soil-to-Invertebrates	2.0E+00		5.5E-01		4.2E-02		ln(Ci) = 0.328 * ln(Cs) + 4.449		3.0E+00		2.6E+00	
Soil-to-Mammals	--		--		--		--		--		--	
Dose Calulations for Target Hazard Quotients (HQs)[2]												
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Dose = TRV	2.0E+00	2.0E+01	3.5E-01	3.5E+00	3.4E-01	6.9E-01	1.7E+01	1.7E+02	2.3E+01	2.3E+02	1.0E+01	1.0E+02
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Table A-9
Ecological Comparison Values Based on the Red-Tailed Hawk and on DTSC-Recommended TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Antimony mg/kg (dw)		Arsenic mg/kg (dw)		Barium mg/kg (dw)		Beryllium mg/kg (dw)		Cadmium mg/kg (dw)		Chromium mg/kg (dw)		Hexavalent Chromium mg/kg (dw)	
	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]
Sitewide ECVs														
Soil	NA	NA	4.4E+03	1.8E+04	NA	NA	NA	NA	1.0E+01	8.0E+03	5.9E+02	5.2E+03	NA	NA
Plant tissue	NA	NA	0.0E+00	0.0E+00	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	NA	NA
Invertebrate tissue	NA	NA	0.0E+00	0.0E+00	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	NA	NA
Prey (mammal) tissue	NA	NA	7.6E+00	2.4E+01	NA	NA	NA	NA	8.6E-01	2.0E+01	2.5E+01	1.2E+02	NA	NA
Bioaccumulation Factors (BAFs)[1]														
Soil-to-Plants	--		--		--		--		--		--		--	
Soil-to-Invertebrates	--		--		--		--		--		--		--	
Soil-to-Mammals	0.05 * Cd		ln(Cm) = 0.8188 * ln(Cs) -4.8471		0.0075 * Cd		0.05 * Cd		ln(Cm) = 0.4723 * ln(Cs) - 1.2571		ln(Cm) = 0.7338 * ln(Cs) - 1.4599		ln(Cm) = 0.7338 * ln(Cs) - 1.4599	
Dose Calulations for Target Hazard Quotients (HQs)[2]														
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Dose = TRV	NA	NA	5.5E+00	2.2E+01	NA	NA	NA	NA	8.0E-02	1.0E+01	2.7E+00	1.6E+01	NA	NA
HQ	NA	NA	1.0E+00	1.0E+00	NA	NA	NA	NA	1.0E+00	1.0E+00	1.0E+00	1.0E+00	NA	NA

Exposure Paramater[3]	value	units
Food Ingestion Rate (FIR	0.08990	kg tissue/day
Soil Ingestion Rate (SIR)	0.0012586	kg soil/day
Plant Ingestion Fraction (F_{food})	0%	Percent
Invertebrate Ingestion Fraction (F_{food})	0%	Percent
Mammal Ingestion Fraction (F_{food})	100%	Percent
Home Range	2471	Acres
Site Use Factor (SUF)	1.00	Unitless
Body Weight (BW)	1.134	kgBW

Microsoft Solver used to calculate ECVs based one re-arranging the standard HQ equation (USEPA, 1997) below:

$$ECV = \frac{HQ \times TRV}{Dose} = \left(\frac{1 \times TRV \times BW}{SIR + (FIR \times BAF) \times SUF} \right)$$

Notes:

soil ECV.

1 bioaccumulation factors (BAFs; kilograms soil per kilogram tissue [kg soil/kg tissue]); from Table 2.

2 exposure parameters from Table 6-3 of the *Human Health and Ecological Risk Assessment Work Plan* (ARCADIS, 2008).

3 dose caluated for a target HQ of 1 (NOAEL and LOAEL based).

4 Low and High ECVs based on low and high TRVs (from Table 4), respectively.

ECV	ecological comparison value for soil.
DTSC	Department of Toxic Substances Control.
dw	dry weight.
High	lowest-observed adverse effects level (LOAEL).
HMW PAHs	high molecular weight polycyclic aromatic hydrocarbons.
kg	kilograms.
kg/day	kilograms per day.
LMW PAHs	low molecular weight polycyclic aromatic hydrocarbons.
Low	no-observed adverse effects level (NOAEL).
mg/kg	milligrams per kilogram.
mg/kg-bw/day	milligrams per kilogram body weight per day.
NA	not available or not applicable.

Table A-9
Ecological Comparison Values Based on the Red-Tailed Hawk and on DTSC-Recommended TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Cobalt mg/kg (dw)		Copper mg/kg (dw)		Lead mg/kg (dw)		Mercury mg/kg (dw)		Molybdenum[4] mg/kg (dw)		Nickel mg/kg (dw)		Selenium mg/kg (dw)	
	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]
Sitewide ECVs														
Soil	9.0E+02	1.8E+03	6.7E+02	4.5E+04	1.7E-02	4.7E+03	2.4E+00	1.1E+01	1.4E+02	1.4E+03	3.7E+02	4.3E+04	3.3E+01	3.9E+02
Plant tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Invertebrate tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Prey (mammal) tissue	8.3E+01	2.1E+02	2.0E+01	3.6E+01	1.8E-01	4.5E+01	4.6E-01	2.1E+00	2.3E+01	2.3E+02	1.2E+01	1.1E+02	2.4E+00	6.2E+00
Bioaccumulation Factors (BAFs)[1]														
Soil-to-Plants	--		--		--		--		--		--		--	
Soil-to-Invertebrates	--		--		--		--		--		--		--	
Soil-to-Mammals	ln(Cm) = 1.307 * ln(Cs) - 4.4669		ln(Cm) = 0.1444 * ln(Cs) + 2.042		ln(Cm) = 0.4422 * ln(Cs) + 0.0761		1.9E-01		0.006 * 50 * Cd		ln(Cm) = 0.4658 * ln(Cs) - 0.2462		ln(Cm) = 0.3764 * ln(Cs) - 0.4158	
Dose Calulations for Target Hazard Quotients (HQs)[2]														
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Dose = TRV	7.6E+00	1.8E+01	2.3E+00	5.2E+01	1.4E-02	8.8E+00	3.9E-02	1.8E-01	2.0E+00	2.0E+01	1.4E+00	5.6E+01	2.3E-01	9.3E-01
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	5.7E-01	5.7E-01	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Table A-9
Ecological Comparison Values Based on the Red-Tailed Hawk and on DTSC-Recommended TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Silver mg/kg (dw)		Thallium mg/kg (dw)		Vanadium mg/kg (dw)		Zinc mg/kg (dw)		LMW PAHs mg/kg (dw)		HMW PAHs mg/kg (dw)	
	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]
Sitewide ECVs												
Soil	1.4E+03	1.4E+04	3.5E+01	3.5E+02	1.6E+02	3.3E+02	5.2E+03	1.4E+05	2.1E+04	2.1E+05	9.0E+03	9.0E+04
Plant tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Invertebrate tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Prey (mammal) tissue	5.7E+00	5.7E+01	3.9E+00	3.9E+01	2.0E+00	4.1E+00	1.4E+02	1.8E+02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bioaccumulation Factors (BAFs)[1]												
Soil-to-Plants	--		--		--		--		--		--	
Soil-to-Invertebrates	--		--		--		--		--		--	
Soil-to-Mammals	4.0E-03		1.1E-01		1.2E-02		ln(Cm) = 0.0706 * ln(Cs) + 4.3632		0.0E+00		0.0E+00	
Dose Calulations for Target Hazard Quotients (HQs)[2]												
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Dose = TRV	2.0E+00	2.0E+01	3.5E-01	3.5E+00	3.4E-01	6.9E-01	1.7E+01	1.7E+02	2.3E+01	2.3E+02	1.0E+01	1.0E+02
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Table A-10
Ecological Comparison Values Based on the Desert Shrew and on DTSC-Recommended TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Antimony mg/kg (dw)		Arsenic mg/kg (dw)		Barium mg/kg (dw)		Beryllium mg/kg (dw)		Cadmium mg/kg (dw)		Chromium mg/kg (dw)		Hexavalent Chromium mg/kg (dw)	
	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]
Sitewide ECVs														
Soil	2.8E-01	2.8E+00	1.1E+01	3.7E+02	2.3E+03	3.7E+03	4.0E+01	4.8E+01	1.5E-02	1.8E+00	3.6E+01	1.5E+02	1.4E+02	5.9E+02
Plant tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.5E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Invertebrate tissue	2.8E-01	2.8E+00	1.3E+00	1.6E+01	2.1E+02	3.3E+02	1.8E+00	2.1E+00	3.0E-01	1.3E+01	1.1E+01	4.4E+01	4.27E+01	1.8E+02
Prey (mammal) tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bioaccumulation Factors (BAFs)[1]														
Soil-to-Plants	--		--		--		--		--		--		--	
Soil-to-Invertebrates	1.0E+00		ln(Ci) = 0.706 * ln(Cs) - 1.421		9.1E-02		4.5E-02		ln(Ci) = 0.795 * ln(Cs) + 2.114		3.1E-01		3.1E-01	
Soil-to-Mammals	--		--		--		--		--		--		--	
Dose Calulations for Target Hazard Quotients (HQs)[2]														
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Dose = TRV	5.9E-02	5.9E-01	3.2E-01	4.7E+00	5.2E+01	8.3E+01	5.3E-01	6.3E-01	6.0E-02	2.6E+00	2.4E+00	9.6E+00	9.2E+00	3.9E+01
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Exposure Paramater[3]	value	units
Food Ingestion Rate (FIR	0.00102	kg tissue/day
Soil Ingestion Rate (SIR)	0.0000203	kg soil/day
Plant Ingestion Fraction (F_{food})	0%	Percent
Invertebrate Ingestion Fraction (F_{food})	100%	Percent
Mammal Ingestion Fraction (F_{food})	0%	Percent
Home Range	0.1	Acres
Site Use Factor (SUF)	1.00	Unitless
Body Weight (BW)	0.005	kgBW

Microsoft Solver used to calculate ECVs based one re-arranging the standard HQ equation (USEPA, 1997) below:

$$ECV = \frac{HQ \times TRV}{Dose} = \left(\frac{1 \times TRV \times BW}{SIR + (FIR \times BAF) \times SUF} \right)$$

Notes:

soil ECV.

1 bioaccumulation factors (BAFs; kilograms soil per kilogram tissue [kg soil/kg tissue]); from Table 2.
2 exposure parameters from Table 6-3 of the *Human Health and Ecological Risk Assessment Work Plan* (ARCADIS, 2008).
3 dose caluated for a target HQ of 1 (NOAEL and LOAEL based).
4 Low and High ECVs based on low and high TRVs (from Table 4), respectively.

ECV ecological comparison value for soil.
DTSC Department of Toxic Substances Control.
dw dry weight.
High lowest-observed adverse effects level (LOAEL).
HMW PAHs high molecular weight polycyclic aromatic hydrocarbons.
kg kilograms.
kg/day kilograms per day.
LMW PAHs low molecular weight polycyclic aromatic hydrocarbons.
Low no-observed adverse effects level (NOAEL).
mg/kg milligrams per kilogram.
mg/kg-bw/day milligrams per kilogram body weight per day.
NA not available or not applicable.

Table A-10
Ecological Comparison Values Based on the Desert Shrew and on DTSC-Recommended TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Cobalt mg/kg (dw)		Copper mg/kg (dw)		Lead mg/kg (dw)		Mercury mg/kg (dw)		Molybdenum mg/kg (dw)		Nickel mg/kg (dw)		Selenium mg/kg (dw)	
	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]
Sitewide ECVs														
Soil	4.2E+01	6.9E+02	2.5E+01	5.8E+03	9.0E+00	7.2E+03	2.1E+00	5.9E+02	2.2E+00	2.2E+01	6.1E-01	1.4E+02	1.8E-01	1.1E+01
Plant tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Invertebrate tissue	5.1E+00	8.5E+01	1.3E+01	3.0E+03	4.7E+00	1.0E+03	1.2E+00	7.9E+00	1.2E+00	1.2E+01	6.4E-01	1.5E+02	2.4E-01	5.7E+00
Prey (mammal) tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bioaccumulation Factors (BAFs)[1]														
Soil-to-Plants	--		--		--		--		--		--		--	
Soil-to-Invertebrates	1.2E-01		5.2E-01		ln(Ci) = 0.807 * ln(Cs) - 0.218		ln(Ci) = 0.3369 * ln(Cs) - 0.078		5.5E-01		1.1E+00		ln(Ci) = 0.733 * ln(Cs) - 0.075	
Soil-to-Mammals	--		--		--		--		--		--		--	
Dose Calulations for Target Hazard Quotients (HQs)[2]														
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Dose = TRV	1.2E+00	2.0E+01	2.7E+00	6.3E+02	1.0E+00	2.4E+02	2.5E-01	4.0E+00	2.6E-01	2.6E+00	1.3E-01	3.2E+01	5.0E-02	1.2E+00
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Table A-10
Ecological Comparison Values Based on the Desert Shrew and on DTSC-Recommended TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Silver mg/kg (dw)		Thallium mg/kg (dw)		Vanadium mg/kg (dw)		Zinc mg/kg (dw)		LMW PAHs mg/kg (dw)		HMW PAHs mg/kg (dw)	
	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]
Sitewide ECVs												
Soil	2.1E+01	2.1E+02	4.1E+00	1.2E+01	3.3E+02	6.6E+02	1.6E-01	1.1E+04	8.0E+01	2.4E+02	2.5E+00	6.2E+01
Plant tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.3E-01	9.0E+00
Invertebrate tissue	4.3E+01	4.3E+02	2.3E+00	6.8E+00	1.4E+01	2.8E+01	4.7E+01	1.8E+03	2.4E+02	7.3E+02	6.4E+00	1.6E+02
Prey (mammal) tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bioaccumulation Factors (BAFs)[1]												
Soil-to-Plants	--		--		--		--		--		--	
Soil-to-Invertebrates	2.0E+00		5.5E-01		4.2E-02		ln(Ci) = 0.328 * ln(Cs) + 4.449		3.0E+00		2.6E+00	
Soil-to-Mammals	--		--		--		--		--		--	
Dose Calulations for Target Hazard Quotients (HQs)[2]												
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Dose = TRV	8.8E+00	8.8E+01	4.8E-01	1.4E+00	4.2E+00	8.3E+00	9.6E+00	4.1E+02	5.0E+01	1.5E+02	1.3E+00	3.3E+01
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Table A-11
Ecological Comparison Values for Merriam's Kangaroo Rat and DTSC-Recommended TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Antimony mg/kg (dw)		Arsenic mg/kg (dw)		Barium mg/kg (dw)		Beryllium mg/kg (dw)		Cadmium mg/kg (dw)		Chromium mg/kg (dw)		Hexavalent Chromium mg/kg (dw)	
	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]
Sitewide ECVs														
Soil	1.2E+01	1.4E+02	6.3E+01	9.3E+02	3.5E+03	5.6E+03	2.3E+01	2.9E+01	1.2E+00	5.4E+02	4.5E+02	1.8E+03	1.7E+03	7.3E+03
Plant tissue	4.2E-01	3.9E+00	2.4E+00	3.5E+01	5.5E+02	8.7E+02	5.9E+00	7.0E+00	7.0E-01	1.9E+01	1.8E+01	7.4E+01	7.1E+01	3.0E+02
Invertebrate tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.6E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Prey (mammal) tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bioaccumulation Factors (BAFs)[1]														
Soil-to-Plants	ln(Cp) = 0.938 * ln(Cs) - 3.233		3.8E-02		1.6E-01		ln(Cp) = 0.7345 * ln(Cs) - 0.5361		ln(Cp) = 0.546 * ln(Cs) - 0.475		4.1E-02		4.1E-02	
Soil-to-Invertebrates	--		--		--		--		--		--		--	
Soil-to-Mammals	--		--		--		--		--		--		--	
Dose Calulations for Target Hazard Quotients (HQs)[2]														
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Dose = TRV	5.9E-02	5.9E-01	3.2E-01	4.7E+00	5.2E+01	8.3E+01	5.3E-01	6.3E-01	6.0E-02	2.6E+00	2.4E+00	9.6E+00	9.2E+00	3.9E+01
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Exposure Paramater[3]	value	units
Food Ingestion Rate (FIR	0.00282	kg tissue/day
Soil Ingestion Rate (SIR)	0.0000677	kg soil/day
Plant Ingestion Fraction (F_{food})	100%	Percent
Invertebrate Ingestion Fraction (F_{food})	0%	Percent
Mammal Ingestion Fraction (F_{food})	0%	Percent
Home Range	0.13	Acres
Site Use Factor (SUF)	1.00	Unitless
Body Weight (BW)	0.0343	kgBW

Microsoft Solver used to calculate ECVs based one re-arranging the standard HQ equation (USEPA, 1997) below:

$$ECV = \frac{HQ \times TRV}{Dose} = \left(\frac{1 \times TRV \times BW}{SIR + (FIR \times BAF) \times SUF} \right)$$

Notes:

soil ECV.

1 bioaccumulation factors (BAFs; kilograms soil per kilogram tissue [kg soil/kg tissue]); from Table 2.

2 exposure parameters from Table 6-3 of the *Human Health and Ecological Risk Assessment Work Plan* (ARCADIS, 2008).

3 dose caluated for a target HQ of 1 (NOAEL and LOAEL based).

4 Low and High ECVs based on low and high TRVs (from Table 4), respectively.

ECV	ecological comparison value for soil.
DTSC	Department of Toxic Substances Control.
dw	dry weight.
High	lowest-observed adverse effects level (LOAEL).
HMW PAHs	high molecular weight polycyclic aromatic hydrocarbons.
kg	kilograms.
kg/day	kilograms per day.
LMW PAHs	low molecular weight polycyclic aromatic hydrocarbons.
Low	no-observed adverse effects level (NOAEL).
mg/kg	milligrams per kilogram.
mg/kg-bw/day	milligrams per kilogram body weight per day.
NA	not available or not applicable.

Table A-11
Ecological Comparison Values for Merriam's Kangaroo Rat and DTSC-Recommended TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Cobalt mg/kg (dw)		Copper mg/kg (dw)		Lead mg/kg (dw)		Mercury mg/kg (dw)		Molybdenum mg/kg (dw)		Nickel mg/kg (dw)		Selenium mg/kg (dw)	
	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]
Sitewide ECVs														
Soil	4.6E+02	7.7E+03	4.5E+02	3.1E+05	2.6E+02	1.1E+05	3.0E+01	1.3E+03	1.2E+01	1.2E+02	2.2E+01	1.1E+04	1.1E+00	2.0E+01
Plant tissue	3.5E+00	5.8E+01	2.2E+01	2.8E+02	6.0E+00	1.8E+02	2.3E+00	1.8E+01	2.9E+00	2.9E+01	1.1E+00	1.2E+02	5.8E-01	1.4E+01
Invertebrate tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Prey (mammal) tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bioaccumulation Factors (BAFs)[1]														
Soil-to-Plants	7.5E-03		ln(Cp) = 0.394 * ln(Cs) + 0.668		ln(Cp) = 0.561 * ln(Cs) - 1.328		ln(Cp) = 0.544 * ln(Cs) - 0.996		2.5E-01		ln(Cp) = 0.748 * ln(Cs) - 2.223		ln(Cp) = 1.104 * ln(Cs) - 0.677	
Soil-to-Invertebrates	--		--		--		--		--		--		--	
Soil-to-Mammals	--		--		--		--		--		--		--	
Dose Calulations for Target Hazard Quotients (HQs)[2]														
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Dose = TRV	1.2E+00	2.0E+01	2.7E+00	6.3E+02	1.0E+00	2.4E+02	2.5E-01	4.0E+00	2.6E-01	2.6E+00	1.3E-01	3.2E+01	5.0E-02	1.2E+00
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Table A-11
Ecological Comparison Values for Merriam's Kangaroo Rat and DTSC-Recommended TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Silver mg/kg (dw)		Thallium mg/kg (dw)		Vanadium mg/kg (dw)		Zinc mg/kg (dw)		LMW PAHs mg/kg (dw)		HMW PAHs mg/kg (dw)	
	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]	Low[4]	High[4]
Sitewide ECVs												
Soil	2.7E+03	2.7E+04	2.1E+02	6.2E+02	1.8E+03	3.5E+03	2.8E+02	9.4E+04	2.4E+04	7.4E+04	9.5E+01	2.8E+03
Plant tissue	3.8E+01	3.8E+02	8.3E-01	2.5E+00	8.5E+00	1.7E+01	1.1E+02	2.7E+03	2.6E+01	4.4E+01	1.4E+01	3.3E+02
Invertebrate tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Prey (mammal) tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bioaccumulation Factors (BAFs)[1]												
Soil-to-Plants	1.4E-02		4.0E-03		4.9E-03		ln(Cp) = 0.554 * ln(Cs) + 1.575		ln(Cp) = 0.4544 * ln(Cs)-1.3205		ln(Cp) = 0.9469 * ln(Cs)-1.7026	
Soil-to-Invertebrates	--		--		--		--		--		--	
Soil-to-Mammals	--		--		--		--		--		--	
Dose Calulations for Target Hazard Quotients (HQs)[2]												
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Dose = TRV	8.4E+00	8.4E+01	4.8E-01	1.4E+00	4.2E+00	8.3E+00	9.6E+00	4.1E+02	5.0E+01	1.5E+02	1.3E+00	3.3E+01
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Table A-12
Ecological Comparison Values Based on the Desert Kit Fox and DTSC-Recommended TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Antimony[4] mg/kg (dw)		Arsenic mg/kg (dw)		Barium[4] mg/kg (dw)		Beryllium[4] mg/kg (dw)		Cadmium mg/kg (dw)		Chromium mg/kg (dw)		Hexavalent Chromium mg/kg (dw)	
	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]
Sitewide ECVs														
Soil	2.1E+01	2.1E+02	2.9E+02	4.5E+03	4.1E+04	6.6E+04	1.9E+02	2.3E+02	1.9E+01	2.3E+03	1.1E+03	5.3E+03	5.0E+03	2.5E+04
Plant tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Invertebrate tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Prey (mammal) tissue	1.1E+00	1.1E+01	8.2E-01	7.7E+00	2.8E+01	4.5E+01	4.3E-01	5.1E-01	1.2E+00	1.1E+01	3.8E+01	1.2E+02	1.2E+02	3.9E+02
Bioaccumulation Factors (BAFs)[1]														
Soil-to-Plants	--		--		--		--		--		--		--	
Soil-to-Invertebrates	--		--		--		--		--		--		--	
Soil-to-Mammals	0.05 * Cd		ln(Cm) = 0.8188 * ln(Cs) -4.8471		0.0075 * Cd		0.05 * Cd		ln(Cm) = 0.4723 * ln(Cs) - 1.2571		ln(Cm) = 0.7338 * ln(Cs) - 1.4599		ln(Cm) = 0.7338 * ln(Cs) - 1.4599	
Dose Calulations for Target Hazard Quotients (HQs)[2]														
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Dose = TRV	5.9E-02	5.9E-01	3.2E-01	4.7E+00	4.2E+01	6.7E+01	2.1E-01	2.4E-01	6.0E-02	2.6E+00	2.4E+00	9.6E+00	9.2E+00	3.9E+01
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	8.1E-01	8.1E-01	3.9E-01	3.9E-01	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Exposure Paramater[3]	value	units
Food Ingestion Rate (FIR	0.07020	kg tissue/day
Soil Ingestion Rate (SIR)	0.0019656	kg soil/day
Plant Ingestion Fraction (F_{food})	0%	Percent
Invertebrate Ingestion Fraction (F_{food})	0%	Percent
Mammal Ingestion Fraction (F_{food})	100%	Percent
Home Range	3039	Acres
Site Use Factor (SUF)	1.00	Unitless
Body Weight (BW)	1.985	kgBW

Microsoft Solver used to calculate ECVs based one re-arranging the standard HQ equation (USEPA, 1997) below:

$$ECV = \frac{HQ \times TRV}{Dose} = \left(\frac{1 \times TRV \times BW}{SIR + (FIR \times BAF) \times SUF} \right)$$

Notes:

soil ECV.

1 bioaccumulation factors (BAFs; kilograms soil per kilogram tissue [kg soil/kg tissue]); from Table 2.

2 exposure parameters from Table 6-3 of the *Human Health and Ecological Risk Assessment Work Plan* (ARCADIS, 2008).

3 dose caluated for a target HQ of 1 (NOAEL and LOAEL based).

4 Low and High ECVs based on low and high TRVs (from Table 4), respectively.

ECV	ecological comparison value for soil.
DTSC	Department of Toxic Substances Control.
dw	dry weight.
High	lowest-observed adverse effects level (LOAEL).
HMW PAHs	high molecular weight polycyclic aromatic hydrocarbons.
kg	kilograms.
kg/day	kilograms per day.
LMW PAHs	low molecular weight polycyclic aromatic hydrocarbons.
Low	no-observed adverse effects level (NOAEL).
mg/kg	milligrams per kilogram.
mg/kg-bw/day	milligrams per kilogram body weight per day.
NA	not available or not applicable.

Table A-12
Ecological Comparison Values Based on the Desert Kit Fox and DTSC-Recommended TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Cobalt mg/kg (dw)		Copper mg/kg (dw)		Lead mg/kg (dw)		Mercury mg/kg (dw)		Molybdenum[4] mg/kg (dw)		Nickel mg/kg (dw)		Selenium mg/kg (dw)	
	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]
Sitewide ECVs														
Soil	3.5E+02	3.4E+03	1.9E+03	6.4E+05	4.4E+02	2.3E+05	3.2E+01	5.1E+02	2.2E+01	2.2E+02	2.0E+01	2.9E+04	5.6E+00	9.2E+02
Plant tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Invertebrate tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Prey (mammal) tissue	2.4E+01	4.7E+02	2.3E+01	5.3E+01	1.6E+01	2.6E+02	6.2E+00	9.9E+01	3.7E+00	3.7E+01	3.2E+00	9.3E+01	1.3E+00	8.6E+00
Bioaccumulation Factors (BAFs)[1]														
Soil-to-Plants	--		--		--		--		--		--		--	
Soil-to-Invertebrates	--		--		--		--		--		--		--	
Soil-to-Mammals	ln(Cm) = 1.307 * ln(Cs) - 4.4669		ln(Cm) = 0.1444 * ln(Cs) + 2.042		ln(Cm) = 0.4422 * ln(Cs) + 0.0761		1.9E-01		0.006 * 50 * Cd		ln(Cm) = 0.4658 * ln(Cs) - 0.2462		ln(Cm) = 0.3764 * ln(Cs) - 0.4158	
Dose Calulations for Target Hazard Quotients (HQs)[2]														
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Dose = TRV	1.2E+00	2.0E+01	2.7E+00	6.3E+02	1.0E+00	2.4E+02	2.5E-01	4.0E+00	1.5E-01	1.5E+00	1.3E-01	3.2E+01	5.0E-02	1.2E+00
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	5.9E-01	5.9E-01	1.0E+00	1.0E+00	1.0E+00	1.0E+00

Table A-12
Ecological Comparison Values Based on the Desert Kit Fox and DTSC-Recommended TRVs

Technical Memorandum 3: Ecological Comparison Values for Metals and PAHs in Soil
PG&E Topock
Needles, California

Protective Media Concentrations (mg/kg)	Silver mg/kg (dw)		Thallium mg/kg (dw)		Vanadium mg/kg (dw)		Zinc mg/kg (dw)		LMW PAHs mg/kg (dw)		HMW PAHs mg/kg (dw)	
	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low[5]	High[5]	Low	High
Sitewide ECVs												
Soil	5.3E+03	5.3E+04	9.7E+01	2.9E+02	2.9E+03	5.8E+03	4.6E+03	4.1E+05	5.0E+04	1.5E+05	1.3E+03	3.3E+04
Plant tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Invertebrate tissue	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Prey (mammal) tissue	2.1E+01	2.1E+02	1.1E+01	3.2E+01	3.6E+01	7.2E+01	1.4E+02	2.0E+02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bioaccumulation Factors (BAFs)[1]												
Soil-to-Plants	--		--		--		--		--		--	
Soil-to-Invertebrates	--		--		--		--		--		--	
Soil-to-Mammals	4.0E-03		1.1E-01		1.2E-02		ln(Cm) = 0.0706 * ln(Cs) + 4.3632		0.0E+00		0.0E+00	
Dose Calulations for Target Hazard Quotients (HQs)[2]												
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Dose = TRV	6.0E+00	6.0E+01	4.8E-01	1.4E+00	4.2E+00	8.3E+00	9.6E+00	4.1E+02	5.0E+01	1.5E+02	1.3E+00	3.3E+01
HQ	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00