Groundwater Record of Decision

Pacific Gas and Electric Company
Topock Compressor Station, Needles, San Bernardino County, California

December 2010

U.S. Department of the Interior

Office of Environmental Policy and Compliance

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Groundwater Record of Decision

Table of Contents

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Groundwater Record of Decision
SWMU 1/AOC 1 and AOC 10
PG&E Topock Compressor Station
Needles, San Bernardino County, California

Part 1: Declaration

United States Department of the Interior

PART 1: THE DECLARATION

A. Site Name and Location

Site Name: Pacific Gas and Electric Company (PG&E) Topock Compressor Station,

CERCLIS Identification Number: CAT080011729

Location: San Bernardino County, California (*See Part 2 – Figure 1*)

B. Statement of Basis and Purpose

This decision document ("Record of Decision" or "ROD") presents the Remedial Action ("Selected Remedy") addressing groundwater contamination resulting from past disposal practices at the PG&E Topock Compressor Station in San Bernardino County, California. The Selected Remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA"), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"). The Selected Remedy was chosen by the United States Department of the Interior ("DOI") on behalf of the U.S. Fish and Wildlife Service ("USFWS"), the Bureau of Land Management ("BLM"), and the Bureau of Reclamation ("Reclamation") (collectively the "Federal Agencies") pursuant to the Federal Agencies' CERCLA lead agency authorities. This decision is based on the Administrative Record file for this site.

The State of California Environmental Protection Agency, Department of Toxic Substances Control ("DTSC"), concurs with the Selected Remedy. DTSC reviewed all site-related documents and identified its preferred alternative in DTSC's draft Statement of Basis. DOI and DTSC have coordinated fully in the selection of a final remedial action and the State concurs with the Selected Remedy.

C. Assessment of Site

The Selected Remedy presented in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Specifically, concentrations of total chromium ("Cr (T)") in groundwater are greater than federal and California regulatory standards and concentrations of hexavalent chromium ("Cr (VI)") in groundwater exceed background levels. The groundwater risk assessment has concluded that Cr (VI) is present in groundwater at concentrations that pose an unacceptable risk to human health if the groundwater were to be used as a drinking water source.

D. Description of Selected Remedy

The Selected Remedy was identified as "Alternative E – In Situ Treatment with Fresh Water Flushing" in the Corrective Measures Study/Feasibility Study ("CMS/FS") conducted for the site (*See Part 2 – Figure 2*). The Selected Remedy includes:

- Construction of an In-Situ Reactive Zone ("IRZ") along National Trails Highway using a line of wells that may be used as both injection and extraction wells to circulate groundwater and distribute an organic carbon source to promote bacteriological reduction of the Cr (VI) to trivalent chromium ("Cr (III)").
- Flushing accomplished through a combination of potable water injection and injection of carbon amended water in wells upgradient of the plume.
- Extraction wells near the Colorado River to provide hydraulic capture of the plume, accelerate cleanup of the floodplain, and enhance the flow of contaminated groundwater through the IRZ line.
- Bedrock extraction wells in the eastern (downgradient) end of the East Ravine to provide hydraulic capture of contaminated groundwater in bedrock. Extracted water will be treated and managed using the same active treatment system that will be used to treat and manage contaminated groundwater extracted from the Alluvial Aquifer.
- Institutional controls to restrict surface land uses and prevent the use of groundwater.
- Monitored natural attenuation as *a long term* component to address residual Cr (VI) that may remain in recalcitrant portions of the aquifer after *in-situ* treatment.

A more detailed description of the Selected Remedy is presented in Section L of the Decision Summary of this ROD.

E. Statutory Determinations

The Selected Remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

The Selected Remedy also satisfies the statutory preference for treatment as a principal element of the remedy.

Because the Selected Remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unrestricted use, a statutory review will be conducted within five years after initiation of remedial action, and every five years thereafter until cleanup standards are achieved to ensure that the remedy is, or will be, protective of human health and the environment.

PG&E Topock Compressor Station – Groundwater ROD

G. Data Certification Checklist

The following information is included in the Record of Decision:

1. Chemicals of concern ("COCs") and their respective concentrations…...Section G
2. Baseline risk represented by the COCs……..……Section G
3. Cleanup levels established for COCs and the basis for these levels……..Section H
4. How source materials constituting principal threats will be addressed….Section D
5. Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD……..Section F
6. Potential land and groundwater use that will be available at the site as a result of the Selected Remedy……..Section F
7. Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected……...Section L
8. Key factor(s) that led to selecting the remedy……..……..Section L

H. Authorizing Signature

Rhea S. Suh
Assistant Secretary for Policy, Management and Budget
U.S. Department of the Interior

1/20/11
Date

Groundwater Record of Decision
PG&E Topock Compressor Station
Needles, California

Part 2: Decision Summary

United States Department of the Interior

PART 2: THE DECISION SUMMARY

The Decision Summary describes the Selected Remedy, explains how the remedy fulfills statutory and regulatory requirements, and provides a substantive summary of the Administrative Record file that supports the remedy selection decision.

A. Site Name, Location, and Description

Pacific Gas and Electric Company ("PG&E") Topock Compressor Station, Needles, CA

The PG&E Topock Compressor Station (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, in the north end of the Chemehuevi Mountains [*See Figure 1*]. The Compressor Station occupies approximately 15 acres of a 65-acre parcel of PG&E-owned land. The PG&E property is surrounded by the Havasu National Wildlife Refuge (the "Refuge") and lies directly south of land managed by BLM and under the jurisdiction of the DOI [*See Figure 2*].

The Compressor Station is not listed as a National Priorities List ("NPL") site. The site is listed in the U.S. Environmental Protection Agency's ("EPA") Comprehensive Environmental Response, Compensation and Liability Information System – CERCLIS EPA ID No. CAT080011729.

B. Site History and Enforcement Activities

PG&E began operations at the Compressor Station in December 1951 to compress natural gas supplied from the southwestern United States for transport through pipelines to PG&E's service territory in central and northern California. Historic records indicate that PG&E held rights to operate a gas pipeline and compressor station dating back to the Federal Act of 2/25/1920 (41 Stat. 449, as amended). Based on available title records, PG&E gained full ownership of the land in 1965.

Current operations at the Compressor Station are very similar to the operations that occurred from the start of facility operations in 1951. The operations consist of six major activities: compression of natural gas, cooling of the compressed natural gas and compressor lubricating oil, water conditioning, wastewater treatment, facility and equipment maintenance, and miscellaneous operations. The greatest use of chemical products involves treatment of cooling water, and the greatest volume of waste produced consists of blowdown from the cooling towers.

From 1951 to 1985, Cr (VI) based corrosion inhibitors and biocides were added to the cooling water. Several different corrosion inhibitors were used during this period; however, all are believed to have contained Cr (VI). Product specification sheets available for one of the additives indicate that it contained 30 percent sodium chromate.

In the early 1960s, a separate biocide containing Cr (VI) was also apparently added to assist in the control of algae, fungi, and/or bacteria.

Until approximately 1970, cooling tower blowdown was discharged directly into percolation beds located in Bat Cave Wash, an unlined arroyo immediately west of the Compressor Station, and either percolated into the ground or evaporated at the surface. Wastewater discharged to percolation beds consisted primarily of cooling tower blowdown (about 95%) and a minor volume of effluent from an oil/water separator and other facility maintenance operations (about 5%). Beginning in 1964, PG&E treated the cooling tower blowdown to remove chromium prior to discharge. Around 1970, PG&E began discharging treated cooling tower blowdown to four single-lined evaporation ponds located approximately ½ mile southwest of the Compressor Station. PG&E replaced the Cr (VI)-based cooling water treatment products with phosphate-based products in 1985. Use of the four, single-lined evaporation ponds continued until 1989. In 1989, the single-lined ponds were replaced with four new, Class II (double-lined) ponds, located approximately 1.2 miles to the northwest. The cooling tower blowdown treatment system and the single-lined ponds were physically removed and clean-closed from 1988 to 1993. The four Class II double-lined ponds, which are on BLM-managed property, are still in use and are operated pursuant to a permit issued by the State of California Regional Water Quality Control Board, Colorado River Basin Region (PG&E 2009).

Previous Groundwater Actions

In 1988, PG&E completed a soil investigation in the Bat Cave Wash area at the request of the California Department of Health Services (now known as DTSC) and the EPA. The soil investigation documented chromium releases to the environment. In 1989, a "Comprehensive Ground Water Monitoring Evaluation" prepared by the California Regional Water Quality Control Board identified chromium releases in groundwater.

By letter dated May 29, 1995, PG&E reported the presence of chromium in groundwater samples taken on the east side of Bat Cave Wash near the north boundary of the PG&E facility. In response, on February 26, 1996, DTSC and PG&E executed a Corrective Action Consent Agreement ("CACA") pursuant to State law under which DTSC directed PG&E to perform a "RCRA Facility Investigation" ("RFI") and a Corrective Measures Study ("CMS") as well as certain "Interim Measures" determined to be necessary to address immediate or potential threats to human health and/or the environment.

In 2003, the Federal Agencies notified PG&E that it was a potentially responsible party ("PRP") pursuant to Section 107 of CERCLA, 42 U.S.C. § 9607, as an owner and operator of a facility from which hazardous substances had been released into the environment. As the CERCLA lead agency for land under its jurisdiction, custody, or control, DOI initiated negotiations with PG&E on an administrative order by which PG&E would implement a remedial investigation and feasibility study ("RI/FS") and other response actions pursuant to Section 104 of CERCLA, 42 U.S.C. § 9604. In July of 2005, the Federal Agencies and PG&E entered into an Administrative Consent

Agreement under which PG&E agreed to implement an RI/FS and certain removal actions, as directed and approved by the Federal Agencies, to protect public health or welfare or the environment from hazardous substances on or under land under the Federal Agencies jurisdiction. Pursuant to the terms of the Administrative Consent Agreement, the parties agreed to coordinate, to the extent practicable, CERCLA response actions with actions required by DTSC pursuant to the requirements of the CACA. In particular, the parties agreed to coordinate the CERCLA RI/FS with the RFI and CMS required under the CACA, and to coordinate any CERCLA removal actions selected by DOI with any Interim Measures required by DTSC.

In the course of the groundwater investigation at the site, PG&E has documented an extensive plume of groundwater contaminated with Cr (VI) that stretches from the PG&E facility under the Refuge and lands managed by BLM toward the Colorado River. On February 3, 2004, PG&E reported concentrations of Cr (VI) of 111 parts per billion ("ppb") in groundwater taken from monitoring well MW34-80 located on BLM-managed property within 100 feet of the Colorado River.

Based on this finding, DTSC ordered PG&E to prepare and submit Interim Measures ("IM") Work Plan No. 2 (“IM No. 2”) "to immediately begin pumping, transport and disposal of groundwater from existing monitoring wells at the MW20 cluster." These monitoring wells located on or near the "MW20 bench" are on BLM-managed lands. By Action Memorandum issued March 3, 2004, BLM selected a time-critical removal action under CERCLA and directed PG&E to implement this action, consistent with IM No. 2, to prevent or abate the release of Cr (VI) into the Colorado River. The scope of this removal action was to extract contaminated groundwater from existing or, if necessary, new wells to maintain a landward hydraulic gradient and ensure that Cr (VI) did not reach the Colorado River.

On May 20, 2004, BLM issued a second Action Memorandum selecting a subsequent time-critical removal action and authorizing PG&E to operate, for a limited period of time, a batch treatment system on the MW20 bench. The purpose of this removal action was to reduce the volume of hazardous waste being shipped offsite by allowing treatment of contaminated groundwater onsite prior to offsite transport and disposal as non-hazardous waste.

On September 17, 2004, BLM issued a third Action Memorandum, in coordination with DTSC, authorizing PG&E to install conveyance piping, monitoring wells, and associated needed improvements to roads to facilitate the implementation of a larger-scale groundwater treatment system (known as “IM No. 3”) that DTSC directed PG&E to install and operate on land acquired by PG&E.

C. Community Participation

Community Involvement Plan

The Federal Agencies prepared and issued a Community Involvement Plan ("CIP") in accordance with the requirements of CERCLA and the NCP, and the CIP is included in the Administrative Record file and information repositories. The CIP serves as a guide for DOI to inform, include, and engage community members, environmental groups, government officials, the media, and other interested parties in the environmental assessment and cleanup activities at this Site.

The Revised Final RCRA Facility Investigation and Remedial Investigation Report, Volume 2 - Hydrogeological Characterization and Results of Groundwater and Surface Water Investigations Report ("RFI/RI Report") was made available to the public in February 2009. The Final Groundwater Corrective Measures Study/Feasibility Study Report for SWMU 1/AOC 1 and AOC 10 ("CMS/FS Report") was made available to the public in December 2009. These documents are included in the Administrative Record and may be found in the information repositories maintained at the Needles Public Library, Lake Havasu City Library, Parker Public Library, Chemehuevi Indian Reservation, Colorado River Indian Tribes Public Library, and the Golden Shores/Topock Station Library.

The Proposed Plan identifying the Federal Agencies preferred alternative was issued for public review and comment on June 4, 2010. The public comment period was held from June 4, 2010 to July 19, 2010. Public meetings to present the Proposed Plan and to solicit oral and written public comments were held on June 22 at the Parker Community/Senior Center in Parker California, on June 23 at the Lake Havasu Aquatic Center in Lake Havasu City, Arizona, on June 29 at the Needles High School in Needles, California, and on June 30 at the Topock Elementary in Topock, Arizona.

Comments received from the public and DOI's responses to those comments are included within the Responsiveness Summary of this ROD (Part 3).

Coordination with DTSC Community Outreach

In addition to specific community involvement activities regarding the evaluation of a preferred alternative, DOI has and will continue to coordinate with DTSC on the following site-specific community participation activities.

- Participation in the Consultative Workgroup ("CWG")

The CWG is an outreach effort initiated by DTSC in 2000. The CWG is made up of representatives of agencies and stakeholders interested in participating in the investigation of Site contamination and development and evaluation of measures to protect human health and the Colorado River and surrounding environment. The CWG

meets regularly to discuss project activities and plans. The Federal Agencies have participated in the CWG since 2003.

- Participation in the Clearinghouse Task Force ("CTF")

The CTF was formed by DTSC in 2008 to develop and implement processes and tools to improve communications and enhance stakeholder understanding of project technical and regulatory information. The goal is to foster timely and effective project management and decision making for the final remedy. The CTF communicates progress to the Topock Leadership Partnership and the CWG, and integrates feedback and direction from these groups into process improvement efforts.

- Communication with Tribal Leadership and Senior Management of Stakeholders at Key Decision Points

DTSC and DOI have implemented a process to reach out to affected tribes and stakeholders to engage tribal leaders and senior management at key decision points in the cleanup process. The Topock Leadership Partnership ("TLP") comprises senior officials (or their authorized representatives) acting in their official capacities. The purpose of the TLP is to exchange information relating to the development, evaluation, selection, and implementation of remedial and corrective action at the Topock site.

Tribal Consultation

Nine federally-recognized Native American tribes - the Chemehuevi Indian Tribe, Cocopah Tribe of Arizona, Colorado River Indian Tribes, Fort Mojave Indian Tribe, Havasupai Indian Tribe, Hualapai Indian Tribe, Quechan Tribe of the Fort Yuma Indian Reservation, Twenty-Nine Palms Band of Mission Indians, and Yavapai-Prescott Tribe (hereinafter "the tribes") - have ties to the area in which the Selected Remedy will be implemented. The federal government has a trust responsibility to these tribes and has consulted with the tribes on the CERCLA RI, the CERCLA FS, and the Proposed Plan, including on a government-to-government basis throughout the groundwater remedy selection process. The BLM also represents the Federal Agencies for purposes of consulting with the tribes pursuant to Section 106 of the National Historic Preservation Act ("NHPA"), and other federal laws and Executive Orders, concerning potential adverse effects on cultural and historic properties that may result from the Selected Remedy.

As the development of CERCLA remedial action alternatives was initiated, the BLM determined that the evaluation, selection, and implementation of a groundwater remedy for the Topock site constitutes an "undertaking" as defined by the NHPA. The NHPA Section 106 process seeks to accommodate historic preservation concerns with the needs of Federal undertakings through consultation among the agencies and other parties, including tribes. The goal of the consultation is to identify historic properties potentially affected by the undertaking, assess the undertaking's effects, and seek ways to avoid, minimize or mitigate any adverse effects on historic properties.

In 2008, the BLM initiated consultation with the tribes, the Advisory Council on Historic Preservation ("ACHP"), the California State Historic Preservation Office ("SHPO"), the Arizona SHPO, and PG&E to develop a Programmatic Agreement ("PA"), as described in 36 CFR §800.14(b), to establish a management framework for consultation under the NHPA. The PA was determined by the parties to be an appropriate vehicle for fulfilling Section 106 consultation responsibilities given the long term nature of remedial action addressing groundwater at the site and the anticipated need to provide for ongoing consultation as new information is developed through the design and implementation of remedial action.

On March 11, 2010, BLM initiated consultation with nine tribes concerning the DOI Proposed Plan. The Proposed Plan was provided to all Topock Project Tribal Executives, Tribal Cultural Resource Management Staff, and California and Arizona SHPO in advance of that public review and comment period as part of the ongoing tribal government consultation for the CERCLA remedy selection undertaking. Tribal comments were accepted through July 19, 2010. Responses to the tribal comments are also included within the Responsiveness Summary of this ROD.

In November of 2010, the BLM, USFWS, ACHP, the SHPOs, and PG&E executed a PA. In developing the PA, the signatories, in consultation with the tribes, determined that the Selected Remedy has the potential to adversely affect historic properties that have been listed in or determined eligible for the National Register of Historic Places, including, but not limited, to the Topock Maze (Locus A), portions of US Route 66, the Atlantic and Pacific Railroad Right-of-Way, certain archaeological sites, as well as certain geoglyphs. The signatories also determined that historic and cultural properties on public lands administered by BLM and the Havasu National Wildlife Refuge managed by USFWS are subject to the requirements of the NHPA, the Archaeological Resources Protection Act, the American Indian Religious Freedom Act, the Native American Graves Protection and Repatriation Act, and applicable Executive Orders concerning consultation regarding the protection of sensitive cultural and historic resources.

The PA recognizes that adverse effects to cultural and historic properties resulting from implementation of the Selected Remedy should be avoided, minimized, or mitigated to the extent practicable, provided that the Selected Remedy protects human health and the environment, attains applicable or relevant and appropriate requirements ("ARARs"), and complies fully with all CERCLA and NCP requirements. In the CMS/FS Report, DOI determined that substantive mitigation measures identified through consultation and adopted by DOI were ARARs that would need to be attained by any remedy selected for the site.

While certain measures contained in the PA to protect cultural and historic properties are unrelated to the CERCLA cleanup or otherwise exceed what is required of the Selected Remedy to satisfy ARARs, the PA does identify certain mitigation measures to mitigate adverse effects resulting from the Selected Remedy that are ARARs. For example, the PA provides that existing monitoring wells and related facilities will be used in

implementing the Selected Remedy to the extent practicable, and that new facilities will be placed in areas already disturbed, to the extent practicable and consistent with protecting human health and the environment and achieving cleanup objectives in a timely manner. The PA also provides that if the Selected Remedy affects a previously unidentified cultural or historic resource, including human remains or associated funerary objects or graves, work in the immediate vicinity of the discovery will cease until a resolution is determined of how to treat the discovery. The PA requires BLM to notify the tribes and parties to the PA of the nature and location of the discovery and to implement appropriate measures to protect the discovery from further disturbance until treatment of the discovery is resolved.

In addition, the PA requires, to the extent practicable, that areas, excluding the Topock Compressor Station and related facilities, affected by implementation of the Selected Remedy be restored to conditions that existed prior to implementation of CERCLA response actions at the site once site remedial action objectives are attained. Specifically, the PA provides that facilities related to the Selected Remedy be removed as soon as practicable upon a determination by DOI that removal of such facilities is protective of human health and the environment. The PA specifies that the removal of such facilities take place along existing graded roads to the extent practicable, in consultation with the tribes and the parties to the PA.

Finally, the PA recognizes that, because the final design of the Selected Remedy will differ from, or include greater detail than, its conceptual design, ongoing consultation with the tribes, PG&E, the SHPOs, and the ACHP will be necessary. Toward that end, the PA establishes a consultation protocol that will be utilized to implement consultation with the tribes and other parties as the Selected Remedy is designed and implemented to identify additional potential adverse effects on cultural and historic properties and evaluate means to avoid, minimize, or mitigate such effects.

D. Scope and Role of Response Action

DTSC is the state lead agency overseeing cleanup at the Compressor Station pursuant to the State's authority to regulate the treatment, storage, and disposal of, and require corrective action to clean up, contaminants classified as hazardous waste pursuant to the Resource Conservation and Recovery Act ("RCRA"), 42 U.S.C. §§ 6901 et seq. DOI is the lead federal agency overseeing response actions addressing the release of hazardous substances on or from land under its jurisdiction, custody, or control near the Compressor Station pursuant to CERCLA.

Investigative and remedial activities at the Compressor Station date back to the 1980s with the identification of Solid Waste Management Units ("SWMUs") through a RCRA facility assessment. Closure activities of former hazardous waste management facilities at the Compressor Station were performed from 1988 to 1993. The RFI began in 1996 when DTSC and PG&E executed a CACA, and numerous phases of data collection and evaluation have been performed as of the date of this ROD. Since 2005, investigative

and remedial activities have been performed in accordance with the requirements of both RCRA and CERCLA

PG&E completed the *Revised Final RCRA Facility Investigation and Remedial Investigation Report, ("RFI/RI") Volume 1 – Site Background and History* ("RFI/RI Volume I Report") in August 2007 and DTSC and DOI approved it later in 2007. The RFI/RI Volume 1 Report contains information on Compressor Station operations; history; and descriptions of SWMUs, Areas of Concern ("AOCs"), and other undesignated areas.

The *Revised Final RCRA Facility Investigation and Remedial Investigation Report, Volume 2 - Hydrogeological Characterization and Results of Groundwater and Surface Water Investigations* ("RFI/RI Volume II Report") was completed in February 2009 and was approved by DTSC and DOI in 2009. The RFI/RI Volume 2 Report contains information on the hydrogeologic characterization and results of groundwater, surface water, pore water, and river sediment investigations to evaluate and characterize the nature and extent of groundwater contamination resulting from the past discharge of wastewater from the Compressor Station.

In November 2009, PG&E completed the *Final Human Health and Ecological Risk Assessment of Groundwater Impacted by Activities at Solid Waste Management Unit (SWMU) 1/Area of Concern (AOC) 1 and SWMU 2, Topock Compressor Station, Needles, California* ("GWRA"). The GWRA evaluated potential risks to human health and ecological receptors associated with groundwater affected by past discharges to supplement the RFI/RI Volume 2 Report. The GWRA provides information to assist risk management decision making about the constituents of concern ("COCs") in groundwater and risk-based concentrations of those constituents. DTSC and DOI approved the GWRA in December 2009.

In December 2009, PG&E completed the *Final Groundwater Corrective Measures Study/Feasibility Study Report for SWMU 1/AOC 1 and AOC 10 at the Pacific Gas and Electric Company* (PG&E), Topock Compressor Station ("CMS/FS Report"). The purpose of the CMS/FS Report was to identify and evaluate groundwater remedial alternatives and to provide the basis for the identification of a preferred alternative to address the defined objectives for the remedial action.

Subsequent to the RFI/RI Volume 2 and Volume 2 Addendum, PG&E completed additional hydrogeologic and groundwater characterization activities in the East Ravine. The additional hydrogeologic and groundwater characterization in the East Ravine has been incorporated into the conceptual site model for the Selected Remedy and was included as an addendum to the CMS/FS Report.

Following completion of additional soil investigations at the site, PG&E will prepare RFI/RI Volume 3. RFI/RI Volume 3 will include final soil and sediment characterization data to complete the RFI/RI requirements to fully characterize the nature and extent of contamination resulting from Compressor Station operations, including the results of investigations of the other SWMUs, AOCs, and undesignated areas. To supplement

RFI/RI Volume 3, PG&E will also prepare a risk assessment that evaluates potential risks to human and ecological receptors that could be exposed to contaminants in soils and other media at the other AOCs and undesignated areas at the Compressor Station. A separate CMS/FS and/or an addendum to this CMS/FS Report will be prepared for additional media and SWMUs/AOCs at the Compressor Station, if appropriate, based on the conclusions and recommendations in RFI/RI Volume 3 and the associated risk assessment.

E. Site Characteristics

Conceptual Site Model

To determine whether constituents are present in groundwater at levels that may potentially pose an unacceptable risk to human health or the environment, a conceptual site model was developed to identify the populations that potentially may be exposed to those constituents in groundwater and determine the pathways by which the exposures may occur. *Figure 3*, published in the GWRA, presents the conceptual site model for the Topock groundwater.

Regional Aquifer Characteristics

The Topock site is situated at the southern (downstream) end of the Mohave Valley groundwater basin, which is in the basin-and-range geologic province. While alluvial groundwater in the northern and central area of the valley is recharged primarily by the Colorado River, most of this groundwater discharges back to the river in the southern area, above where the Alluvial Aquifer thins near the entrance to Topock Gorge.

Site Aquifer Characteristics

The hydrogeologic conditions of the site described below are summarized from the RFI/RI Volume 2 Report, Volume 2 Addendum, and the Final Groundwater CMS/FS Report. The site is located at the southern downstream end of the Mohave Valley groundwater basin. Groundwater in the Mohave Basin occurs in the Tertiary and younger alluvial fan and fluvial deposits. The unconsolidated alluvial and fluvial deposits are underlain by the Miocene Conglomerate and pre-Tertiary metamorphic and igneous bedrock. The bedrock typically has lower permeability; therefore groundwater movement occurs primarily in the overlying unconsolidated deposits. In the Mohave groundwater basin, water-bearing zones may occur locally where bedrock formations are weathered or fractured, although no areas have been identified where saturated bedrock formations are capable of yielding significant quantities of groundwater.

Groundwater occurs under unconfined to semi-confined conditions within the alluvial fan and fluvial sediments beneath most of the site. The alluvial sediments consist primarily of clayey/silty sand and clayey gravel deposits inter-fingered with more permeable sand and gravel deposits. The alluvial deposits exhibit considerable variability in hydraulic

conductivity between fine- and coarse-grained sequences. The fluvial sediments similarly consist of interbedded sand, sandy gravel, and silt/clay. The fluvial deposits at the site include the older Pleistocene deposits as well as more recent fluvial deposits associated with the Colorado River. The saturated portion of the alluvial fan and fluvial sediments are collectively referred to as the Alluvial Aquifer. *Figure 4* presents a schematic cross-section to illustrate the hydrogeologic setting between the Compressor Station and the Colorado River. In the floodplain area adjacent to the Colorado River, the fluvial deposits interfinger with and are hydraulically connected to the alluvial fan deposits. The interface between alluvial and fluvial units occurs near the western edge of the floodplain. The Topock Compressor Station is located on an upland alluvial terrace near the southern edge of the Alluvial Aquifer where the aquifer pinches out against the underlying, sloping bedrock.

As shown in *Figure 4*, the water table in the Alluvial Aquifer is flat and typically equilibrates to an elevation within 2 to 3 feet of the river level. On the basis of the variable topography, the depth to groundwater ranges from as shallow as 5 feet below ground surface ("bgs") in the floodplain to approximately 170 feet bgs at the upland alluvial terrace areas. The saturated thickness of the Alluvial Aquifer is about 100 feet in the floodplain and thins to the south, pinching out along the Miocene Conglomerate and bedrock outcrops. In the western portions of the site, where the depth to bedrock increases, the saturated Alluvial Aquifer is over 200 feet thick.

Under natural conditions, groundwater in the Alluvial Aquifer flows from west-southwest to east-northeast across the site. Localized areas of northward flow likely occur along the mountain front to the south of the compressor station. Gradients are very small due to the limited recharge, with a typical value of 0.0005 foot/foot in the alluvial area. Under average conditions, groundwater velocity ranges from about 25 to 46 feet/year, according to numerical model estimates. Gradients are upward between bedrock and the overlying Alluvial Aquifer and typically, but not universally, upward within the Alluvial Aquifer.

Additional hydrogeologic data collected from February through July 2009 for the East Ravine groundwater investigation refined the site hydrogeologic conceptual model presented in the RFI/RI Volume 2, specifically mapping bedrock structure and the bedrock/Alluvial Aquifer contact, and characterizing hydraulic properties, groundwater gradient and flow, and groundwater quality in bedrock. Groundwater occurs in the bedrock formations underlying and south of the East Ravine. The water table in the bedrock units equilibrates to an approximate elevation similar to the water table present in the Alluvial Aquifer. Testing and monitoring shows that groundwater in fractured bedrock is in hydraulic communication with the Alluvial Aquifer. Compared to the Alluvial Aquifer, the fractured rock permeabilities are overall very low. Additional characterization of bedrock groundwater in the East Ravine is ongoing.

The groundwater in the alluvium and shallow bedrock directly beneath the Topock site is derived mostly from the relatively small recharge from the nearby mountains. Mineral content of site groundwater is variable but is mostly brackish water with total dissolved solids ("TDS") between 1,000 and 15,000 milligram per liter (mg/l). In general, TDS

content increases with depth, with the highest TDS concentrations found in the deepest alluvial and bedrock wells. The TDS concentration in fluvial groundwater increases with distance away from the river and with depth, becoming similar to alluvial groundwater quality in deeper fluvial wells west of the floodplain.

As alluvial groundwater approaches the river, its elevation and hydraulic gradient become increasingly influenced by fluctuations in river level. Dam operations on the Colorado River cause the river level to fluctuate on daily and seasonal cycles. Groundwater levels in monitoring wells completed in the floodplain follow the same cycles. Alluvial groundwater naturally discharges to the river during lower river stages in fall and winter, whereas the river recharges the alluvial groundwater system during the spring and summer months. Since 2004, the IM No. 3 groundwater extraction and treatment system has maintained a consistent year-round landward gradient in the area in the floodplain.

Under non-pumping conditions, as alluvial groundwater flows through the organic-rich fluvial floodplain sediments bordering and underlying the river, the groundwater chemistry becomes more reducing, with reduced oxygen content, Cr (VI) converted to Cr (III), nitrate converted to ammonia and detectable manganese and iron observed. Decay of organic material in the river deposits created the reducing conditions, which in turn supports microbial communities that maintain the reduced conditions. Based on sampling and analysis of fluvial deposits and river sediments, reducing conditions were observed at all tested floodplain locations near the river and in all tested river sediments. In some of the older and deeper fluvial sediments, oxidizing (i.e., non-reducing) conditions prevail, owing to a relative shortage of organic carbon at depth; however, those non-reduced zones appear to be separated from the river by zones of fluvial sediments with reducing conditions.

The presence of reducing conditions in the floodplain area serves as a natural barrier to Cr (VI) migration to the river and will be discussed later. Cr (VI) in alluvial groundwater is chemically reduced (i.e., transformed) into Cr (III) in the presence of reducing conditions. Cr (III) is much less mobile and poses much less risk than does Cr (VI). The presence of this natural barrier is an important component of the selected groundwater remedy described in this ROD.

Cultural Resources

The Topock site lies within a larger area of traditional cultural importance and spiritual significance to some tribes in the area. Thousands of years of human history are evident in the area surrounding the Compressor Station. Among the larger and better-known cultural resources on the site is an expansive desert geoglyph or intaglio known as the Topock Maze. Although the Maze is viewed as one contiguous element of a larger area having unique value to some tribes, archaeological documents refer to three geographically-distinct parts, two of which overlie the groundwater plume. Prominent historic-era features, several of which intrude upon the Maze and also overlie the groundwater plume, include segments of historic U. S. Route 66, the National Trails Highway, and the right-of-way of the Atlantic and Pacific/Atchison, Topeka and Santa Fe

Railroad. A broad spectrum of archaeological resources is also present within the project site and on adjacent lands. Properties on and near the project site that are listed in the National Register of Historic Places include Native American cultural resources and elements of the historic "built environment."

Biological Resources

The Topock site is located adjacent to and partially on the Refuge managed by USFWS. The Refuge was established in 1941 to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people.

The dominant plant communities at the site consist of creosote bush scrub (generally west of National Trails Highway) and salt cedar (generally between National Trails Highway and the Colorado River and at the mouth of Bat Cave Wash). These plant communities support a variety of common wildlife species and have provided habitat for several species that are currently designated as threatened or endangered by state and federal endangered species acts.

Federally listed species that occur on the Refuge include the southwestern willow flycatcher (*Empidonaz traillii extimus*), the desert tortoise (Mohave population) (*Gopherus agassizii*), the Yuma clapper rail (*Rallus longirostris yumanensis*), the Colorado pikeminnow (*Ptychocheilus lucius*), the razorback sucker (*Xyrauchen texanus*), and the bonytail chub (*Gila elegans*). Some of the state-listed species that occur on the Refuge include western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), the Gila woodpecker (*Melanerpes uropygialis*), the elf owl (*Micrathene whitneyi*), and Arizona Bell's vireo (*Vireo bellii arizonae*).

The contamination pathway from AOC 1 leads from upland terrestrial/wash habitat to the confluence of Bat Cave Wash with the Colorado River. At this point, there is a salt cedar (Tamarix spp.) thicket that is saturated with water year-round. This salt cedar thicket provides some southwestern willow flycatcher habitat on the Refuge on the west bank of the Colorado River. This habitat has likely functioned as a sink for sediment deposition over time. In addition, the Refuge is charged with protecting wildlife and wildlife habitat for species other than threatened and endangered species. The habitat in and around the Topock site is suitable for bighorn sheep, bobcats, chuckwallas, red-tailed hawks and other mammals, reptiles, and birds. Observations of mountain lion activity have been reported in this area as well.

Groundwater Characterization

The current information regarding groundwater characterization at the Topock site is based on an extensive investigation, sampling, and monitoring program with data collected from July 1997 to the present. Multiple phases of drilling and hydrogeologic investigations have been conducted to characterize site hydrogeology, groundwater conditions, and the nature and extent of Contaminants of Potential Concern ("COPCs") in groundwater. These investigations included the installation and sampling of 112

groundwater monitoring wells at 53 locations (including 27 individual well clusters) to support the RFI/RI groundwater characterization. As part of IM implementation during November 2003 through April 2006, seven groundwater test and extraction wells and two injection wells were installed. *Figure 2* shows the location of monitoring wells used in the characterization of groundwater at the site.

The RFI/RI groundwater data include analytical results for a wide variety of chemicals constituents and parameters including Cr (VI), Cr (T), specific conductance, pH, copper, nickel, zinc, lead, total petroleum hydrocarbons ("TPH"), and general chemistry parameters (including total dissolved solids TDS, chloride, fluoride, sulfate, nitrate, and other parameters), Title 22 trace metals, volatile organic compounds ("VOCs"), semivolatile organic compounds ("SVOCs"), polychlorinated biphenyls ("PCBs"), perchlorate, and radionuclides. Field water quality parameter data (specific conductance, temperature, pH, oxidation-reduction potential, and dissolved oxygen) were also collected during the routine groundwater sampling and are stored in the project analytical database.

Background concentrations for trace metals in groundwater, including Cr (T), have been calculated for the Topock site, and are reported in PG&E's *Revised Groundwater Background Study, Steps 3 and 4: Report of Results*. The groundwater background study was completed to assess the range of naturally occurring background concentrations of Cr (VI), Cr (T), and 17 other trace metals in groundwater near the PG&E Topock site and surrounding region. Six rounds of groundwater samples were collected from 25 wells near the PG&E Topock Site over a one-year period. The calculated Upper Tolerance Limits ("UTLs") are deemed tentative background concentrations. This means that if concentrations above this value are found in the future, a closer examination of the local geochemical environment would be necessary to determine whether the sample is natural or anthropogenic in nature.

Based on the characterization data presented in the RFI/RI report, the COPCs in groundwater related to SWMU 1/AOC 1 are Cr (T), Cr (VI), molybdenum, selenium, and nitrate. Only Cr (T) and Cr (VI) exhibit defined groundwater plumes. Molybdenum, selenium, and nitrate occur at concentrations exceeding background levels in localized areas. The Cr (VI) groundwater plume extends from the former percolation beds in Bat Cave Wash to the floodplain area north of the railroad tracks (*See Figure 2*). The existing dimensions of the plume exceeding natural background levels underlie an area that is approximately 175 acres. The volume of contaminated groundwater in the Alluvial Aquifer is currently estimated to be approximately 1.50 billion gallons (approximately 4,600 acre-feet). Nearly all of the Cr (VI) releases to alluvial groundwater at the site are believed to have occurred during the 1951 to 1964 period when untreated wastewater from the compressor station was discharged to Bat Cave Wash. Within the plume, Cr (VI) is typically present at all depth intervals of the alluvial portion of the aquifer, but is generally limited to deep wells in the fluvial portion of the aquifer near the river. As discussed earlier, reducing conditions have been documented in most shallow to mid-depth fluvial wells and sediments near and underlying the river. South of the railroad tracks, these reducing conditions are also encountered in deep wells

near and beneath the river. Under non-pumping conditions, as Cr (VI) migrates in groundwater from non-reducing conditions in the alluvial and deep fluvial sediments to reducing conditions near and beneath the river, it undergoes chemical reduction and transforms to Cr (III), which is immobilized in the sediments, as evidenced by its absence in groundwater samples collected from fluvial wells screened in reducing material.

The results of five rounds of groundwater sampling (April-September 2008) in monitoring wells installed in Arizona on the opposite side of the Colorado River have shown that Cr (VI) and Cr (T) are not present at concentrations above background levels in all eight monitoring locations east of the river.

Cr (VI) is also present within the Miocene conglomerate and pre-tertiary metadiorite bedrock formations east and southeast of the Topock Compressor Station. Cr (VI) concentrations in bedrock groundwater appear to be limited in extent to shallow and to a much lesser extent, mid-depth intervals. Currently, investigation data suggest Cr (VI) greater than or equal to 32 µg/L in the shallow and mid-depth wells extends approximately 1,500 feet east southeast of the compressor station, however, investigations of the extent of contamination in the East Ravine are ongoing. The mass of Cr (VI) in bedrock likely represents less than one percent of the total plume mass due to the low porosity of these bedrock formations.

Cr (VI) is relatively stable under the non-reducing conditions of the Alluvial Aquifer beneath the uplands portions of the Topock site. Once Cr (VI) encounters a sufficiently reducing geochemical environment, as found in portions of fluvial materials in the floodplain, it quickly reverts to Cr (III). CR (III) is essentially immobile except under specific pH or other conditions not present at the Topock site. Strongly-reducing geochemical conditions are observed in groundwater in most of the fluvial deposits along the Colorado River floodplain. Reducing conditions in floodplain areas of the site are derived from organic carbon in the younger fluvial deposits. Groundwater in the shallow bedrock of the East Ravine area is notably less reducing, presumably due to the stronger hydraulic communication with alluvial groundwater and/or surface runoff. Wherever the natural reducing capacity of the fluvial material is present, chromium is converted to its stable form of Cr (III) and is essentially immobile. The reducing conditions in the fluvial sediments provide a natural geochemical barrier that would, at the very least, greatly limit the movement of Cr (VI) in groundwater through the fluvial sediments adjacent to and beneath the Colorado River. Calculations suggest that there is sufficient capacity within the floodplain and beneath the river in the Alluvial Aquifer to reduce at least a significant portion of the Cr (VI) plume were the plume to come in contact with these sediments.

Surface Water Characterization

Since July 1997, surface water samples were collected from up to 43 surface water sampling locations. Water quality sampling was conducted at up to 18 surface water monitoring locations along the Colorado River during the RFI/RI. The current surface water monitoring program in place since 2005, includes routine surface water sample collection from nine shoreline locations and nine in-channel stations at specific depths in

the Colorado River (*Figure 5*). Since 2005, River Monitoring Program ("RMP") events have been conducted quarterly during most of the year and monthly during low river stages (typically November through January). Prior to 2005, RMP events typically were performed quarterly. Surface water samples have also been collected during one-time events, such as during the pore water study in January 2006. Samples have been analyzed for chromium, trace metals, general chemistry parameters, stable isotopes, and perchlorate. The chemical-specific ARARs for surface water are the Federal Water Pollution Control Act, California Toxics Rule, and the drinking water MCLs as defined in the California and federal Safe Drinking Water Acts.

None of the average PCOC concentrations for the samples from the shoreline, in-channel, and pore water study surface water locations exceed the most conservative chemical-specific surface water ARAR. Parameters were detected upstream and downstream of the site at similar frequencies and similar concentrations. There was no discernable difference between COPC results in samples collected upstream or downstream of Bat Cave Wash in the Colorado River. Based on data collected during the monitoring period of the RFI/RI, no site-related contamination of surface water was observed.

Pore Water Sampling

Pore water samples have been collected from up to 70 pore water locations underneath the Colorado River. These samples were collected from two one-time events in February 2003 and January 2006 at depths of 2 and 6 feet below the bottom of the Colorado River. The analytical suite included chromium and general chemistry parameters. Objectives for the pore water and sediment sampling included assessing chromium concentrations in pore water and determining whether geochemical conditions in shallow sediments below the Colorado River favored chromium reduction. Cr (VI) was not detected in any of the pore water samples. Cr (T) was detected in the 2003 sampling event in pore water samples from three locations at trace concentrations around 1 µg/L, well below the California surface water quality criteria of 50 µg/L. Cr (T) was not detected in pore water in the 2006 sampling event.

River Sediment Sampling

Colorado River sediment samples were collected from up to 18 locations. These samples were collected from two one-time events in February 2003 and December 2005, at depths ranging from the surface to 2 or 3 feet below the bottom of the Colorado River. The analytical suite included chromium and general chemistry parameters. Along with the pore water samples from the pore water study, the sediment sampling results were used in a multiple lines of evidence approach to determine whether geochemical conditions in shallow sediments below the Colorado River favored chromium reduction. Cr (T) concentrations did not exceed sediment quality guidelines and Cr (VI) was not detected in sediment samples.

F. Current and Potential Future Land and Water Uses

Land Uses

The Compressor Station occupies approximately 15 acres of a 65-acre parcel of PG&E-owned land. The surrounding area includes land owned and/or managed by a number of government agencies and private entities including the BLM, Reclamation, USFWS, San Bernardino County, California Department of Transportation, Burlington Northern Santa Fe Railroad, Metropolitan Water District of Southern California, and the Fort Mohave Indian Tribe.

The Compressor Station property is immediately surrounded by the Refuge. Recreational activities at the Refuge include sightseeing, bird watching, fishing, hunting, and canoeing. All areas within the Refuge and outside the Compressor Station are currently accessible for some or all of these activities and are expected to remain accessible in the future.

Other land uses in the area are predominantly open space, interspersed with industrial facilities, recreational uses, and transportation infrastructure. Open space near the Compressor Station is characterized primarily by sparse desert vegetation on steep, rocky slopes. The area is bisected by several steep-sided ephemeral streams, including Bat Cave Wash and several unnamed washes that flow north to the confluence of the Colorado River. Open space along the Colorado River floodplain is characterized by shifting sand dunes and associated riparian vegetation, primarily non-native tamarisk (salt cedar).

The nearest communities are mobile home parks at Topock, Arizona and Moabi Regional Park, California. Topock is located on the Arizona (or eastern) side of the Colorado River, about 0.5 mile east-northeast of the Compressor Station. Moabi Regional Park is located on the California (or western) side of the Colorado River about 1 mile northwest of the Compressor Station. The community of Golden Shores, Arizona, the largest nearby community, is located approximately 5 miles north of the Compressor Station on the east side of the Colorado River.

A major gas utility and transportation corridor is located within the project site. This corridor includes six natural gas transmission pipelines, the Burlington Northern Santa Fe Railway, and the Interstate 40 freeway. Other developed land uses within the project site include National Trails Highway, former Route 66, and various unnamed access roads. A former gravel quarry is located approximately 1,500 feet southwest of the Compressor Station. Evaporation ponds associated with the Compressor Station operations are located approximately 3,000 feet west of the Compressor Station. In addition, an interim remedial measures groundwater treatment plant and numerous groundwater well clusters are located near the Compressor Station.

Current land uses at the site are likely to remain the same for the foreseeable future. PG&E plans to continue owning and operating the Compressor Station and associated

property as an industrial operation for the foreseeable future. The railroad and highway will also continue in their current use for the foreseeable future. The primary conservation mission of USFWS, as it applies to the Refuge, limits human use of the Refuge property. In the future, human use of the Refuge property will likely continue to be restricted to recreational uses. Although current uses of the BLM-managed land in the area are predominantly recreational, BLM has determined that residential use of some of this property cannot be precluded.

Groundwater and Surface Water Uses

Groundwater affected by or in the vicinity of the Cr (VI) groundwater plume currently is not used as a drinking water supply. The nearest groundwater supply wells in California are located approximately 1.3 miles west-northwest of the plume at the Park Moabi Marina. Groundwater supply wells are also located at private residences south of the Topock Marina on the eastern side of the Colorado River approximately 0.3 mile east-southeast of the eastern extent of the plume.

Given that the BLM has determined that the possibility of residential use of property overlying or adjacent to the plume area cannot be precluded, the possibility of future development of the groundwater aquifer as a drinking water supply was considered in the risk assessment and feasibility study and as a part of this decision document.

The Colorado River, located adjacent to and east of the Cr (VI) plume, is a major source of water for irrigation, drinking, and other uses by humans and wildlife. The closest downstream supply intake is located approximately 21 river miles downstream of the railroad bridge over the Colorado River. The Colorado River also supports recreational uses of swimming, boating, and fishing. In addition, the Colorado River provides essential habitat and supports various plant and wildlife species, including threatened or endangered species. It is expected that use of the Colorado River as a major source of water for irrigation, drinking, and other uses by humans and wildlife will remain the same for the foreseeable future.

G. Summary of Site Risks

CERCLA requires that remedial action selected by the CERCLA lead agency must protect human health and the environment from current and potential threats posed by releases of hazardous substances into the environment. The GWRA was completed to assist risk management decision-making by quantitatively evaluating COPCs in groundwater and determining whether the COPCs are potential threats to human health or the environment. The GWRA was conducted in accordance with governing USEPA and DTSC guidance and was reviewed and approved by DOI and DTSC. The COPCs that are related to the facility and are identified as potential risks to human or ecological receptors are identified as COCs that then become the focus of the remedial action objectives and remedial alternatives. The GWRA developed the conceptual site model, including identified sources of groundwater contamination, potential transport

mechanisms, potential exposed receptors and exposure pathways, and potential exposure point concentrations for impacts by activities at SWMU 1/AOC 1 and SWMU 2. The key conclusions of the GWRA, for purposes of defining objectives for this remedial action, are:

- The potential transport of constituents in groundwater to the Colorado River represents an insignificant transport pathway; floodplain COPCs are not being transported to the Colorado River at concentrations that exceed screening-level surface water criteria.

- There are no current direct or indirect complete exposure pathways for human contact with impacted site groundwater; thus, there are no human populations currently at risk of adverse health effects due to groundwater at the Topock site.

- There is no significant ecological exposure pathway for contact with impacted site groundwater; thus, there are no ecological receptors currently at risk of adverse effects due to the presence of COPCs in groundwater.

- Due to the possibility of future development of the groundwater as a drinking water supply, the GWRA included a quantitative risk characterization of future hypothetical human groundwater users that may be exposed to site groundwater in a residential setting. Both child and adult future hypothetical residential groundwater users were considered. Potential exposure through ingestion and dermal contact while bathing and showering was evaluated. Potential cumulative cancer risks and non-cancer hazard indices were estimated for all COPCs, including the constituents that were not related to SWMU 1/AOC 1. The risk characterization concluded that:

    - Cr (VI) is present in site groundwater at concentrations that could pose a potential hazard to the future hypothetical human groundwater user, if the groundwater were to be developed as a potable source of water in the future (*Table 1*). Based on the results of the risk estimates and the fact that the presence of Cr (VI) is related to historical releases from SWMU 1/AOC 1, Cr (VI) is a COC for this remedial action.

    - The calculated noncarcinogenic risk-based remediation goal for Cr (VI) is 46 µg/L based on the hypothetical child receptor.

The GWRA determined that other COPCs either were not associated with SWMU 1/AOC 1 and/or are not present in site groundwater at levels of potential concern to human health or the environment. DTSC and DOI, however, concluded that although the non-cancer hazards associated with molybdenum, selenium and nitrate are much lower than those associated with Cr (VI), these constituents do have risks above a hazard index of 1 and they do contribute to a hazard quotient greater than 1 at localized areas within the plume. For example, Cr (VI) contributed 95% to the combined Cr (VI),

molybdenum, selenium, and nitrate hazard index. DTSC directed PG&E to continue monitoring molybdenum, selenium, and nitrate and to consider their associated impacts in future soil and soil to groundwater risk evaluations.

H. Remedial Action Objectives

The objectives of this remedial action are defined based on the conclusions of the GWRA and ARARs identification. The Remedial Action Objectives ("RAOs") are intended to provide a general description of the cleanup objectives and to provide the basis for the development of site-specific remediation goals.

The RAOs for groundwater in this remedial action are to:

1. Prevent ingestion of groundwater as a potable water source having Cr (VI) in excess of the regional background concentration of 32 µg/L Cr (VI).
2. Prevent or minimize migration of Cr (T) and Cr (VI) in groundwater to ensure concentrations in surface water do not exceed water quality standards that support the designated beneficial uses of the Colorado River (11 µg/L Cr (VI)).
3. Reduce the mass of Cr (T) and Cr (VI) in groundwater at the site to achieve compliance with ARARs in groundwater. This RAO will be achieved through the cleanup goal of the regional background concentration of 32 µg/L of Cr (VI).
4. Ensure that the geographic location of the target remediation area does not permanently expand following completion of the remedial action.

I. Description of Alternatives

The remedial alternatives to address contaminated groundwater at the Site were evaluated in the CMS/FS Report and are presented below. The alternatives are identified with letters to correspond with the description of the alternatives within the CMS/FS Report.

Generally, Alternatives A and B would not include any active treatment or other measures to remove Cr (VI) from groundwater. Alternatives C, D, and E would rely primarily on treating the Cr (VI) underground (also known as "in-situ" treatment) by injecting a carbon food source into the aquifer to "feed" the naturally-occurring bacteria thereby accelerating the change of Cr (VI) to Cr (III) by enhancing the naturally occurring biological conditions that transform contaminants. Alternative F would extract contaminated groundwater and treat it above-ground using an industrial treatment plant. Alternatives G and H would combine in-situ treatment with above-ground treatment. Alternative I would continue the existing Interim Measure currently in place by which limited volumes of water are extracted and treated using an existing above-ground treatment facility.

Provided below is a more specific description of each alternative. In the section that follows ("Comparative Analysis of Alternatives"), the alternatives are compared using

the nine remedy selection criteria required by CERCLA. As explained in that section, Alternative E was the Preferred Alternative presented in the Proposed Plan and is the alternative chosen as the Selected Remedy in this ROD.

Alternative A: No Action

Regulations governing CERCLA response action generally require that the "no action" alternative be evaluated to establish a baseline for comparison. Under the No Action alternative, no active construction, operational, or monitoring activities would occur. There would be no active treatment to reduce chromium concentrations in groundwater. While natural processes converting Cr (VI) to Cr (III) would continue to occur within the river sediments near the Colorado River, there would be no government restrictions on the use of groundwater in locations where concentrations exceed cleanup levels for the foreseeable future. No additional groundwater monitoring facilities would be constructed under this alternative, nor would any ongoing sampling or well maintenance activities be conducted to monitor concentrations of contaminants in groundwater or in the Colorado River.

Estimated Capital Cost: $0
Estimated Time to Achieve RAOs: 220-2,200 years

Alternative B – Monitored Natural Attenuation ("MNA")

No active treatment to reduce Cr (VI) concentrations in groundwater would occur under this alternative. This alternative would rely only on the naturally occurring organic conditions in the shallow groundwater areas of the Site near the river to convert and remove Cr (VI) from groundwater. Restrictions on the use of groundwater in the area of the plume would be maintained during the remediation period. The existing groundwater monitoring network would potentially be enhanced with additional monitoring wells, and the monitoring program of routine sampling, analysis, and reporting would occur until the cleanup goals are attained.

Estimated Net Present Value: $25,000,000 - $54,000,000
Estimated Time to Achieve RAOs: 220-2,200 years

Alternative C – High volume In-situ Treatment

Alternative C would involve active in-situ groundwater treatment through distribution of an organic carbon food source (such as whey) through high volume injection through a minimum number of wells installed primarily in previously disturbed areas. The organic carbon would be injected to enhance natural biological conditions that convert Cr (VI) to immobile Cr (III) thereby removing it from groundwater. This alternative would be implemented in two phases: the first phase would treat the plume edge nearest the river, and the second phase would treat the interior of the plume through installation of a limited number of wells.

Estimated Net Present Value: $119,000,000 - $255,000,000
Estimated Time to Achieve RAOs: 10 to 60 years

Alternative D – Sequential In-situ Treatment

Under this alternative, treatment of the plume would be accomplished through injection of carbon using wells within the interior of the plume to convert Cr (VI) to insoluble Cr (III), which would remove chromium from groundwater. Treatment would be implemented in several sequential phases involving construction of approximately 12 lines of injection and extraction wells to distribute the carbon food source over the entire plume.

Estimated Net Present Value: $118,000,000 - $254,000,000
Estimated Time to Achieve RAOs: 10 to 20 years

Alternative E – In-situ Treatment with Fresh Water Flushing

Alternative E would involve flushing to push the plume through an In-Situ Reactive Zone ("IRZ") located along National Trails Highway. Flushing would be accomplished through a combination of fresh water injection and injection of carbon-amended water in wells to the west of the plume. This alternative would also include using extraction wells in the area near the Colorado River to capture and control the plume, accelerate cleanup of the floodplain, and flush the groundwater with elevated Cr (VI) through the treatment zone. Additional extraction wells would be located in an area northeast of the Compressor Station where the flushing efficiency from injection wells alone is relatively poor. Water extracted from the near-river wells and wells northeast of the Compressor Station would be treated with the carbon food source and the water would be reinjected west of and within the Cr (VI) plume.

Estimated Net Present Value: $92,000,000 - $198,000,000
Estimated Time to Achieve RAOs: 10 to 110 years

Alternative F – Pump and Treat

This alternative would involve pumping groundwater, construction and operation of an above-ground treatment system to remove chromium from the extracted groundwater, and reinjection of the treated water back to the aquifer.

Estimated Net Present Value: $187,000,000 - $401,000,000
Estimated Time to Achieve RAOs: 15 to 150 years

Alternative G – Combined Floodplain In-situ / Pump and Treat

This alternative would combine floodplain cleanup by in-situ treatment, with treatment of the uplands portion of the plume by pumping groundwater, construction and operation of

an above-ground treatment plant to remove chromium from the extracted groundwater, and reinjection of the treated water back into the aquifer. The floodplain cleanup would involve construction of in-situ treatment zones at National Trails Highway and between National Trails Highway and the Colorado River.

Estimated Net Present Value: $177,000,000 - $380,000,000
Estimated Time to Achieve RAOs: 10 to 90 years

Alternative H – Combined Upland In-situ / Pump and Treat

This alternative would combine in-situ treatment in the upland portions of the plume, with pump-and-treat technology in the floodplain (consisting of pumping groundwater, above-ground treatment to remove chromium from the extracted groundwater, and reinjection of the treated water back into the aquifer). This alternative differs from Alternative G by relying on an in-situ treatment zone as the dominant feature of the cleanup rather than pump and treat.

Estimated Net Present Value: $127,000,000 - $273,000,000
Estimated Time to Achieve RAOs: 10 to 70 years

Alternative I – Continued Operation of Interim Measure Groundwater Treatment

This alternative would involve continued operation of the current Interim Measure Groundwater Treatment Plant as the final remedial action at the site. The plant includes a pump and treat system that extracts groundwater and utilizes chemical reduction, precipitation, and filtration to remove Cr (VI). The Interim Measure system would operate with the existing equipment with existing procedures using the existing process at the existing flow rate until RAOs are attained.

Estimated Net Present Value: $186,000,000 - $398,000,000
Estimated Time to Achieve RAOs: 100 to 960 years

Addressing Chromium in Bedrock in East Ravine

The development of a hydraulic containment and treatment system for groundwater in the bedrock was evaluated in conjunction with alternatives C, D, E, F, G, and H instead of developing and evaluating a separate range of remedial alternatives to attain RAOs in the East Ravine bedrock. East Ravine bedrock groundwater would be addressed through natural attenuation in alternatives A and B.

For alternatives C through H, hydraulic containment would involve pumping from a group of wells near the eastern end of the East Ravine. The assumed location for these wells from a hydraulic and infrastructure perspective would be along the former National Trails Highway. For alternative I, hydraulic containment would be through the existing Interim Measure pump and treat system. The approach for management and treatment of groundwater extracted from the bedrock would vary depending on the alternative. The

quantity of extracted bedrock groundwater would be minor relative to alluvial groundwater. For Alternatives C, D, and E, bedrock groundwater would be amended with a carbon food source and reinjected in the alluvial aquifer along with amended alluvial groundwater. For alternatives F, G, H, and I, extracted bedrock groundwater would undergo above ground treatment with extracted alluvial groundwater. For alternative B, bedrock groundwater would be monitored to assure that the Cr (VI) is changed by natural conditions and that there is no adverse effect to the Colorado River.

If it is determined that additional measures are needed to achieve RAOs in the East Ravine bedrock, other technologies will be evaluated and adopted as necessary through a ROD Amendment or Explanation of Significant Differences ("ESD"), to supplement the pumping wells. In addition to pumping for hydraulic control, technologies that may be applicable to East Ravine bedrock groundwater may include, but are not limited to, freshwater injection for flushing and injection of carbon amendments for in-situ treatment of Cr (VI).

Common Elements and Distinguishing Features of Each Alternative

Alternative C (High Volume In-situ Treatment) and Alternative D (Sequential In-situ Treatment) and Alternative E (In-situ Treatment with Freshwater Flushing) all rely on in-situ treatment technology. In contrast to Alternative E, however, the in-situ treatment concept for Alternatives C and D involves distributing carbon throughout the plume, while Alternative E involves flushing the plume toward an established in-situ reductive zone. Both concepts have technical challenges that can be overcome. Alternative E provides in-situ treatment with fewer wells but more pipelines than Alternatives C and D. Generation of in-situ treatment byproducts would be considerably less with Alternative E than with Alternatives C and D because the in-situ component of Alternative E would only be applied along National Trails Highway and in a limited area around each of the upland injection wells. Overall, a much smaller fraction of the aquifer would become reduced with Alternative E than with Alternatives C and D. In comparison to Alternative D, Alternative E would involve construction primarily in previously disturbed areas, thereby resulting in less grading and construction of fewer access roads.

In comparison to Alternatives F, G, H, and I that include ex-situ treatment, Alternative E is substantially more cost-effective and would result in substantially fewer effects to the community, workers, and environment. Alternatives F, G, and H require the construction of a large aboveground treatment plant with a high level of energy requirements that would generate waste byproducts to be transported offsite with associated energy use and traffic hazards. Alternatives F, G, H, and I would generate waste byproducts from an ex-situ treatment plant that would require long-term monitoring and containment after the RAOs at the site are attained.

J. Comparative Analysis of Alternatives

This section summarizes the comparative analysis of the alternatives considered for remediating contaminated groundwater at the site performed in the CMS/FS Report. The alternatives were evaluated against nine criteria, as set forth in the NCP (§300.430(f)), comprising two "threshold" criteria, five "balancing" criteria, and two "modifying" criteria. These criteria include: (1) Overall Protection of Human Health and the Environment, (2) Compliance with ARARs, (3) Long-term Effectiveness and Permanence, (4) Reduction of Toxicity, Mobility, or Volume through Treatment, (5) Short-term Effectiveness, (6) Implementability, (7) Cost, (8) State Acceptance, and (9) Community Acceptance.

Overall Protection of Human Health and the Environment

Alternative A would not satisfy the threshold criterion for protecting human health and the environment because there would be no institutional controls imposed to restrict use of groundwater in locations where Cr (VI) concentrations exceed the cleanup goals, and there would be no monitoring to evaluate changes in geochemical conditions near the river over the long time period required to reach the cleanup goals. Alternatives B through I were found to satisfy the threshold criterion of protecting human health and the environment. Alternatives C, D, E, F, G, and H were ranked high for this criterion; these alternatives would all provide for protection of human health from exposure due to use of groundwater as a drinking water supply in both the short term and long term. These alternatives would also provide additional certainty for river protection as a result of floodplain cleanup (mass removal in the floodplain and establishment of a geochemical barrier) as the initial step in implementation and/or through hydraulic control. Alternatives B and I ranked medium for this criterion primarily because of the long time required to attain cleanup goals, which would require long-term use of institutional controls, as well as the uncertainty about the robustness of the natural geochemical conditions near the river over this relatively long time for Alternative B, and the high level of operation and maintenance for Alternative I.

The historic practice of wastewater discharge to Bat Cave Wash and the use of Cr (VI) at the site have been eliminated. Therefore, sources of wastewater discharge and Cr (VI) have been controlled. However, the historical source of contaminated groundwater in bedrock at East Ravine has not yet been determined, and the evaluation of whether leaching of Cr (VI) from contaminated soils represents a significant transport pathway to groundwater has not yet been completed. There is no distinction between the alternatives with respect to this criterion.

Compliance with Applicable or Relevant and Appropriate Requirements

Applicable or Relevant and Appropriate Requirements ("ARARs") identified by DOI for the Topock site in the CMS/FS Report are provided in Table 2.

Alternatives A, B, and I were determined not to satisfy all identified ARARs. Specifically, these alternatives did not satisfy the "reasonable time frame" requirement established by the California State Water Resources Control Board Resolution 92-49. This Resolution requires that the remedial action have "a substantial likelihood to achieve compliance, within a reasonable time frame, with the cleanup goals and objectives" established for a site. The CMS/FS Report determined that Alternatives C, D, E, F, G and H would comply with this ARAR.

The CMS/FS Report identified a number of statutes established to protect cultural, historic, or religious values as sources of ARARs for the Topock Site. Broadly speaking, these statutes require that a federal agency identify and consider the effects of an undertaking on cultural and historic properties and evaluate measures, through consultation, to avoid, minimize, or mitigate any adverse effects that otherwise would result from the undertaking. Some of these statutes have more specific or prescriptive requirements that must be satisfied when specific circumstances are present. As a threshold matter, the CMS/FS Report found that none of the alternatives would be unable to satisfy the ARARs derived from these statutes. As the Selected Remedy is designed and implemented, DOI will continue to consult with the tribes and other parties to ensure that these ARARs are satisfied.

As described previously in the Tribal Consultation section of this ROD, the PA executed by the BLM, USFWS, ACHP, SHPOs, and PG&E establishes certain mitigation measures that the Selected Remedy will be required to attain. As the Selected Remedy is designed and implemented, the Federal Agencies will continue to engage in consultation with the tribes, ACHP, SHPOs, and others to identify potential effects on cultural and historic properties and to evaluate measures to avoid, minimize, or mitigate any adverse effects, thereby ensuring that the Selected Remedy satisfies these ARARs.

With respect to any remedial action to be undertaken within the Refuge, the National Wildlife System Administration Act has been identified as an ARAR. This statute governs the use and management of National Wildlife Refuges, requiring that ongoing and proposed activities and uses on a Refuge are appropriate and compatible with both the mission of the National Wildlife Refuge System, as well as the specific purposes for which a Refuge was established. Any remedial action proposed on the Refuge is subject to the formal appropriate use/compatibility determination process. Accordingly, prior to the selection of a remedial action by DOI/USFWS, the Refuge Manager must find the remedial action to be both an appropriate use of the Refuge and compatible with the mission of the Refuge and the Refuge System as a whole. In addition, the Endangered Species Act ("ESA") has been identified as an ARAR for this site. As the Selected Remedy is designed and implemented, DOI will continue to consult with USFWS to ensure that proposed activities remain appropriate and compatible with the Refuge mission and that the requirements of the ESA are satisfied.

Long-Term Protectiveness and Permanence

Alternative A (No Action) ranked the lowest of all alternatives because this alternative does not include institutional controls to preclude future groundwater use nor would it provide for monitoring to verify the effectiveness of natural attenuation processes and to determine when the RAOs have been achieved. Any future changes in site conditions that may cause undesirable impacts to the Colorado River or unacceptable exposures to other receptors would not be detected under Alternative A. Alternative B ranked medium because, in contrast to Alternative A, Alternative B would include monitoring and institutional controls; however, this alternative would rely on natural attenuation to convert Cr (VI) to Cr (III), and while the reducing conditions have been shown to be robust, there is no way to prove that these conditions exist everywhere. Over the centuries that would be required for MNA to reach cleanup goals, it is possible that the geochemistry or groundwater flow directions, or even the location of the Colorado River channel, could change significantly.

Alternatives F, G, H, and I all ranked medium for long-term effectiveness, permanence, and reliability. These alternatives included ex-situ treatment that would generate waste requiring land disposal of treatment residuals at an offsite, permitted landfill. Such off-site disposal would require long-term containment, management, and monitoring that would not be required by in-situ treatment alternatives.

Alternatives C, D, and E ranked medium-high for this criterion. While there is uncertainty regarding the ability to distribute substrates across the targeted area, and Alternative E relies on flushing to remove contaminants from the upland portion of the aquifer, comparatively few long-term controls would be required for these alternatives following attainment of cleanup goals.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternatives F, G, and I ranked high for this criterion because the toxicity, mobility, and volume of Cr (VI) would be reduced throughout the plume. Byproducts from in-situ treatment would be expected to be localized to the reducing zone formed by the IRZ and within the range of naturally occurring concentrations found at the site but could remain temporarily elevated above baseline and background concentrations in some portions of the aquifer. For these reasons, Alternatives C, D, E, and H ranked medium high. Byproducts from ex-situ treatment would be managed through disposal at an offsite, permitted disposal facility. Alternatives A and B ranked medium because the amount of plume destroyed or treated would be less certain due to the passive nature of treatment and the extent and average capacity of the floodplain area to naturally reduce Cr (VI) over time.

Short-Term Effectiveness

Timeliness of the remedy and protection of the community, workers, and environment during remedy implementation were the factors considered in evaluating short term

effectiveness. Taking these factors into consideration, Alternative B ranked medium because of the minimal footprint but relatively long time to cleanup. Alternatives C and E ranked medium-low because of the comparatively shorter remediation period and relatively limited construction and operational activities that would occur primarily in previously disturbed areas. Alternatives A, D, F, G, H, and I received a low ranking for short-term effectiveness. Alternative A ranked low primarily because of the extensive time to cleanup with no controls during the remedial period. Alternatives F, G, H, and I ranked low as a result of construction and operation of an aboveground treatment plant and the greater amount of construction, aboveground visual impact, worker/operator presence onsite, electrical power requirements, and trucking requirements for chemical delivery and waste transportation and disposal. Alternative D ranked low primarily because the location of remedial facilities would not be limited to previously disturbed areas and because of the need for subsequent additional disturbance from grading, road construction, facility construction, and operation and maintenance.

Implementability

Alternatives A and B ranked high for implementability because Alternative A involved no remedial action, and the only remedial activities associated with Alternative B were monitoring well construction and maintenance and administration of institutional controls. Alternative I also ranked high because the system has been shown to be technically implementable over the years it has operated. Alternatives D, E, F, G, and H ranked medium because while these alternatives are administratively implementable, there would be technical challenges associated with the active treatment processes. Alternative E requires additional approvals from landowners and associated water agencies for the water supply well and pipeline. Alternative C ranked low for this criterion because of the relatively more complex technical challenges associated with balancing reductant delivery and hydraulic containment of the plume, as well as construction within Bat Cave Wash.

Cost

The costs of each alternative are estimated to a level of accuracy of +50 to -30 percent, consistent with the preliminary nature of the design development (approximately 2 to 5 percent design development). The table below summarizes the estimated present value and nominal (total lifetime alternative) costs for the remedial alternatives. The costs for Alternatives A and B were the lowest; therefore, these alternatives ranked high in cost-effectiveness. Alternatives C, D, E, and H were the next most costly; therefore, these alternatives ranked medium in cost-effectiveness. Alternatives F, G, and I were the most expensive of the alternatives and therefore ranked low in cost effectiveness.

Alternative Cost Summary

Description	Net Present Value	Nominal Costs
Alternative A—No Action	$0	$0
Alternative B—Monitored Natural Attenuation	$25,000,000 - $54,000,000	$513,000,000
Alternative C—High Volume In-situ Treatment	$119,000,000 - $255,000,000	$206,000,000
Alternative D—Sequential In-situ Treatment	$118,000,000 - $254,000,000	$191,000,000
Alternative E—In-situ Treatment with Freshwater Flushing	$92,000,000 - $198,000,000	$184,000,000
Alternative F—Pump and Treat	$187,000,000 - $401,000,000	$443,000,000
Alternative G—Combined Floodplain In-situ/Pump and Treat	$177,000,000 - $380,000,000	$329,000,000
Alternative H—Combined Upland In-situ/Pump and Treat	$127,000,000 - $273,000,000	$225,000,000
Alternative I—Continued Operation of Interim Measure	$186,000,000 - $398,000,000	$2,030,000,000

State Acceptance

This criterion considers the degree to which the State of California agrees with DOI's analyses and recommendations as described in the Proposed Plan and supporting documentation. DTSC reviewed all site-related documents and identified its preferred alternative in DTSC's draft Statement of Basis. DOI and DTSC have coordinated fully in the selection of a final remedial action, and the State concurs with the Selected Remedy.

Community Acceptance

The RFI/RI Report, CMS/FS Report, and Proposed Plan were made available to the public in July 2010 and all are available in the Administrative Record file located at the BLM Lake Havasu Field Office and the information repositories found at the Chemehuevi Indian Reservation Environmental Protection Office, the Colorado River Indian Tribes Library, the Golden Shores/Topock Station Library, and the Lake Havasu City Library. A public comment period was held June 4, 2010 to July 19, 2010. DOI's response to all comments received during this period is included in the Responsiveness Summary.

K. Principal Threat

The GWRA concluded that Cr (VI) is the principal threat present in groundwater at concentrations that could pose a potential hazard to the future hypothetical groundwater user, if the groundwater were to be used as a source of drinking water. All of the alternatives would eventually address the principal threat by reducing Cr (VI) concentrations in groundwater to acceptable levels, but they vary substantially in the amount of time and disturbance required. All of the alternatives, except Alternative A, would rely on the use of institutional controls until RAOs were achieved to ensure that exposure pathways were not created during the remedial process. Alternative A did not include institutional controls and therefore presented the possibility of future exposure to human populations in residential setting prior to attainment of cleanup goals. Alternatives B through I included institutional controls; however Alternatives B and I were considered less protective than Alternatives C, D, E, F, G, and H because they would require a considerably longer time period to achieve RAOs, and therefore required a longer period over which institutional controls would be maintained. Alternatives C through G were all considered equally protective in this regard.

With regard to verifiable river protection, Alternatives C, D, E, F, G and H were considered equally protective. Alternative I ranked lower than Alternatives C through H because of the considerably longer time until cleanup goals were achieved. Existing data show that concentrations in surface water collected from the Colorado River, both upgradient and downgradient of the site, both before and after implementation of the interim measure, are below water quality standards that support the designated uses of the Colorado River (CH2M HILL, 2009a), and the groundwater risk assessment concluded that the potential transport of constituents in groundwater to the Colorado River represents an insignificant transport pathway (ARCADIS, 2009). The two alternatives that relied on natural processes to convert Cr (VI) to Cr (III) (Alternatives A and B) presented some uncertainty about protection of the river in the long term because there was no way to prove that the reducing conditions exist everywhere, and over the centuries that would be required for natural processes to reach cleanup goals, it is possible that the geochemistry or groundwater flow directions, or even the location of the Colorado River channel, could change significantly. Further studies to assess the effectiveness of long-term natural attenuation in the East Ravine will continue during remedial design.

Alternatives C, D, E, and G included floodplain cleanup (mass removal and establishment of geochemical barriers in the floodplain) as the initial step in the implementation. Alternatives E, F, G, H, and I included extraction and, thereby, hydraulic control, providing additional certainty of river protection. Alternatives C through H also included extraction within the East Ravine bedrock to provide hydraulic control of East Ravine groundwater. For Alternative I, uncertainty existed regarding the flow direction of groundwater in bedrock at East Ravine.

These two approaches (mass removal/establishment of geochemical barrier in floodplain and hydraulic containment) both would require a high level of management to ensure that

the natural reducing conditions in the floodplain were not damaged or otherwise altered in a manner that diminishes the natural reductive capacity of the floodplain. Management of reducing conditions will involve regular sampling of groundwater to monitor reduction/oxidation conditions and possibly dosing with organic carbon to restore floodplain reducing capacity if it becomes depleted.

L. Selected Remedy

The Selected Remedy to remediate groundwater contamination at the Topock Site is Alternative E - In-situ Treatment with Fresh Water Flushing. Alternative E is selected because it will achieve the RAOs while substantially reducing, through treatment, the amount of Cr (VI) in the groundwater [which is the principal threat at the site], and will do so in a reasonable time frame with fewer adverse effects to cultural resources and biological resources than other alternatives considered. Alternative E also includes bedrock extraction wells in the eastern (downgradient) end of the East Ravine, with the water from the bedrock extraction wells managed within the active treatment system for the alluvial aquifer.

If it is determined that additional measures are needed to achieve RAOs in the East Ravine bedrock, other technologies will be evaluated and applied to supplement the pumping wells. In addition to pumping for hydraulic control, technologies that may be applicable to East Ravine bedrock may include, but are not limited to, freshwater injection for flushing and injection of carbon amendments for in place treatment of Cr (VI).

Because the variable nature of the geologic materials beneath the site may result in some localized areas being resistant to in-situ treatment and flushing, the Selected Remedy also includes monitored natural attenuation as a long term component to address residual Cr (VI) that may remain in portions of the aquifer formation after a majority has been treated by In-situ Treatment with Fresh Water Flushing. Monitored natural attenuation relies on the naturally occurring chemical transformation and dilution properties of the groundwater system to change Cr (VI) to Cr (III) in groundwater.

Summary of the Rationale for the Selected Remedy

The key factors upon which the remedy decision is based are presented below along with a description of how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria.

The Selected Remedy meets both of the threshold criteria of (1) protecting human health and the environment, attaining media cleanup goals (over a reasonable timeframe), and controlling sources of releases; and (2) compliance with the identified chemical-, location-, and action-specific ARARs. The Selected Remedy also provides a sufficient degree of long-term effectiveness, permanence, and reliability; is implementable; is

relatively cost-effective; and provides a sufficient degree of protectiveness to the community, workers, and environment during implementation.

Detailed Description of the Selected Remedy

The Selected Remedy involves flushing to accelerate plume movement through an IRZ barrier located along National Trails Highway. Flushing will be accomplished through a combination of fresh water injection and injection of carbon amended water in wells to the west of the plume. The Selected Remedy also includes extraction wells near the Colorado River to provide hydraulic capture of the plume, accelerate cleanup of the floodplain, and flush the groundwater with elevated Cr (VI) through the IRZ line. Additional extraction wells will be located in an area northeast of the Compressor Station where the flushing efficiency from injection wells alone is relatively poor. The Selected Remedy was designed to meet the RAOs by active groundwater treatment until cleanup goals are attained. Figure 6 illustrates the conceptual remedial approach for the Selected Remedy.

The Selected Remedy consists of three main elements: an IRZ line along the length of National Trails Highway, extraction wells near the Colorado River pumping carbon-amended water to the western area of the plume, and freshwater injected west of the plume to accelerate groundwater flow.

Institutional controls are measures undertaken to limit or prohibit activities that may interfere with the integrity of a cleanup action or result in unacceptable human exposure to hazardous substances remaining at a site. Such measures are adopted to assure the continued protection of human health. The institutional controls adopted by the Selected Remedy for the Site are specified in the *BLM Lake Havasu Field Office Resource Management Plan* issued in May 2007 and in the *1994 Lower Colorado River National Wildlife Refuges Comprehensive Management Plan.* These plans restrict surface uses and use of the groundwater. Institutional controls will remain in place for the duration of the remedy until RAOs are achieved.

The IRZ along National Trails Highway will be constructed using a line of wells that may be used either as injection or extraction wells to circulate groundwater and distribute the organic carbon source.

The extraction wells near the river will provide hydraulic control to prevent contaminated groundwater from reaching the river. Extraction near the river will also help to draw carbon-amended water across the floodplain to treat the existing Cr (VI) beneath the floodplain east of National Trails Highway. The extracted water will be amended with carbon substrate and reinjected in the western portion of the plume where it will help induce an increased hydraulic gradient to accelerate the movement of the contaminated groundwater through the IRZ, where it will be treated. The assumed flow rate of groundwater extracted from the extraction wells, amended with carbon substrate, and reinjected is approximately 640 gpm. The primary purpose of adding carbon to the

reinjected water is to create treatment zones in the vicinity of each injection well where any Cr (VI) in the injected water would be reduced.

To further accelerate the movement of groundwater toward reducing zones, and to enhance distribution of the organic carbon, additional injection wells will be constructed in areas further to the west and north of the plume, and within the southern portion of the plume for freshwater injection. Freshwater injection will involve piping freshwater to the site from an offsite source. The injection of freshwater at an assumed rate of approximately 500 gpm will induce a hydraulic gradient to accelerate the movement of the site groundwater through the IRZ, where it will be treated. This fresh water injection also serves to constrain westward movement of the carbon amended water and flush much of this water eastward toward the extraction wells.

Cost Estimate for the Selected Remedy

The Total Present Worth Cost of the Selected Remedy is approximately $184,000,000 based on a present worth discount rate of 3.17% and 29-year O&M. These costs are summarized in *Table 3.*

The costs developed for the CMS/FS Report do not represent bid- or construction-level engineering costs. It is fully expected that the quantities, layouts, and configuration of the Selected Remedy will vary from that described herein. Costs were estimated using unit rates appropriate for the size and scope of the alternatives. Costs were based on 2008 costs or for past costs escalated to 2008. Future costs were not escalated.

The information in this cost estimate summary table is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an ESD, or a ROD amendment. This is an order-of-magnitude engineering cost estimated that is expected to be within +50 to -30 percent of the actual cost.

Expected Outcomes of Selected Remedy

The estimated time to achieve RAOs with the Selected Remedy is approximately 29 years based on the simulated time to remove 98 percent of the Cr (VI) mass within the plume. The amount of Cr (VI) mass within the East Ravine bedrock is estimated to be less than one percent of the total plume mass, and therefore does not significantly affect the simulated time to cleanup. The actual cleanup time will be dependent on the rate at which organic carbon can be distributed to all areas of contaminated groundwater in the floodplain and/or contaminated groundwater in recalcitrant zones in the upland areas can be flushed to the IRZ treatment line where it will be treated by injected organic carbon. The range of time to achieve RAOs is estimated to be between 10 and 110 years. By attaining the RAOs, the Selected Remedy will reduce the potential human health risk from exposure to Cr (VI) and Cr (T) in a hypothetical future use of groundwater as a

potable water supply/drinking water source and support the designated beneficial uses of the Colorado River (after cleanup goals have been attained). Further restrictions on groundwater use to address Cr (VI) in groundwater would not be necessary.

Socioeconomic effects from implementation of the Selected Remedy were evaluated by addressing how impacts to the physical environment may affect the socioeconomics of the area, as well as addressing how socioeconomic effects associated with the Selected Remedy may affect the physical environment. For this particular project, changes associated with increased economic output and employment were assessed for the surrounding region of influence for the construction, operation and maintenance, and decommissioning phases of the proposed project and project alternatives. The Selected Remedy will provide a modest economic benefit to the surrounding region, which may attract new residents resulting in some indirect growth. The vast majority of economic benefit is expected to occur during the construction phase, but these impacts are expected to be short-term. Long-term economic effects associated with operation and maintenance of the Selected Remedy are anticipated to be relatively modest compared with the economic output of the surrounding region. Employment associated the operation and maintenance of the Selected Remedy would also be modest, resulting little change to population and housing, and well below projected growth for the region.

M. Statutory Determinations

Based on the information currently available, DOI expects that the Selected Remedy, In-situ Treatment with Fresh Water Flushing, will satisfy the following requirements of CERCLA § 121(b): (1) be protective of human health and the environment; (2) comply with ARARs; (3) be cost-effective; (4) utilize permanent solutions and treatment technologies to the maximum extent practicable; and (5) satisfy the preference for treatment as a principle element of the remedy.

Protection of Human Health and the Environment

The Selected Remedy will protect human health and the environment in the long term through reduction of Cr (VI) concentrations in groundwater by in-situ treatment. Monitoring will provide data to evaluate the effectiveness of in-situ treatment. The Selected Remedy protects human health in the short term by limiting exposure through restriction of groundwater use as potable water source until cleanup goals are met.

Compliance with ARARs

The Selected Remedy will attain chemical-specific ARARs, including, for example, the following. By achieving cleanup goals less than MCLs, the remedy will comply with federal (40 CFR Part 141-Subpart G) and California (22 CCR Division 4, Chapter 15) Safe Drinking Water Act requirements for Cr (T) in groundwater delivered by a public water supply system. The Selected Remedy will comply with the Federal Water Pollution Control Act because surface water samples collected within the river near the

site, both before and after implementation of the IMs, show concentrations less than federal water quality criteria (40 CFR 131.38) for Cr (VI), naturally occurring reducing conditions in sediments near the Colorado River, and dilution provided by the river are expected to continue to prevent contaminated groundwater from causing exceedances of these standards in the river prior to remedy completion. By achieving cleanup goals in groundwater, the Selected Remedy will provide additional certainty that contaminated groundwater will not cause exceedances of Federal water quality criteria established under the Federal Water Pollution Control Act (40 CFR 131.38) for Cr (VI) in the Colorado River in the future.

The Selected Remedy will satisfy location-specific ARARs, including, for example, the following. Because surface water bodies are not being modified, USFWS coordination requirements (40 CFR 6.201) will not be triggered. Because RCRA-regulated treatment systems will not be constructed in a floodplain or seismic zone, RCRA seismic and floodplain requirements (40 CFR 264.18) will not be triggered. Construction of wells and piping in floodplain or wetland areas will be performed in a manner that complies with federal floodplain and wetlands protection requirements (40 CFR 6.201). Steps will be taken during design and implementation to ensure compatibility with the National Wildlife Refuge System Administration Act. The requirements of the National Historic Preservation Act ("NHPA") (16 U.S.C. § 470, et seq.) will be satisfied through the implementation of the Programmatic Agreement, discussed previously, or through additional consultation in compliance with Section 106 of the NHPA. Other cultural or historic resource protection ARARs, including, for example, those established by the National Archaeological and Historic Preservation Act (16 U.S.C. § 469, et seq.), the Native American Graves Protection and Repatriation Act (25 U.S.C. § 3001, et seq.), and the Archaeological Resources Protection Act (16 U.S.C. § 470aa-ii, et seq.), will be attained through the design and implementation of the Selected Remedy as circumstances require. If a well for potable water is located in the future on land owned or controlled by the State of Arizona, the requirements of A.R.S. § 41-841 through 847 require that there will be no excavation of a historic site. If a well for potable water is located on land other than Arizona state land, A.R.S. § 41-861 through 866 require that no human remains or specified cultural objects will be disturbed intentionally, and unintentional disturbances will be reported.

The Selected Remedy will be designed and implemented to attain action-specific ARARs, including, for example, the following. Injection of reductant material and recirculation of groundwater will be performed in a manner that meets Federal Underground Injection Control requirements (40 CFR Parts 144-148). There will be no discharge of fill to wetlands or waterways (40 CFR 230.10), point source discharge of pollutants to waters of the United States (40 CFR Parts 122, 125), or other activities that alter the course, condition, or capacity of navigable waters (33 USC § 401 and 403). Remedial activities will comply with applicable NPDES construction stormwater requirements (40 CFR 122.26). Remedial activities will not emit regulated hazardous air pollutants (40 CFR Parts 61, 63). Installation of wells, piping, and reagent storage equipment will be performed in a manner that does not result in a "take" of threatened or endangered species, damage their critical habitat (50 CFR part 402), or impact migratory

birds (15 USC § 703-712). Waste generated during remedial activities will be handled in compliance with hazardous waste generator requirements (22 CCR Division 4.5, Chapters 11, 12, 18). Regulated waste piles, tank systems, landfills, and miscellaneous units will not be constructed. Monitoring will be performed in accordance with RCRA (22 CCR Division 4.5, Ch. 14, Article 6) and California Water Code (23 CCR Div. 3, Chapter 15; 27 CCR Div. 2, Subdivision 1; Calif. Water Code Section 13801(c)) monitoring requirements. Because RAOs will achieve background levels for chromium, the Selected Remedy will comply with the substantive provisions of State Water resource Control Board ("SWRCB") Resolution 68-16 that requires maintenance of the highest water quality consistent with maximum benefit to the people of the State, and with the substantive provisions of SWRCB Resolution 92-49 that require restoration of background water quality. The Selected Remedy will also result in achieving Basin Plan water quality objectives for chromium in groundwater. Appropriate land use covenants will be implemented (22 CCR 67391.1). Arizona well standards (A.A.C. R-12-15-850; A.R.S. Title 5, Chapter 2, Article 10) will be met for potable water supply wells constructed in Arizona.

A complete list of all ARARs identified by DOI for the Topock Site is provided in *Table 2.*

Cost Effectiveness

The Selected Remedy will be cost-effective. As defined by the NCP, a remedy is "cost-effective if its costs are proportional to its overall effectiveness." (40 CFR §300.430(f)(1)(ii)(D)). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination: long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness. Overall effectiveness was then compared to costs to determine cost-effectiveness. The relationship of the overall effectiveness of the Selected Remedy was determined to be proportional to its costs.

The estimated present worth cost of the Selected Remedy is $184,000,000.

Utilize Permanent Solutions and Treatment Technologies

The Selected Remedy includes in-situ treatment by distributing an organic carbon substrate within the floodplain to create geochemically-reduced conditions to convert Cr (VI) in groundwater to insoluble Cr (III) and thereby reducing the toxicity and mobility of the site contaminants.

Five-year Reviews

Section 121(c) of CERCLA and NCP §300.430(f)(5)(iii)(C) provide the statutory and regulatory requirements for conducting five-year reviews. Because the Selected Remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be

conducted within five years after initiation of remedial action and every five years after until attainment of the RAOs to ensure that the remedy is, or will be, protective of human health and the environment.

Figures and Tables

Figure 1. Topock Location Map with Nearby Communities and Tribal Reservations

Figure 2. Topock Federal, State, and Private Property Boundaries, Cr (VI) Plume Boundary and Groundwater Monitoring Well Locations

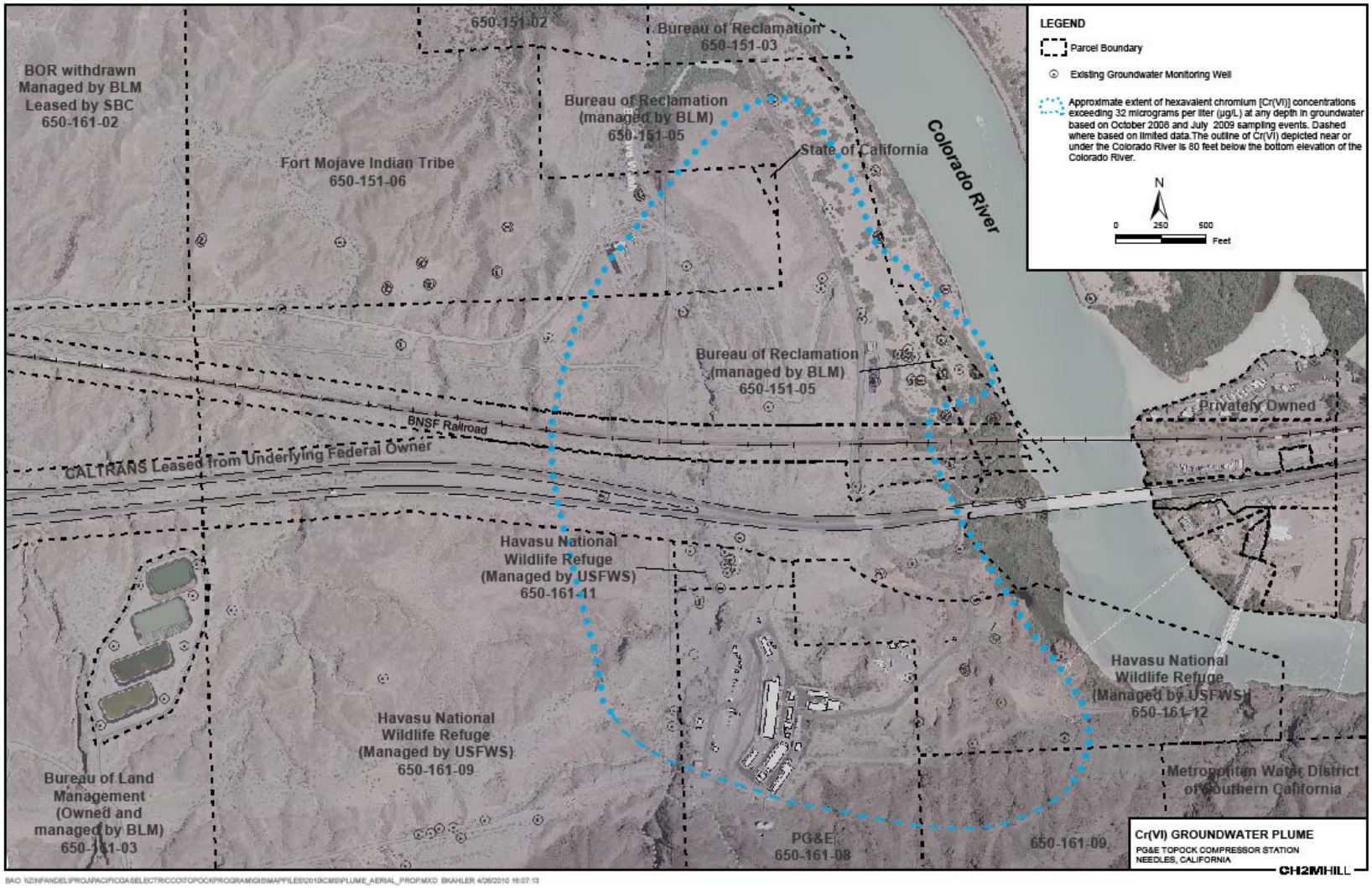


Figure 3. Topock Groundwater Conceptual Site Model

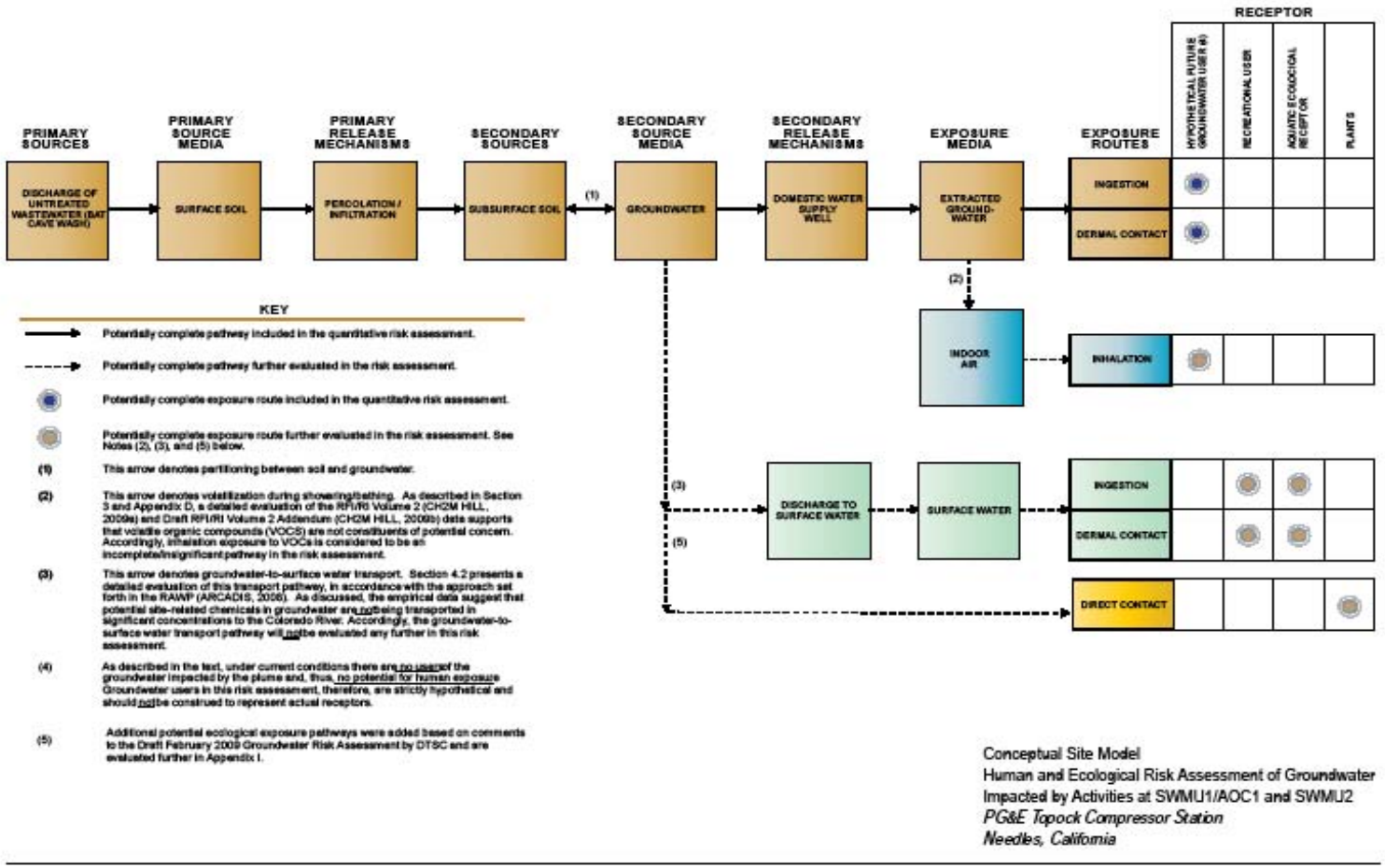


Figure 4. Topock Hydrogeologic Cross-Section

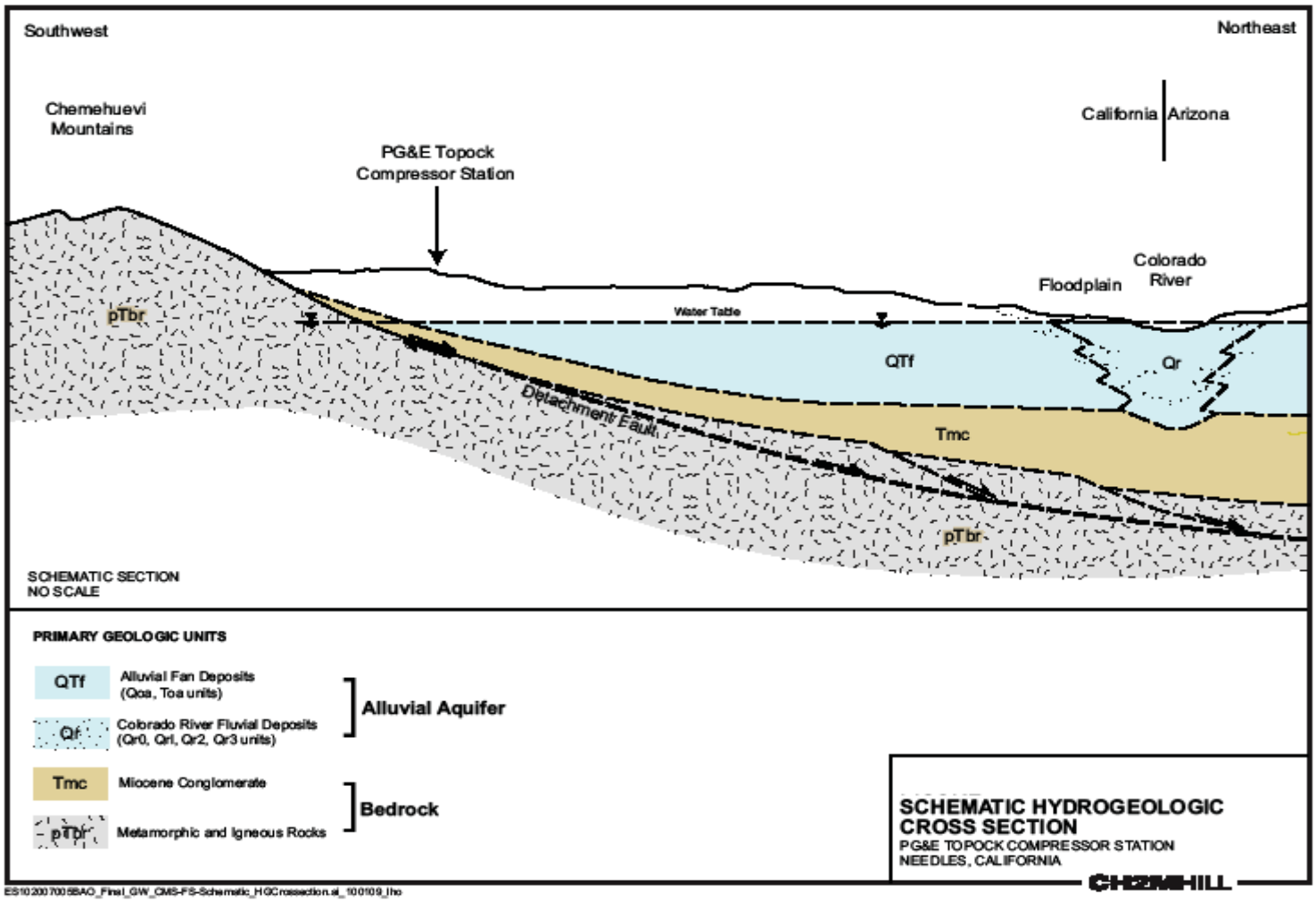


Figure 5. Surface Water Monitoring Locations.

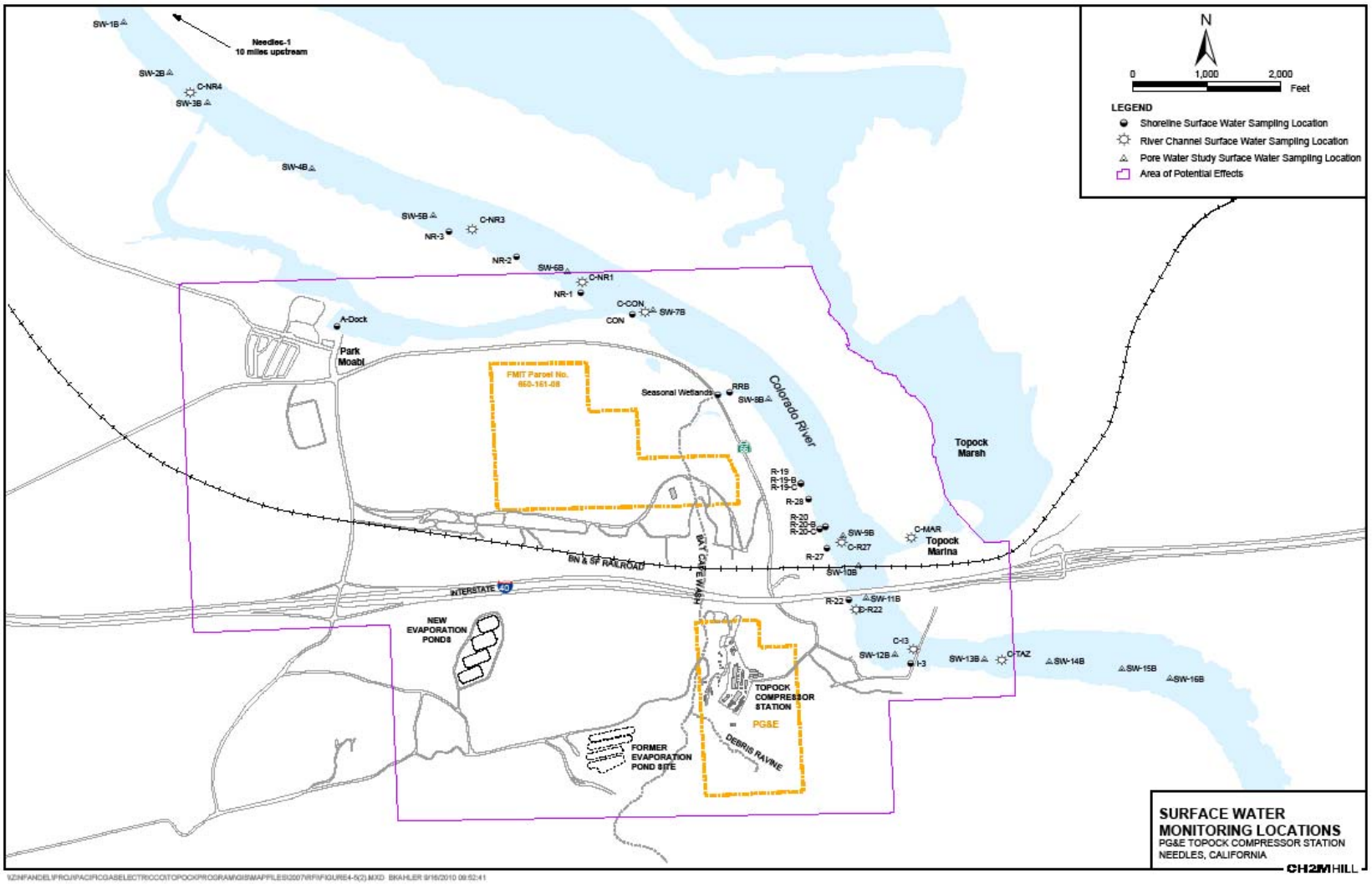


Figure 6. Alternative E – In-Situ Treatment with Fresh Water Flushing – Conceptual Drawing

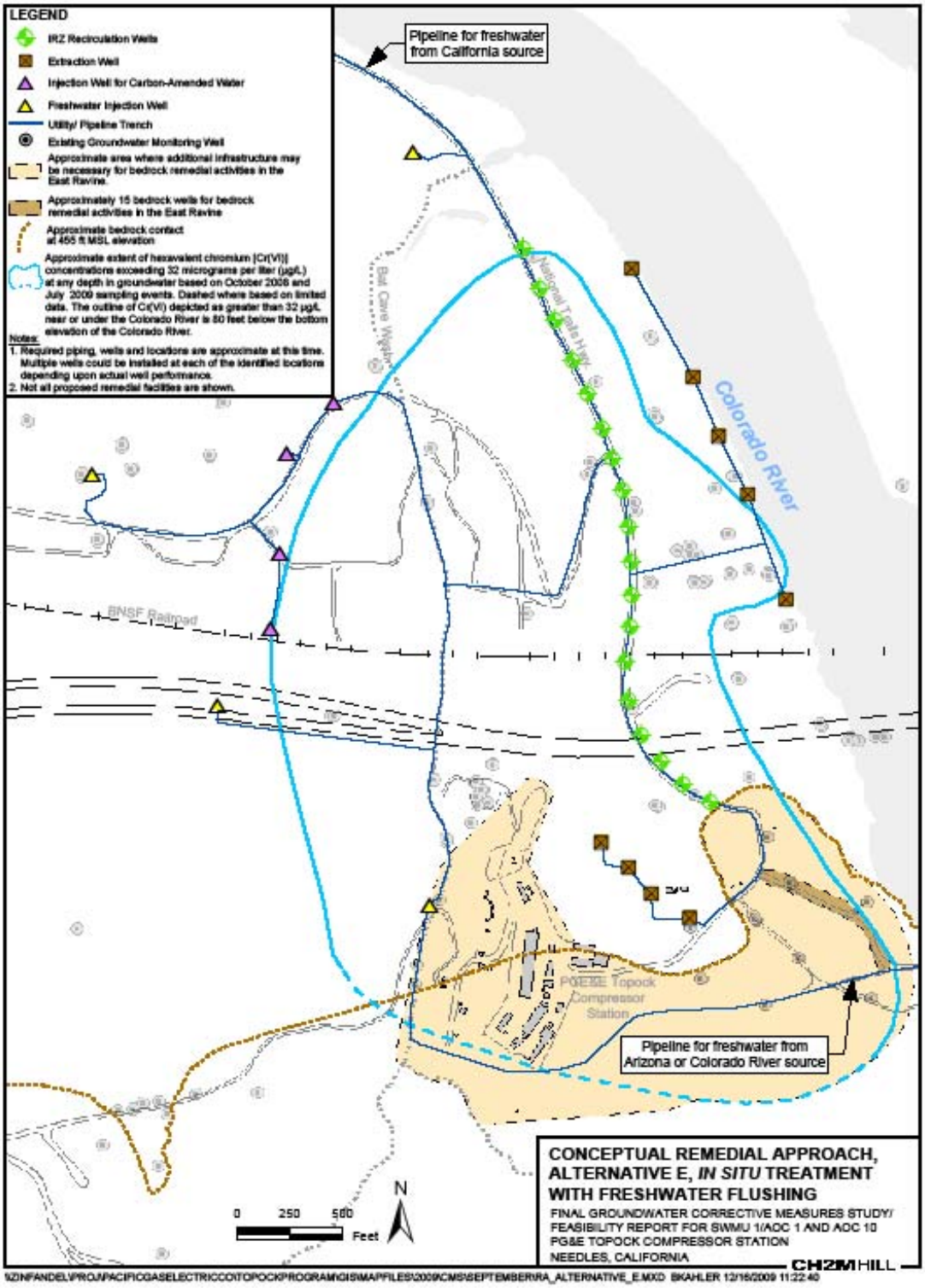


Table 1. Human Health Risk Assessment Results: Hypothetical Groundwater User

HERA of Groundwater Impacted by Activities at SWMU 1/AOC 1 and SWMU 2
PG&E Topock Compressor Station, Needles, California

Summary of Estimated Potential Human Health Risk Assessment Results: Hypothetical Future Groundwater User

Chemical of Potential Concern	Number of Wells Sampled	Number of Wells Exceeding Cumulative Hazard Threshold	Frequency	Average Hazard Index at Wells where Chemical is Driving Risk	Number of Wells Exceeding Cumulative Hazard Threshold – Sensitivity Analysis	Frequency	Average Hazard Index at Wells where Chemical is Driving Risk – Sensitivity Analysis	Total Number of Samples	Number of Detections	Number of Wells Exceeding Background Levels	Frequency
Aluminum	64	0	0.0%	NA	0	0.0%	NA	294	21	16	25.0%
Antimony	68	7	10.3%	9.6E+00	3	4.4%	7.9E+00	384	9	8	11.8%
Arsenic	110	3	2.7%	1.2E+01	3	2.7%	1.0E+01	460	190	3	2.7%
Barium	107	2	1.9%	1.7E+00	1	0.9%	1.7E+00	559	361	10	9.3%
Beryllium	68	0	0.0%	NA	0	0.0%	NA	374	20	14	20.6%
Cadmium	68	1	1.5%	1.4E+00	0	0.0%	NA	374	1	1	1.5%
Chromium, hexavalen	167	65	38.9%	6.6E+01	64	38.3%	6.5E+01	2,780	1650	69	41.3%
Cobalt	68	2	2.9%	1.6E+00	2	2.9%	6.2E-01	374	13	8	11.8%
Copper	86	0	0.0%	NA	0	0.0%	NA	1,049	358	40	46.5%
Fluoride	104	5	4.8%	1.2E+01	5	4.8%	8.4E+00	491	426	5	4.8%
Lead	83	7	8.4%	2.7E+00	2	2.4%	1.8E+00	474	62	36	43.4%
Mercury	68	0	0.0%	NA	0	0.0%	NA	380	1	1	1.5%
Molybdenum	83	17	20.5%	1.1E+00	14	16.9%	1.0E+00	563	528	38	45.8%
Nickel	86	2	2.3%	6.6E-01	2	2.3%	6.6E-01	1,049	479	38	44.2%
Nitrate as nitrogen	165	8	4.8%	8.4E-01	3	1.8%	7.7E-01	844	573	52	31.5%
Selenium	76	2	2.6%	1.3E+00	1	1.3%	1.4E+00	396	168	17	22.4%
Silver	68	3	4.4%	9.2E-01	0	0.0%	NA	374	8	7	10.3%
Thallium	68	2	2.9%	1.1E+00	2	2.9%	2.6E+00	374	2	2	2.9%
Vanadium	83	17	20.5%	1.1E+00	9	10.8%	8.7E-01	462	372	19	22.9%
Zinc	86	0	0.0%	NA	0	0.0%	NA	1,049	725	37	43.0%

Notes:

(1) See Appendix P for an explanation of methodologies used in determining material contributors to elevated hazard.

(2) As described in Section 6.3 of the text, the noncarcinogenic hazard from lead is not evaluated using the traditional reference dose approach. Well-specific lead EPCs are instead compared to the California Action Level for lead, which is a legally enforceable drinking water standard designed to protect public health. The ratio of the lead EPC to the lead CAL is therefore approximately analogous to hazard index; a ratio above the threshold value of 1.0 indicates potential for adverse health effects to hypothetical future groundwater users.

(3) Estimated potential noncancer hazard indices are presented in Table 7-2.

(4) Estimated EPCs are based on maximum detected concentrations when 95% UCLs OTM cannot be reliably calculated with ProUCL 4.0 because there are less than eight samples or less than five detections in the dataset. The sensitivity analysis bases EPCs on mean concentrations when 95% UCLs OTM cannot be reliably calculated with ProUCL 4.0.

EPC = exposure point concentration
NA = not applicable
OTM = of the mean
UCL = upper confidence limit

Table 2. Applicable or Relevant and Appropriate Requirements (ARARs) and other factors To Be Considered (TBCs)

Appendix A - Corrective Measures Study/Feasibility Study Report for Chromium in Groundwater, PG&E Topock Compressor Station, Needles, California

Note: Only substantive requirements of the statutes and regulations listed here must be attained for on-site remedial actions. Compliance with administrative, procedural, and permitting requirements of these statutes and regulations is not required for on-site actions.

FEDERAL REQUIREMENTS			
	ARAR or TBC and Citation	**Determination**	**Description and Applicability**
CHEMICAL-SPECIFIC			
1.	Federal Safe Drinking Water Act • 42 USC § 300f, *et seq.* • 40 CFR 141 -- Subpart F– Maximum Contaminant Level Goals (MCLGs)	ARAR Relevant and Appropriate	MCLGs are not federally enforceable drinking water standards, but CERCLA § 121(d) identifies MCLGs as relevant and appropriate requirements.
2.	Federal Safe Drinking Water Act • 42 USC § 300g-1 • 40 CFR 141 -- Subpart G – National Primary Drinking Water Regulations (MCLs)	ARAR Relevant and Appropriate	These MCLs are relevant and appropriate standards, which establish the maximum permissible level of contaminants (eg. Chromium) in sources (or potential sources) of drinking water. MCLs may be applicable where water at a CERCLA site is delivered through a public water supply system.

3.	Federal Water Pollution Control Act (CWA) • 33 USC §§ 1251-1387 • 40 CFR 131.38	ARAR Applicable	These are federally promulgated Water Quality Standards for surface waters. Such water quality standards include specific criteria for water bodies in California, including standards for Hexavalent Chromium.
4.	Occupational Safety and Health Act • 29 USC § 651, *et seq.* • 29 CFR 1910.1026	TBC	This Act provides standards for workers engaged in field activities associated with remedial actions under the NCP, including occupational exposure to Hexavalent Chromium. Pursuant to the NCP preamble, OSHA standards are not ARARs but may be included as TBCs.
LOCATION-SPECIFIC			
5.	Federal Land Policy and Management Act (FLPMA) • 43 USC § 1701, *et seq.* • 43 CFR 2800	ARAR Applicable	In managing public lands, BLM is directed to take any action necessary to prevent unnecessary or undue degradation of the lands. Actions taken on the public land (i.e. BLM-managed land) portions of the Topock site should provide the "optimal balance between authorized resource use and the protection and long-term sustainability of sensitive resources."
6.	U.S. Department of Interior, Bureau of Land Management, *Approved Resource Management Plan and Final Environmental Impact Statement*, May 2007	TBC	The Resource Management Plan provides further direction on how FLPMA requirements will be satisfied.
7.	National Wildlife Refuge System Administration Act, as amended • 16 USC §§ 668dd-ee • 50 CFR Part 27	ARAR Applicable	This Act governs the use and management of National Wildlife Refuges. The Act requires that FWS evaluate ongoing and proposed activities and uses to ensure that such activities are appropriate and compatible with both the mission of the overall National Wildlife Refuge System, as well as the specific purposes for which the Havasu National Wildlife Refuge was established. The Topock site includes portions of the Havasu National Wildlife Refuge. Prior to selection of a remedial action by DOI/FWS, that remedial action must be found by the Refuge Manager to be both an appropriate use of the Refuge and compatible with the mission of the Refuge and the Refuge System as a whole. Any remedial action proposed

			to be implemented on the Refuge that was not selected by DOI/FWS would be subject to the formal appropriate use/compatibility determination process.
8.	Executive Order 8647; 6 FR 593	TBC	This Executive Order establishes the Havasu National Wildlife Refuge and describes the purposes for which it was created.
9.	Appropriate Use Policy • 603 FW 1	TBC	This policy elaborates on the appropriate uses of a National Wildlife Refuge, ensuring that such uses contribute to fulfilling the specific refuge's purposes and the National Refuge System's mission.
10.	Compatibility Policy • 603 FW 2	TBC	This policy specifies the guidelines for determining the compatibility of proposed uses of a National Wildlife Refuge. This determination is done once a proposed use is deemed appropriate (see number 9 above).
11.	Lower Colorado River National Wildlife Refuges, Comprehensive Management Plan (1994-2014)	TBC	The Comprehensive Management Plan provides further direction on how compliance with the National Wildlife Refuge System Administration Act, as amended, shall be achieved.
12.	Fish and Wildlife Conservation Act • 16 USC §§ 2901-2911	TBC	Federal departments and agencies are encouraged to utilize their authority to conserve nongame fish and wildlife and their habitats and assist States in the development of their conservation plans.
13.	Fish and Wildlife Coordination Act • 16 USC §§ 661-667e • 40 CFR 6.302(g)	ARAR Applicable	This Act requires that any federally-funded or authorized modification of a stream or other water body must provide adequate provisions for conservation, maintenance, and management of wildlife resources and their habitat. Necessary measures should be taken to mitigate, prevent, and compensate for project-related losses of wildlife resources. Any remedial action selected for the Topock site that includes any modification of a water body will be subject to these requirements.

14.	National Historic Preservation Act • 16 USC § 470, *et seq.* • 40 CFR 6.301(b) • 36 CFR 800.1, *et seq.*	ARAR Applicable	This statute and the implementing regulations direct federal agencies to consider the effects of their undertakings on historic properties included in or eligible for inclusion in the National Register of Historic Places and to consult with certain parties before moving forward with the undertaking. The agency must determine, based on consultation, if an undertaking's effects would be adverse and consider feasible and prudent alternatives that could avoid, mitigate, or minimize such adverse effects on a National Register or eligible property. The agency must then specify how adverse effects will be avoided or mitigated or acknowledge that such effects cannot be avoided or mitigated. The Topock site includes historic properties in or eligible for inclusion in the National Register and remedial action selected for the Topock site qualifies as an undertaking pursuant to the NHPA. Measures to avoid or mitigate adverse effects of any selected remedial action that are adopted by the agency through consultation must be implemented by the remedial action to comply with the NHPA.
15.	National Register Bulletin 38	TBC	Guidelines for evaluating and documenting traditional cultural properties.
16.	Preservation Brief 36	TBC	Guidelines for planning, treating, and managing historic landscapes.
17.	National Archaeological and Historic Preservation Act • 16 USC § 469, *et seq.* • 36 CFR 65 • 40 CFR 6.301(c)	ARAR Applicable	This statute requires the evaluation and preservation of historical and archaeological data which might otherwise be irreparably lost or destroyed through any alteration of terrain as a result of federal construction projects or a federally-licensed activity. The Topock site includes historical and archaeological data. Any remedial action selected for the Topock site must include measures for the evaluation and preservation of historical and archaeological data that might be lost or destroyed as a result of the remedial action.
18.	Archaeological Resources Protection Act • 16 USC § 470aa-ii, *et seq*. • 43 CFR 7.1, *et seq.*	ARAR Applicable	This statute provides for the protection of archeological resources located on public and tribal lands. The Act establishes criteria which must be met for the land manager's approval of any excavation or removal of archaeological resources if a proposed activity involves soil disturbances. The Topock site includes archaeological resources on public land. Any remedial action selected for the Topock site must satisfy the criteria applicable to excavation or removal of archaeological resources that might be affected as a result of the remedial action.

19.	Historic Sites Act • 16 USC §§ 461-467 • 40 CFR 6.301(a)	ARAR Applicable	Pursuant to this Act, federal agencies are to consider the existence and location of historic sites, buildings, and objects of national significance using information provided by the National Park Service to avoid undesirable impacts upon such landmarks. The Topock site includes areas which are considered historic sites. Undesirable impacts on these sites that might result from any remedial action selected for the Topock site will be evaluated and mitigated to the maximum extent practicable.
20.	Executive Order No. 11593	TBC	This Order directs the Federal Agencies to initiate measures for the protection and enhancement of the cultural environment. These measures include assuring that steps are taken to make records, drawings, and/or maps and have such items deposited in the Library of Congress when, as the result of a Federal action, a property listed on the National Register of Historic Places is to be substantially altered.
21.	Native American Graves Protection and Repatriation Act (NAGPRA) • 25 USC § 3001, *et seq.* • 43 CFR 10.1, *et seq.*	ARAR Applicable	NAGPRA establishes requirements regulating the removal and trafficking of human remains and cultural items, including funerary and sacred objects. The Topock site may contain human remains. If remediation activities result in the discovery of Indian human remains or related objects, NAGPRA requirements must be met.
22.	American Indian Religious Freedom Act • 42 USC § 1996, *et seq.*	ARAR Relevant and Appropriate	The United States must "protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise [their] traditional religions…" Any remedial action selected for the Topock site must satisfy this requirement.
23.	Executive Order No. 13007	TBC	In managing federal lands, the United States "shall, to the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions, (1) accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners, and (2) avoid adversely affecting the physical integrity of such sacred sites."
24.	Executive Order No. 13175	TBC	Federal Agencies are to conduct regular and meaningful consultation and collaboration with tribal officials in the development and implementation of Federal policies that have tribal implications.

25.	Executive Order No. 12898	TBC	Federal agencies shall conduct "activities that substantially affect human health or the environment, in a manner that ensures that such programs, policies, and activities do not have the effect of excluding persons (including populations) from participation in, denying persons (including populations) the benefits of, or subjecting persons (including populations) to discrimination under such programs, policies, and activities, because of their race, color, or national origin."
26.	Executive Order No. 13352	TBC	The Department of Interior shall, to the extent permitted by law, "implement laws relating to the environment and natural resources in a manner that promotes cooperative conservation."
27.	Resource Conservation and Recovery Act • 42 USC § 6901, *et.seq.* • 40 CFR 264.18	ARAR Applicable	These regulations promulgated under RCRA establish Seismic and Floodplain considerations which must be followed for treatment, storage, or disposal facilities constructed, operated, or maintained within certain distances of fault lines and floodplains. Portions of the Topock site are located on or near a 100-year floodplain.
28.	Floodplain Management and Wetlands Protection • 40 CFR § 6.302(a) & (b) • 40 CFR 6, Appendix A	ARAR Applicable	Before undertaking an action, agencies are required to perform certain measures in order to avoid the long and short term impacts associated with the destruction of wetlands and the occupancy and modification of floodplains and wetlands. The regulation sets forth requirements as means of carrying out the provisions of Executive Orders 11988 and 11990.
29.	Executive Order 11988 – Floodplain Management	TBC	Executive Order 11988 requires evaluation of the potential effects of actions that take place in a floodplain to avoid, to the extent possible, adverse impacts.
30.	Executive Order 11990 -- Responsibilities of Federal Agencies to Protect Wetlands	TBC	Executive Order 11990 requires that potential impacts to wetlands be considered, and as practical, destruction, loss, or degradation of wetlands be avoided.

ACTION-SPECIFIC			
31.	Federal Safe Drinking Water Act • 42 USC §300f, *et seq.* Part C – Protection of Underground Sources of Drinking Water • 40 CFR 144 -148	ARAR Applicable	These Underground Injection Control Regulations assure that any underground injection performed on-site will not endanger drinking water sources. Substantive requirements include, but are not limited to, regulation of well construction and well operation. These requirements will be applicable if underground injection is proposed as a part of a site remedy.
32.	Federal Water Pollution Control Act (Clean Water Act) • 33 USC § 1344 • 40 CFR 230.10	ARAR Applicable	This section of the Clean Water Act prohibits certain activities with respect to on-site wetlands and waterways. No discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed activity which would have less adverse impact to the aquatic ecosystem.
33.	Federal Water Pollution Control Act (Clean Water Act) • 33 U.S.C. § 1342 • 40 CFR 122 • 40 CFR 125	ARAR Applicable	These National Pollutant Discharge Elimination System (NPDES) requirements regulate discharges of pollutants from any point source into waters of the United States.
34.	Federal Water Pollution Control Act (Clean Water Act) • 40 CFR 122.26	ARAR Applicable	These regulations define the necessary requirements with respect to the discharge of storm water under the NPDES program. These regulations will apply if proposed remedial actions result in storm water runoff which comes in contact with any construction activity from the site remediation.
35.	River and Harbor Act of 1899 • 33 USC §§ 401 and 403	ARAR Applicable	This Act prohibits the creation of any obstruction in navigable waters, in addition to banning activities such as depositing refuse, excavating, filling, or in any manner altering the course, condition, or capacity of navigable waters. These requirements will apply if proposed activities at the Topock site have the potential of affecting any navigable waters on the site.

36.	Colorado River Front Work and Levee System Act • 44 Stat. 1010 (1927)	TBC	Any proposed remediation activities shall not interfere with the water operations or related water management activities and responsibilities of the Bureau of Reclamation.
37.	Clean Air Act • 42 USC §§ 7401, *et seq.* National Ambient Air Quality Standards (NAAQS) • 40 CFR 50	TBC	These ambient air quality standards define levels of air quality to protect the public health. NAAQSs are not enforceable in and of themselves, but they may be used as guidance if remediation activities create potential air quality impacts.
38.	Clean Air Act • 42 USC §§ 7401, *et seq.* National Emission Standards for Hazardous Air Pollutants (NESHAP) • 40 CFR 61 • 40 CFR 63	ARAR Applicable	NESHAPs are regulations which establish emissions standards for certain hazardous air pollutants (HAPs) identified in the regulations. NESHAPs will apply if remediation activities on the site produce identified HAP emissions.
39.	Religious Freedom Restoration Act • 42 USC § 2000bb	ARAR Applicable	Pursuant to this Act, the government shall not substantially burden a person's exercise of religion, unless the application of the burden is in furtherance of a compelling government interest, and it is the least restrictive means of furthering that interest. To constitute a "substantial burden" on the exercise of religion, a government action must (1) force individuals to choose between following the tenets of their religion and receiving a governmental benefit or (2) coerce individuals to act contrary to their religious beliefs by the threat of civil or criminal sanctions. If any remedial action selected imposes a substantial burden on a person's exercise of religion, it must be in furtherance of a compelling government interest and be the least restrictive means of achieving that interest.
40.	Endangered Species Act of 1973 • 16 USC §§ 1531-1544	ARAR	The ESA makes it unlawful to remove or "take" threatened and endangered plants and animals and protects their habitats by prohibiting certain activities. Examples of such species in or around the Topock site may include, but are not limited to, southwestern

	• 50 CFR 402	Applicable	willow flycatcher, Mojave Desert tortoise, Yuma clapper rail, Colorado pike minnow, razorback sucker, and bonytail chub. Any remedial action selected for the Topock site will not result in the take of, or adverse impacts to, threatened and endangered species or their habitats, as determined based on consultation with the Fish and Wildlife Service under section 7 of the ESA.

41.	Migratory Bird Treaty Act • 16 USC §§ 703-712	ARAR Applicable	This Act makes it unlawful to "take, capture, kill," or otherwise impact a migratory bird or any nest or egg of a migratory bird. The Havasu National Wildlife Refuge, which is part of the Topock site, was created as a refuge and breeding ground for migratory birds and other wildlife, therefore, there is potential for contact with migratory birds during proposed remediation activities. Any remedial action selected for the Topock site will be designed and implemented so as to not take, capture, kill, or otherwise impact a migratory bird, nest, or egg.
42.	Executive Order 13186: Responsibilities of Federal Agencies To Protect Migratory Birds	TBC	This Order directs executive departments and agencies to take certain actions to further implement the Migratory Bird Treaty Act, including supporting the conservation intent of the migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities and by avoiding or minimizing, to the extent practicable, adverse impacts on migratory bird resources when conducting agency actions.
ARIZONA REQUIREMENTS			
	ARAR or TBC and Citation	**Determination**	**Description and Applicability**
LOCATION-SPECIFIC			

43.	Archeological Discoveries • A.R.S. § 41-841 through 847	ARAR	This Act prohibits any person from knowingly excavating on Arizona State or State agency owned land which is a historic or prehistoric ruin, burial ground, archaeological or paleontological site. These requirements will apply if the selected remedy involves excavation in Arizona.
44.	Historic Preservation • A.R.S. § 41-865	ARAR	This Act restricts any person from disturbing human remains or funerary objects on land owned or controlled by the State. These requirements will apply if the selected remedy involves excavation in Arizona.
ACTION-SPECIFIC			
45.	Arizona Well Standards • A.A.C. R-12-15-850	ARAR	These requirements on the placement of wells will apply if the selected remedy includes placement of wells in Arizona.
46.	Design criteria for treatment units • A.A.C. R18-5-(501-502)	ARAR	These minimum design criteria will apply if the selected remedy includes construction of a groundwater treatment plant.
47.	Requirements for wells, groundwater withdrawal, treatment, and reinjection • A.R.S. §45-454.01	ARAR	This statute exempts new well construction, withdrawal, treatment, and reinjection into a groundwater aquifer as a part of a CERCLA Remedial Action from the requirements of the Arizona Groundwater Code, except that they must comply with the substantive requirements of A.R.S. 45-594, 45-595, 45-596, and 45-600. If groundwater that is withdrawn is not reinjected into the aquifer, the groundwater shall be put to reasonable and beneficial use.

48.	Well construction standards • A.R.S. §45-594 and 595	ARAR	These provisions identify the well construction standards and requirements for new well construction in the State of Arizona. These requirements will apply if the selected remedy involves the construction of wells in Arizona.
49.	Notice of intention to drill • A.R.S. §45-596	ARAR	Substantive requirements will apply if the selected remedy involves the construction of wells in Arizona.
50.	Report by driller • A.R.S. §45-600	ARAR	Substantive requirements will apply if the selected remedy involves the construction of wells in Arizona.
51.	Arizona Remedial Action Requirements • A.R.S. §49-282.06(A)(2)	ARAR	Any treatment of groundwater must be conducted in a manner to provide for the maximum beneficial use of the waters of the state.

CALIFORNIA REQUIREMENTS			
	ARAR or TBC and Citation	**Determination**	**Description and Applicability**
CHEMICAL-SPECIFIC			
52.	California Safe Drinking Water Act • Title 22, CCR, Div 4, Ch 15, §64431, §64444	ARAR Applicable	Maximum Contaminant Levels (MCLs) which shall not be exceeded in the water supplied to the public. California state MCLs for drinking water standards are more stringent than primary federal standards.
53.	Secondary MCLs list for drinking water • Title 22, CCR, Div 4, Ch 15, §64449	ARAR Relevant and Appropriate	State secondary MCLs for drinking water standards are more stringent than federal standards. These secondary MCLs are relevant and appropriate standards, which establish the maximum permissible level of contaminants in sources (or potential sources) of drinking water. These secondary MCLs would be applicable if water at the site was used as drinking water and delivered through a community water supply system.
54.	Characteristics of Hazardous Waste • Title 22, CCR, Div 4.5, Ch 11, Article 3, §66261.20- §66261.24	TBC	These criteria do not establish substantive requirements, but instead describe the analysis by which waste is determined to be hazardous. These regulations outline Toxicity Characteristic Leaching Procedure (TCLP) regulatory levels, persistent and bioaccumulative toxic substances total threshold limit concentrations (TTLC), and soluble threshold limit concentration (STLC).
55.	Groundwater and vadose zone protection standards • Title 22, CCR, Div 4.5, Ch 15, Article 6,	ARAR Applicable	RCRA hazardous waste Interim Status TSD facilities shall comply and ensure that hazardous constituents entering the groundwater, surface water, and soil from a regulated unit do not exceed the concentration limit from contaminants of concern in the uppermost aquifer underlying the waste management area beyond the point of

	§66265.94		compliance.
56.	State Water Quality Control Policy Porter-Cologne Water Quality Control Act (California Water Code Sections 13140, *et seq.*)	TBC	
57.	Regional Water Quality Control Plan Objectives Porter-Cologne Water Quality Control Act (California Water Code Sections 13240, 13241)	TBC	
58.	Regional Water Quality Control Plan Implementation Porter-Cologne Water Quality Control Act (California Water Code Sections 13242)	TBC	
59.	*Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities* DTSC Human and Ecological Risk Division July 1996	TBC	
60.	*Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities* DTSC Human and Ecological Risk Division July 1992	TBC	
61.	*Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual – Interim Final (EPA/540/1-89/002)* United States Environmental Protection Agency December 1989	TBC	

62.	*Selecting Inorganic Constituents As Chemicals Of Potential Concern At Risk Assessments At Hazardous Waste Sites And Permitted Facilities* DTSC Final Policy, February 1997	TBC	

LOCATION-SPECIFIC			
63.	Seismic and Floodplain standards • Title 22, CCR, Div 4.5, Ch 14, Article 2, §66264.18	ARAR Relevant and Appropriate	These standards are relevant and appropriate for TSD facilities constructed, operated, or maintained within certain distances of fault lines, floodplains, or the maximum high tide.
64.	*Drilling, Coring, Sampling and Logging at Hazardous Substance Release sites* Guidance Manual for Ground Water Investigations, Cal/EPA, July 1995	TBC	
65.	*Reporting Hydrogeologic Characterization Data at Hazardous Substance Release sites* Guidance Manual for Ground Water Investigations, Cal/EPA, July 1995	TBC	
66.	*Guidelines for Hydrogeologic Characterization of Hazardous Substance Release Sites, Volume 1 & 2,* Cal/EPA, July 1995	TBC	
67.	*Aquifer Testing for Hydrogeologic Characterization* Guidance Manual for Ground Water Investigations, Cal/EPA, July 1995	TBC	
68.	*Application of Borehole Geophysics at Hazardous Substance Release Sites* Guidance Manual for Ground Water Investigations, Cal/EPA, July 1995	TBC	

69.	*Ground Water Modeling for Hydrogeologic Characterization* Guidance Manual for Ground Water Investigations Cal/EPA, July 1995	TBC	
70.	*Monitoring Well Design and Construction for Hydrogeologic Characterization* Guidance Manual for Ground Water Investigations, Cal/EPA, July 1995	TBC	
71.	*Advisory – Active Soil Gas Investigation* DTSC/CRWQCB-Los Angeles Region, January 2003	TBC	
72.	*Representative Sampling of Ground Water for Hazardous Substances,* Cal/EPA, July 1995	TBC	
73.	*Accumulating Hazardous Waste at Generator Sites,* Cal/EPA, July 1995	TBC	
ACTION-SPECIFIC			
74.	Hazardous Waste Control Act (HWCA) Standards applicable to generators of hazardous waste • Title 22, CCR, Div 4.5, Ch 12, Article 1, §66262.11	ARAR Applicable	Owners or operators who generate waste shall determine whether waste is a hazardous waste. Applicable for any operation where waste is generated. The determination of whether wastes generated during remedial activities are hazardous shall be made when the wastes are generated.
75.	Hazardous Waste Control Act (HWCA) • Title 22, CCR, Div 4.5, Ch 12, Article 1, §66262.12	ARAR Applicable	A generator shall not treat, store, dispose of, transport or offer for transportation, hazardous waste without having received an identification number. Substantive requirements will be applicable for any operation where waste is generated. The determination of whether wastes generated during remedial activities

			are hazardous shall be made when the wastes are generated.
76.	Hazardous Waste Control Act (HWCA) Standards for owners and operators of hazardous waste transfer and TSD facilities • Title 22, CCR, Div 4.5, Ch 14, Article 2	ARAR Applicable	Establish requirements for a hazardous waste treatment facility to have a plan for waste analysis, develop a security system, conduct regular inspections, provide training to facility personnel, and use a quality assurance program during construction. The requirements may be applicable if CERCLA response action includes treatment, storage, or disposal as defined under RCRA, or may be relevant and appropriate if the requirements address problems or situations sufficiently similar to the specific circumstances at the site that their usage will be well suited.
77.	Hazardous Waste Control Act (HWCA) Standards applicable to generators of hazardous waste • Title 22, CCR, Div 4.5, Ch 12, Article 2, §66262.20, §66262.22	ARAR Applicable	A generator of hazardous waste who transports or offers hazardous waste for transportation shall prepare a manifest. Substantive requirements will be applicable for any operation where waste is generated. The determination of whether wastes generated during remedial activities are hazardous shall be made when the wastes are generated.
78.	Hazardous Waste Control Act (HWCA) Standards applicable to generators of hazardous waste • Title 22, CCR, Div 4.5, Ch 12, Article 3, §66262.30, §66262.31, §66262.32, §66262.33	ARAR Applicable	Before transporting hazardous waste or offering hazardous waste for transportation off-site, the generator must do the following in accordance with DOT regulations: package the waste, label and mark each package of hazardous waste, and ensure that the transport vehicle is correctly placarded.
79.	Hazardous Waste Control Act (HWCA) Standards applicable to generators of hazardous waste • Title 22, CCR, Div 4.5, Ch 12, Article 3, §66262.34	ARAR Applicable	Requirements with respect to accumulation of waste on-site.

80.	Hazardous Waste Control Act (HWCA) Standards applicable to generators of hazardous waste • Title 22, CCR, Div 4.5, Ch 12, Article 4, §66262.40, §66262.41	ARAR Applicable	Establishes requirements for record keeping of manifests, test results, waste analyses, and Biennial Reports. Any substantive requirements shall be attained.
81.	Corrective Action • Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.100 (a) through (d), (f), (g)(1), and (h)	ARAR Relevant and Appropriate	The owner or operator is required to take corrective action under Title 22, CCR, §66264.91 to remediate releases from the regulated unit and to ensure that the regulated unit achieves compliance with the water quality protection standard. Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.
82.	Corrective action for Waste Management Units • Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.101	ARAR Relevant and Appropriate	The owner or operator is required to take corrective action to remediate releases from any solid or hazardous waste management unit at the facility to protect public health and the environment. Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.
83.	Closure and post-closure care • Title 22, CCR, Div 4.5, Ch 14, Article 7, §66264.111, §66264.112, §66264.115 through 120	ARAR	Owners and operators shall close a facility and perform post-closure care when contaminated subsurface soil cannot be practically removed or decontaminated. Contaminated soil, residues, or groundwater from remedial action at a site will achieve clean closure; otherwise, post-closure care requirements will be relevant and appropriate.

84.	Use and management of containers • Title 22, CCR, Div 4.5, Ch 14, Article 9	ARAR Applicable	Containers used for the transfer or storage of hazardous waste must be in good condition, compatible with the waste, kept closed except to add or remove materials and be inspected weekly. The area used to store the containers must provide adequate secondary containment and be designed with runoff controls. Also, appropriate closure of the containers must take place.
85.	Tank systems • Title 22, CCR, Div 4.5, Ch 14, Article 10	ARAR Applicable	The remedial activities may involve storage and/or treatment in tanks. These tanks are required to have secondary containment, be monitored and inspected, be provided with overfill and spill protection controls, and operated with adequate freeboard. Also, appropriate closure must take place.
86.	Waste piles • Title 22, CCR, Div 4.5, Ch 14, Article 12	ARAR Applicable	The waste piles should be placed upon a lined foundation or base with a leachate system, protected from precipitation and wind dispersal, designed to prevent run on and run off. Also, closure and post-closure care requirements. Remedial action may involve soil excavation and the compiling of soil in a temporary waste pile. This requirement is applicable if the excavated waste meets RCRA hazardous waste criteria.
87.	Landfills • Title 22, CCR, Div 4.5, Ch 14, Article 14	ARAR Relevant and Appropriate	The requirements for landfills include the design and operation, action leakage rate, monitoring and inspection, response actions, surveying and recordkeeping and closure and post-closure care.
88.	Miscellaneous Units • Title 22, CCR, Div 4.5, Ch 14, Article 16	ARAR Applicable	Applies to waste management unit not otherwise regulated under RCRA. It may include pumps, auxiliary equipment, air strippers, etc. The substantive requirements include design, construction, operation, maintenance and closure of the unit that will ensure protection of human health and the environment. The actions include general inspections for safety and operation efficiency, testing and maintenance of the equipment (including testing of warning systems). Applicable if pumps are used for extraction and treatment of leachate that meets RCRA hazardous waste criteria.

89.	Land Disposal Restrictions (LDR) for RCRA wastes and non-RCRA wastes • Title 22, CCR, Div 4.5, Ch 18, Articles 1, 3, 4, 10, 11	ARAR Applicable	Movement of hazardous waste to new locations and placed in or on land will trigger LDR. General applicability, dilution prohibited, waste analysis and record keeping, and special rules apply for wastes that exhibit a characteristic waste. Best Demonstrated Available Technology (BDA) standards for each hazardous constituent in each listed waste, if residual is to be disposed. Utilize treatment standards table when necessary. Where applicable, hazardous waste generated from remedial activities must comply with LDR and meet the treatment standards or notify the disposal facility of the treatment standards before disposal at an appropriate offsite disposal facility.
90.	Hazardous Waste Control Act (HWCA) Standards for owners and operators of hazardous waste transfer and TSD facilities • Title 22, CCR, Div 4.5, Ch 14, Articles 3 and 4	ARAR Applicable	Establish requirements for a facility to plan for emergency conditions. In addition, the design and operation of the facility must be done to prevent releases. Other requirements include testing and maintenance of equipment and incorporation of communication and alarm systems and contingency plan. The requirements may be applicable if CERCLA response action includes treatment, storage, or disposal as defined under RCRA, or may be relevant and appropriate if the requirements address problems or situations sufficiently similar to the specific circumstances at the site that their usage will be well suited.
91.	Hazardous Waste Control Act (HWCA) Groundwater monitoring and response • Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.91 (a) and (c)	ARAR Relevant and Appropriate	Owners or operators of a RCRA surface impoundment, waste pile, land treatment unit, or landfill shall conduct a monitoring and response program for each regulated unit. Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.
92.	Hazardous Waste Control Act (HWCA) Monitoring • Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.97 (b), (c), (d) and (e)(1) through (e)(5)	ARAR Relevant and Appropriate	Requirements for monitoring groundwater, surface water, and vadose zone. Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.

93.	Hazardous Waste Control Act (HWCA) Detection Monitoring • Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.98	ARAR Relevant and Appropriate	Requires the owner or operator of a regulated unit to develop a detection monitoring program that will provide reliable indication of a release. Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.
94.	Hazardous Waste Control Act (HWCA) Evaluation Monitoring • Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.99	ARAR Relevant and Appropriate	Requires the owner or operator of a regulated unit to develop an evaluation monitoring program that can be used to assess the nature and extent of a release from the unit. Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.
95.	Discharges of Waste to Land • Title 23 CCR, Div 3, Ch 15	ARAR Relevant and Appropriate	The regulations in this chapter pertain to water quality aspects of hazardous waste discharge to land, establishing waste and site classifications and waste management requirements for waste treatment, storage, or disposal in landfills, surface impoundments, waste piles, and land treatment facilities. Requirements in this chapter are minimum standards for proper management of each waste category. Pursuant to Section 2511 (Exemptions), because this remediation constitutes actions taken by public agencies to cleanup unauthorized releases of waste, these regulations will only apply if the proposed remedial activities include (1) removal of waste from the immediate place of release, or (2) keeping some contamination in place.
96.	Consolidated Regulations for Storage, Treatment, Processing, or Disposal of Solid Waste • Title 27 CCR, Div 2, Subdivision 1	ARAR Relevant and Appropriate	The regulations in this subdivision (promulgated by the State Water Resources Control Board (SWRCB)) pertain to water quality aspects of discharges of solid waste to land for treatment, storage, or disposal. Pursuant to Section 20090 (Exemptions), because this remediation constitutes actions taken by public agencies to cleanup unauthorized releases of waste, these regulations will only apply if the proposed remedial activities include (1) removal of waste from the immediate place of release, or (2) keeping some contamination in place.

97.	Requirements for land-use covenants • Cal. Code Regs. Title 22, § 67391.1	ARAR Applicable	This regulation requires appropriate restrictions on use of property in the event that a proposed remedial alternative results in hazardous materials remaining at the property at levels which are not suitable for unrestricted use of the land. This is an ARAR with respect to PG&E-owned land at the Topock site.
98.	California Water Code Section 13801(c) • California Well Standards, Bulletin 74-90 (Supplement to Bulletin 74-81)	ARAR Applicable	These standards for water, cathodic, and monitoring wells will be applicable if the remediation requires use of such wells.
99.	State Water Resources Control Board Resolution No. 88-63 Adoption of Policy Entitled "Sources of Drinking Water"	ARAR Applicable	With certain exceptions, all surface and ground waters of the State of California are to be considered suitable, or potentially suitable, for municipal or domestic water supply. The Regional Water Quality Control Board and State Water Resources Board have designated the beneficial use of the ground and surface waters in the Topock Site area as "municipal and domestic water supply." This designation is set forth in the Basin Plan.
100.	Water Quality Control Plan; Colorado River Basin-Region 7, June 2006 (Basin Plan)	ARAR Applicable	This Basin Plan designates the Colorado River and the Colorado Hydrologic unit as having the beneficial use of "MUN" (or, municipal or domestic water supply). The Basin Plan also prescribes General Surface Water Objectives and Ground Water Objectives, in addition to Specific Surface Water Objectives for the Colorado River, which include a flow-weighted average annual numeric criterion for salinity for the portion of the Colorado River on the Topock Site of 723 mg/L. This TDS value must not be exceeded in any remedial alternative being considered.
101.	State Water Resources Control Board Resolution No. 68-16 ("Antidegradation Policy") Statement of Policy with respect to Maintaining High Quality of Waters in California	ARAR Applicable	Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.

102.	State Water Resources Control Board Resolution No. 92-49 Policies and Procedures for investigation and Cleanup and Abatement of Discharges under Water Code Section 13304	ARAR Relevant and Appropriate	Section III.A of this Resolution states that the Regional Water Board shall" "concur with any investigative and abatement proposal which the discharger demonstrates and the Regional Water Board finds to have a substantial likelihood to achieve compliance within a reasonable time frame…"
103.	State Water Resources Control Board Resolution No. 77-1 Policy with Respect to Water Reclamation in California	TBC	
104.	*Transportation Plan* Preparation Guidance for Site Remediation DTSC, May 1994	TBC	

TABLE 3

Alternative E

Remedial Alternative Cost Summary - In-Situ Treatment with Freshwater Flushing

Site: Topock
Date: 12/13/2009

CAPITAL COSTS

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL		NOTES
Wells						
Injection & Extraction Wells	1	See Note	$5,701,860	$5,700,000		See Table D-12. Does not include freshwater extraction wells.
Monitoring	28	WELL	$60,800	$1,700,000		28 new wells assumed
SUBTOTAL				$7,400,000		
In Situ Systems						
IRZ	1	LS	$4,034,500	$4,030,000		See Table D-13c
SUBTOTAL				$4,030,000		
Ex Situ Treatment						
Treatment plant	0			$0		
SUBTOTAL				$0		
Infrastructure						
Pipelines & Conduit / Wire & Trench	1	See Note	$8,860,766	$8,860,000		See Table D-16
Access Roads	3	1,000 LF	$16,200	$50,000		
Fresh water						
Wells	1	LS	$158,700	$160,000		Assumed one 10" diameter well (shown on Table D-12)
Pipeline	1.6	1,000 LF	$100,000	$160,000		1,600 feet of 10" steel pipe running across existing pipe bridge and supports.
SUBTOTAL				$9,230,000		
Remove IM3 Treatment Plant						
IM3 treatment - restoration and deconstruction	1	LS	$1,600,000	$1,600,000		See Table D-17
SUBTOTAL				$1,600,000		
SUBTOTAL				$22,300,000		
Prime Contractor Cost Factors[1]						
General Conditions (sub mob, sub GC)	10%			$2,230,000		USEPA costing guidance EPA-540-R-00-002
Field Construction Management and Engineer SDC	10%			$2,450,000		
Pre-construction (work plans, design, as-builts)	14%			$3,780,000		
Project Management	5%			$1,540,000		
Contractor Markup (G&A, fee)	21%			$6,780,000		
SUBTOTAL			75%	$16,800,000		
Miscellaneous						
Institutional Controls and other Administrative Approvals	1	CONSTR PHASES	$1,000,000	$1,000,000		Allowance
Biological Monitoring	1	CONSTR YRS	$330,000	$330,000		Allowance
Cultural Monitoring	1	CONSTR YRS	$330,000	$330,000		Allowance
Regulatory Oversight	1	CONSTR YRS	$300,000	$300,000		Allowance
Soil Cuttings	1	CONSTR PHASES	$200,000	$200,000		Allowance - see also Section D.2.1.7 for description of this line item.
SUBTOTAL				$41,300,000		
Contingency	25%			$10,300,000		
TOTAL CAPITAL COST				**$51,600,000**		
			Low Range		High Range	
			$36,100,000		**$77,400,000**	

Table 3 Continued

OPERATIONS AND MAINTENANCE COST

DESCRIPTION	UNITS	UNIT COST		O&M	Long-Term Mon.	NOTES
		Duration:		29 years	10 years	
Ex Situ Treatment Plant O&M	YR					
Freshwater well maintenance & pumping	100 gpm	$ 11,108		$ 55,542	$ -	500 gpm of freshwater. Cost is for electricity for pumping, and maintaining well.
IRZ	YR	See Note		$ 1,031,500	$ -	Labor, materials, maintenance, well cleaning, reagents, reporting. Cost based on site experience in California and adjusted for flow and carbon demand. See Table D-14.
IRZ Well Replacement	10%	Capital Cost of Wells		$ 106,596	$ -	Replace 10% of wells each year.
Maintenance of Wells (Non IRZ)	See Note			$ 1,023,251	$ 393,341	Assume maintenance as percent of capital cost of wells. 10% for extraction and monitoring wells; 20% for injection wells.
Groundwater/Surface Water Monitoring	YR	See Note		$ 158,276	$ 67,500	$135,000/event for S&A, data mgmt. 6 events in first yr of a Phase, then 1 event/yr. Based on cost for recent similar activities at Topock. Every two years during Alt. B or LTM.
Reporting - Site-wide Groundwater Monitoring	YR	See Note		$ 121,241	$ 60,000	$156,000 for first sampling event in a Phase, then $120,000/year. Assume once per two years during LTM. Based on cost for recent similar activities at Topock.
Reporting - Performance	YR	See Note		$ 50,000	$ 25,000	Allowance of $50,000/report in years remedy is operating. Assume once per two years during LTM.
Other Facilities - Road maintenance	3.0 x 1,000 LF	$ 700		$ 2,126	$ -	
Other O&M Costs						
Permit Compliance	YR	See Note		$ 360,000	$ 72,000	$360,000/year based on IM3 compliance costs. 20% assumed during LTM.
Groundwater ICs	YR	$ 20,000		$ 20,000	$ 20,000	Allowance
Biological Surveys	YR	See Note		$ 100,000	$ 20,000	$100,000/yr from recent site costs for monitoring per PBA document. Spring DETO and SWFL surveys). 20% assumed during LTM.
Cultural Surveys	YR	See Note		$ 50,000	$ 10,000	Annual allowance. 20% assumed during LTM.
Reg/stakeholder oversight	YR	See Note		$ 100,000	$ 20,000	Annual allowance. 20% assumed during LTM.
Water rights	$/ac-ft	$ 27		$ 8,694	$ -	Based on current invoices from the City of Needles
5-year reviews	YR	$ 15,000		$ 15,000	$ 15,000	$75,000/review based on cost at other sites; done once per 5 years.
SUBTOTAL				$ 3,200,000	$ 703,000	
Contingency	25%			$800,000	$176,000	
SUBTOTAL				$4,000,000	$879,000	
TOTAL O&M COST				**$4,000,000**	**$900,000**	

POST-REMEDIATION DECONSTRUCTION COSTS

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL		NOTES
Restoration of areas disturbed during construction.	1	LS	$1,000,000	$1,000,000		Allowance
Deconstruct roads and small structures	1	LS	$700,000	$700,000		$500K allowance for roads (including Rt 66), $200K for structures other than treatment plant
Deconstruct wells	138	WELL	$30,000	$4,140,000		Cost per well from experience at Topock
Deconstruct new treatment plant	0	LS				
SUBTOTAL				$5,840,000		
Contingency	25%			$1,460,000		
TOTAL POST-REMEDIATION DECONSTRUCTION COST				**$7,300,000**		

PRESENT VALUE ANALYSIS

PERIOD	COST TYPE	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR[2]	PRESENT VALUE	NOMINAL VALUE	NOTES
							See Section D.2.4 for more information on Present Value calculations
0	CAPITAL COST, YEAR 0	$51,600,000	-	1.000	$51,600,000	$51,600,000	
29	ANNUAL O&M COST, YEAR 1-30		$4,000,000	18.785	$75,138,196	$116,000,000	
10	LONG TERM MONITORING, YEAR 31-40		$900,000	3.421	$3,078,878	$9,000,000	
41	POST-REMEDIATION DECONSTRUCTION, YEAR 41	$7,300,000	-	0.278	$2,030,637	$7,300,000	
	TOTAL PRESENT VALUE OF ALTERNATIVE				**$132,000,000**		
				Low Range		High Range	
				$92,000,000		**$198,000,000**	
Total Nominal Cost					**$184,000,000**		

Note:

Acronyms and abbreviations are defined in Table D-11. Total costs rounded to 3 significant figures.

Source Information:

1. Factors are applied cumulatively and based on United States Environmental Protection Agency. July 2000. A Guide to Developing and Documenting Cost Estimates During the Feasibility Study. EPA 540-R-00-002. (USEPA, 2000).
2. Discount factor of 3.17% per year is used

Groundwater Record of Decision
SWMU 1/AOC 1 and AOC 10
PG&E Topock Compressor Station
Needles, California

Part 3: Responsiveness Summary

United States Department of the Interior

RESPONSIVENESS SUMMARY
GROUNDWATER RECORD OF DECISION
PG&E TOPOCK COMPRESSOR STATION

December 2010

U.S. Department of the Interior
Office of Environmental Policy and Compliance

TABLE OF CONTENTS

Table of Contents

LIST OF ACRONYMS and ABBREVIATIONS

µg/L	micrograms per liter
AOC	Area of Concern
APE	Area of Potential Effect
ARAR	applicable or relevant and appropriate requirement
AZ	Arizona
bgs	below ground surface
BLM	United States Bureau of Land Management
BOR	United States Bureau of Reclamation
CA	California
CACA	Corrective Action Consent Agreement
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CIP	community involvement plan
CMS/FS	corrective measures study/feasibility study
COC	constituent of concern
COPC	constituent of potential concern
COPEC	constituent of potential environmental concern
Cr (III)	trivalent chromium
Cr (T)	total chromium
Cr (VI)	hexavalent chromium
CWG	Consultative Working Group
DOI	United States Department of the Interior or "the Department"
DTSC	California Environmental Protection Agency, Department of Toxic Substances Control
EIR	environmental impact report
EPC	exposure point concentration
ESA	Endangered Species Act
gpm	gallons per minute
GWRA	groundwater human health and ecological risk assessment
HI	health index
HNWR	Havasu National Wildlife Refuge
IM	interim measure
IRZ	in-situ reactive zone
MCL	maximum contaminant level
mg/L	milligrams per liter
Mn	manganese
Mn (II)	manganese (II) oxide
Mn (IV)	manganese (IV) oxide
MNA	monitored natural attenuation
MnO_2	manganese dioxide

MWD	Metropolitan Water District
NCP	National Contingency Plan
O&M	operation and maintenance
OSWER	Office of Solid Waste and Emergency Response
PG&E	Pacific Gas and Electric Company
PRBs	permeable reactive barriers
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RFI/RI	Resource Conservation and Recovery Act facility investigation/ remedial investigation
ROD	Record of Decision
RWQCB	Regional Water Quality Control Board
SHPO	State Historic Preservation Officer
SWFL	southwestern willow flycatcher
SWMU	Solid Waste Management Unit
TBC	to be considered
TDS	total dissolved solids
USC	United States Code
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UTL	upper tolerance limit
VOC	volatile organic compound

EXECUTIVE SUMMARY

This Responsiveness Summary Section of the Record of Decision ("ROD") summarizes public comments on the Proposed Plan and the supporting analysis and information, including the Remedial Investigation and Feasibility Study ("RI/FS"), received during the tribal consultation and public comment period on the proposed groundwater remedy for the Topock Compressor Station Remediation Site (the "Site") and provides the Department of the Interior's (the "Department's" or "DOI's") responses to those comments. This Responsiveness Summary was prepared in accordance with the requirements of Section 117 of the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"), as amended, and 40 CFR Section 300.430(f) of the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"). Comments submitted during the tribal consultation and public comment period addressing issues other than the proposed groundwater remedy, while not addressed in this Responsiveness Summary, are included in the Administrative Record for this remedy selection decision.

The *Revised Final RCRA Facility Investigation and Remedial Investigation Report, Volume 2 - Hydrogeological Characterization and Results of Groundwater and Surface Water Investigations Report* ("RFI/RI") (CH2M Hill 2009a) was made available to the public in February 2009. The *Final Groundwater Corrective Measures Study/Feasibility Study Report for SWMU 1/AOC 1 and AOC 10 Report* ("CMS/FS") (CH2M Hill 2009b) was made available to the public in December 2009. These reports, along with the DOI Proposed Plan and other supporting documents, can be found in the Administrative Record file located at the Bureau of Land Management ("BLM") Lake Havasu Field Office in Lake Havasu City, AZ. These documents may be found in the information repositories maintained at the Needles Public Library, Lake Havasu City Library, Parker Public Library, Chemehuevi Indian Reservation, Colorado River Indian Tribes Public Library, and the Golden Shores/Topock Library Station.

Comments received during the tribal consultation and public comment period indicate a wide range of sentiment regarding the remedial process and the proposed remedy. Several commenters expressed strong and deeply held beliefs that the Selected Remedy would result in significant, adverse effects on an area they consider to be sacred to their culture and religion. These commenters generally preferred Alternatives A or B (no action or monitored natural attenuation) over the Selected Remedy. On the other end of the spectrum, several commenters expressed strong concerns that the Selected Remedy would not remediate Site contamination quickly or comprehensively enough and that this was due to the Department's giving too much weight to concerns about impacts on cultural resources. These commenters generally favored a more aggressive pump and treat approach (e.g., Alternative F). In the Department's view, the Selected Remedy strikes the appropriate balance between these competing concerns. It will provide hydraulic control to prevent contaminants from reaching the river while drawing carbon-amended water across the floodplain to accelerate treatment, protecting human health and the environment and attaining ARARs, but with fewer adverse effects to cultural resources and biological resources than other alternatives considered.

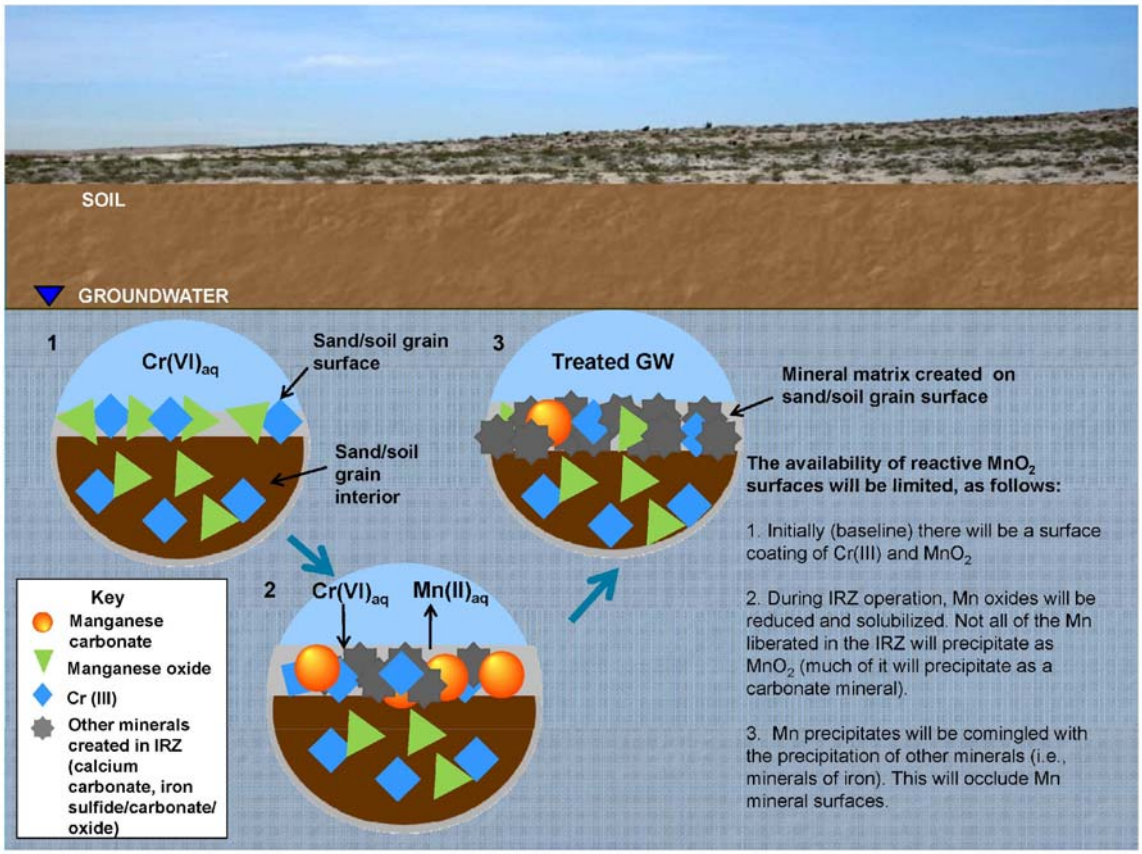
Several commenters expressed concerns about institutional controls imposed as part of the remedy and how such controls may affect access to the area. Access to the Topock area is currently addressed in the BLM Lake Havasu Field Office Resource Management Plan and the United States Fish and Wildlife Service ("USFWS") Lower Colorado River National Wildlife

Refuges Comprehensive Management Plan. Recreational activities at the Havasu National Wildlife Refuge ("HWNR") include sightseeing, bird watching, fishing, hunting, and canoeing. All areas within the HNWR and outside the Compressor Station are considered publicly accessible for such activities and are likely to remain publicly accessible in the future. The Department recognizes that important riparian habitat and cultural resources are located in the area. The Federal Agencies will continue to manage the area to protect and prevent irreparable damage to these valuable resources.

Several commenters were concerned that the hexavalent chromium ("Cr (VI)") contamination had already reached the Colorado River. Based on data collected during the RFI/RI monitoring period, no Site-related contamination of the Colorado River was observed. Over 700 surface water samples were collected from 43 locations in the Colorado River to determine the occurrence and extent of constituents of potential concern ("COPCs") in surface water for the RFI/RI. None of the average concentrations for the samples from the shoreline, in-channel, and pore water study surface water locations exceeds the most stringent surface water contaminant limits. Moreover, there was no discernable difference between results in samples collected upstream or downstream of Bat Cave Wash in the Colorado River. None of the Cr (VI) and total chromium ("Cr (T)") concentrations from the RFI/RI samples collected from the Colorado River exceeded the chemical-specific surface water criteria of 11 and 50 micrograms per liter ("µg/L"), respectively.

Several comments questioned the validity of the cost information provided in the CMS/FS and Proposed Plan. It should be recognized that costs of each alternative are estimated to a level of accuracy of +50 to -30 percent, consistent with the preliminary nature of the design development (approximately 2 to 5 percent design development). The costs are included in the CMS/FS for comparison purposes. Present-value analysis is the method used to evaluate expenditures, either capital or operation and maintenance, that occur over different time periods. This standard methodology allows for cost comparisons of different remedial alternatives on the basis of a single cost figure for each alternative. The NCP (40 CFR 300.430) requires estimation of the net present value of capital and operation and maintenance costs for remedial alternatives.

Several commenters had questions and concerns about the potential for trivalent chromium ("Cr (III)"), generated from the conversion of Cr (VI) to Cr (III) during the in-situ treatment process, to reconvert back to Cr (VI). The US Geological Survey, in support of the Topock Remediation Project, examined this issue in depth and concluded that the most likely scenario after in-situ remediation is complete is that mineral coatings on aquifer sediments will consist of a complex mixture of mostly iron oxides with some Cr and manganese oxides ("MnO_2"). For oxidation to occur, Cr (III) would have to come into contact with MnO_2. Since both are solid phases with low solubility, this is unlikely under natural conditions (see illustration provided below). USGS concluded that it is doubtful that enough MnO_2 will be in direct contact with chromium hydroxides ("$Cr(OH)_3$") to cause oxidation and mobilization of Cr (VI) above background levels.



Permanence of Chromium Treatment: Limited availability of reactive Mn, Figure G3 CMS/FS Report for Chromium in Groundwater Appendix G: In-situ Reactive Zone Treatment Design Elements

Several commenters were concerned that the preferred alternative would create byproducts and that the contamination from these byproducts and the Cr (VI) could potentially reach the river. The introduction of the in-situ treatment zone can affect the stability of naturally-occurring minerals found in the aquifer solids and can temporarily mobilize certain naturally-occurring metals within the treatment zone (primarily iron, manganese, and arsenic). River water contains oxygen. When river water interacts with groundwater in the aquifer these metals are precipitated, thus removing them from the groundwater. These reactions are well characterized and the mechanisms of iron, arsenic, and manganese removal are effective. Additionally, extraction wells near the river will provide hydraulic control to prevent water originating in the plume from reaching the river.

Several commenters voiced concerns about the potential impacts to groundwater supply wells in the surrounding communities due to extraction of water for the fresh water flushing portion of the proposed remedy. Freshwater injection involves piping fresh water to the site from an offsite source. The injection of fresh water at an assumed rate of approximately 500 gallons per minute ("gpm"), combined with the floodplain groundwater extraction, amendment, and reinjection, is sufficient to induce a hydraulic gradient to accelerate the movement of the site groundwater through the in-situ reactive zone ("IRZ"). No consumptive use would be associated with the in-situ treatment and freshwater flushing elements of the Selected Remedy because all extracted water would come from the Colorado River Basin and would be returned to the Colorado River

Basin via reinjection wells within the Colorado River accounting surface. The extraction well location and/or extraction rates will be adjusted during remedy design, based on a hydrologic analysis, to ensure that groundwater extraction does not have substantial adverse affects on the production rates of existing nearby wells. Very small, localized effects on the groundwater table near the freshwater extraction wells are, however, possible.
The offsite source of fresh water for this alternative could be the same as the water source for the Topock Compressor Station. The Topock Compressor Station is currently purchasing its water from wells in Arizona owned by Southwest Water Inc. Future water supply may be from the Colorado River or from wells on the California side of the river. This will be further evaluated as part of the remedy design.
This public involvement process and the Department's incorporation of these comments in the remedy selection process are evident in the ROD, which is being released at this time.

INTRODUCTION

This Responsiveness Summary Section of the ROD summarizes and responds to public comments on the Proposed Plan which identified the Department's preferred alternative among the remedial alternatives evaluated to address chromium contamination in groundwater from the Pacific Gas and Electric ("PG&E") Topock Compressor Station. On March 11, 2010, BLM initiated consultation with nine tribes concerning DOI's Proposed Plan. The Proposed Plan was provided to all Topock Project Tribal Executives, Tribal Cultural Resource Management Staff, and California and Arizona State Historic Preservations Officers ("SHPOs") in advance of that public review and comment period as part of the ongoing tribal government consultation regarding CERCLA remedy selection. Tribal comments were accepted through July 19, 2010.

The Proposed Plan was issued for public review on June 4, 2010. The public comment period was held from June 4, 2010 to July 19, 2010. Public meetings were held on June 22 at the Parker Community/Senior Center in Parker, CA, on June 23 at the Lake Havasu Aquatic Center in Lake Havasu City, AZ, on June 29 at the Needles High School in Needles, CA, and on June 30 at the Topock Elementary in Topock, AZ, to present the Proposed Plan and to accept oral and written public comments. The transcripts for the public meetings have been placed in the Administrative Record.

The Responsiveness Summary serves two functions:

1. It provides the CERCLA lead agency with information about the views of the community on the Proposed Plan and the supporting analysis and information, including the RI/FS, located in the Site information repository; and
2. It documents how public comments were considered during the decision-making process, and responds to significant comments regarding remedy selection.

Public involvement in the review of Proposed Plans is required by Section 117(a) of CERCLA, as amended, and Sections 300.430(f)(3)(i)(F) and 300.430(f)(5)(iii)(B) of the NCP. Significant comments on the Proposed Plan are addressed in this Responsiveness Summary, which was prepared in accordance with the Community Involvement Plan ("CIP") for the PG&E Topock Compressor Station, and applicable Environmental Protection Agency ("EPA") guidance. Comments regarding the State of California's implementation of State requirements and decision-making process, and other comments on topics beyond the scope of characterizing Site contamination and the evaluation and selection of CERCLA remedial action, are not addressed in this Responsiveness Summary. The comments presented in this Responsive Summary have been considered by the Department in its final selection of a remedy to address groundwater contamination at the Site.

Commenters on the Proposed Plan included the San Diego County Water Authority, Metropolitan Water District of Southern California, Colorado River Indian Tribe, Hualapai Tribe, Chemehuevi Tribe, Fort Mohave Indian Tribe, Fort Mohave tribal members, and private citizens. Responses to significant comments received at both public meetings and in writing during both the tribal and public comment periods are included. Comments have been organized into the following categories:

- Legal Issues (Policy Issues, CERCLA Requirements and Issues, Public Participation Process)

- RFI/RI
- Risk Assessment
- CMS/FS (Remedial Action Objectives, Technology Evaluation and Alternative Development, Implementability, Cost, Short and Long-term Effectiveness)
- Preferred Remedy
- Tribal Concerns/Impacts
- Community Concerns/Impacts

The information provided in the tables below includes comments specific to the groundwater investigation, alternative evaluation, and the alternative selection, summarized or paraphrased from written comments or transcripts of verbal comments made at public meetings. The actual transcripts from the public meetings and the complete set of comment letters are available in the Administrative Record for the Topock Site at the following location:
Bureau of Land Management – Lake Havasu Field Office
2610 Sweetwater Avenue
Lake Havasu City, AZ
(928) 505-1200
Hours: Monday – Friday
8:00 a.m. to 4:30 p.m.

COMMENTS & RESPONSES

A. LEGAL AND POLICY ISSUES

	Comment	DOI Response
1.	Several commenters asked how institutional controls will affect access to the area.	Institutional controls are mechanisms used to limit human exposure to hazardous substances at or near a contaminated site, or to ensure the effectiveness of the remedial action over time, when contaminants remain at a site at levels that preclude unrestricted use of the property. Land use management plans established by BLM and USFWS HNWR provide for restrictions on the drilling of new groundwater wells in the plume or its path until Remedial Action Objectives are attained. No other access restrictions are established by the Selected Remedy.
2.	Shoreline in the Project area invites recreational usage. While the Tribes recognize this as a natural human impulse, that impulse may be monitored, and where appropriate, its adverse effects reasonably mitigated to balance the multiplicity of interests interacting along the River at the site of the Topock Remediation Project. Just as Tribal peoples would not be welcome to throw a party at Stonehenge or in the Sistine Chapel, we ask that the same respect be shown for our sacred sites. The Tribes therefore recommend that a process of monitoring shoreline usage be incorporated into the overall Proposed Plan for the Project. The purpose of the shoreline monitoring process shall be to minimize the incidence of and mitigate adverse impacts to religious and spiritual access and, or, usage by area Tribal peoples.	The shoreline of the Colorado River periodically attracts recreational usage of the beaches near the remediation site. Depending on the water level in the river, one to four small sand beaches and one gravel beach under the I-40 Bridge are available to boaters and anglers. The primary access to these beaches is via watercraft. No work that would increase access to the beaches is planned as part of the remediation. Because of the heavy vegetation along the river, it is expected that the new extraction well infrastructure to be installed near the river will be screened from the beaches. Given this, the project will not provide additional public access to the site, and the well installation will not encourage or attract increased public access or visitors.
3.	The Fort Mojave Indian Tribe has	DOI solicited applicable or relevant and

	ARARs as well and piecemeal selection of ARARs to rule out alternatives could work both ways.	appropriate requirements ("ARARs") from State agencies, tribal governments, and stakeholders on several occasions, including by letter from the office of the Solicitor dated April 28, 2006. Counsel representing the Fort Mojave Indian Tribe ("FMIT") responded in writing to this and other requests for the identification of ARARs on June 15, 2006, May 8, 2007, September 28, 2007, and August 28, 2009. DOI wrote written responses to these letters on December 4, 2007 and October 29, 2009, and counsel for DOI and FMIT met in person on this topic on July 15, 2009. All ARARs proposed by FMIT were given full consideration by DOI and most of these proposed ARARs were, in fact, adopted by DOI.
4.	How long will institutional controls identified in the BLM Resource Management Plan and HNWR Comprehensive Management Plan remain in place?	Institutional Controls will remain in place concerning groundwater use until remedial action objectives have been achieved. The management plans for BLM and the HNWR will remain in effect after the remedy is complete.
5.	Will development at Topock Marina, Park Moabi or other areas be limited or reduced as a result of institutional controls?	Development at the Topock Marina, Moabi Regional Park, and other nearby areas will not be restricted based on institutional controls imposed to prohibit use of groundwater in the Topock plume area until remedial action objectives are achieved.
6.	Can you please explain the detailed process for DTSC and DOI responding to stakeholder comments on the Statement of Basis and the EIR that will be provided? Does DTSC/DOI staff actually review and prepare responses to comments received? Or does DTSC/DOI provide the comments to PG&E who then prepares the desired PG&E response to comments in order to frame the response that best meets PG&E desire and needs? Will DTSC/DOI ensure that each and every comment is provided a detailed and complete response?	The Responsiveness Summary provides an overview of significant community concerns regarding the alternatives evaluated in the Feasibility Study, the preferred alternative identified in the Proposed Plan, the underlying information and analysis supporting the selection of a remedy, and how community input was incorporated into the ROD. DOI has developed specific responses to comments related to the groundwater remedy for the Topock site. Comments that go beyond the scope of the Proposed Plan, such as comments on documents and decisions generated by the State of California and comments unrelated to the CERCLA remedy selection decision

	Does DTSC/DOI have an obligation to ensure that each and every comment is provided a detailed and thorough response?	are not included in this Responsiveness Summary. Responses presented in this Responsiveness Summary have been prepared by DOI and have not been shared outside of the Department prior to the final issuance of this ROD.
7.	One of the issues that we see is that there's a lack of institutional memory; that many of the issues handled with this project are related to individual tenure within the different agencies; and if those employees no longer are there or something changes -- there's a restaffing, there's a reorganization -- those memories get pushed to the side.	Under CERCLA, an administrative record for a site is kept and is the complete body of documents that were considered or relied upon when selecting a response action. The Administrative Record for the Topock Site has been established in the BLM Lake Havasu Field Office and provides federal agency representatives and the public a thorough compilation of the information considered selecting remedial action.
8.	One commenter suggested, in going through the public repositories, that some information seemed to be missing. This commenter requested that DOI re-notice the public comment period at such a time that all the documents are determined to be readily available in the repository. This commenter suggested that when asked where these documents were, the librarian had no idea.	DOI personnel completed a review of the repositories at all locations and found them complete with respect to the documents that provide the supporting information for the evaluation of alternatives and remedy selection decision made by DOI. Representatives also spoke with library personnel who were immediately able to provide directions to their respective repository locations and provide information regarding the number of inquiries regarding the documents.

B. RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION

	Comment	**DOI Response**
1.	One commenter suggested that while there currently is not a contaminant transport pathway from groundwater to surface water, the risk to the Colorado River if such a pathway occurred should be recognized. The commenter also pointed out that the remedial action objectives identify prevention of migration of the plume to the	The Groundwater Risk Assessment contains an evaluation of whether there could be significant transport of site-related constituents to surface water (i.e., the Colorado River). This evaluation was based on a series of screening-level evaluations for those constituents determined to be floodplain Contaminants of Potential Concern ("COPCs). The sequential screening process was based first on a

	Colorado River, which substantiates the need to identify the risk to the river in this document.	comparison of floodplain groundwater exposure point concentrations (”EPCs”) to surface water criteria, secondly on a comparison of downstream surface water results to surface water criteria, and lastly on a comparison of downstream to upstream surface water concentrations. These comparisons concluded that the groundwater-to-surface water transport evaluation indicates that the potential transport of constituents in groundwater to the Colorado River represents an insignificant transport pathway: in other words, floodplain COPCs are not being transported to the Colorado River at concentrations that exceed screening-level surface water criteria. The flow of the Colorado River at Topock is regulated by BOR, primarily by the controlled release of water from Davis Dam on Lake Mohave approximately 33 miles upstream. Given this, it is not likely that the conditions evaluated in the GWRA will change in the foreseeable future.
2.	Is the salt [previously] dumped on the ground at the Site considered a contaminant or contamination? Has the salt impacted groundwater or does it have the potential to impact groundwater? What is the background level for salt in soil, groundwater and surface water?	The salt content in soils is not addressed by the proposed groundwater remedy. Constituents in soils will be addressed in the selection of a separate remedy for soils. Salts have not been identified as a chemical of potential concern in groundwater at the Site. A background level for salt in soil has not been calculated, but might range significantly considering the desert environment within the Topock area. Soils or wastes that could contain elevated salts that might impact groundwater in the future will be addressed during the soil investigation and remedy selection process.
3.	What were the chromium concentrations in the cooling tower blowdown? Was it greater than the 32 micrograms per liter that was identified as the upland groundwater background levels? What was the total amount of treated water that	As described in the RFI/RI Volume 1, samples of the effluent from the single-step treatment system (from 1964 through 1969) contained Cr (T) at concentrations of 13.81 and 14.41 parts per million (“ppm”) (1 mg/L = 1 ppm, thus 32 µg/L = .032 ppm). In late 1969, the single-step treatment process was

	was injected?	replaced by a two-step system. Laboratory reports of wastewater samples collected in the mid-1970s generally show chromium concentrations at 1 ppm or less. The RFI/RI Volume 1 cites records indicating that, during the injection period (June 1970 through December 1973), an estimated 29.4 million gallons of treated wastewater were injected into well PGE-8. In addition, handwritten notes by an unknown author (circa 1984) indicated that 42 million gallons of wastewater had been injected into the well.
4.	One commenter noted that they did not understand what "clean closed" actually means. Was PG&E allowed by DTSC to leave any residual contamination in the soil above residential standards of background levels? If so what were these levels that DTSC allowed to be left in the soil? Were these concentrations above regional soil background levels? Do any of these contaminants have the potential to migrate and impact groundwater? Have any of these contaminants migrated to groundwater?	Closure is the term used to describe taking a RCRA regulated disposal unit out of service. *Clean closure* means that all hazardous wastes have been removed from a given RCRA regulated unit and any releases at or from the unit have been remediated so that further cleanup under RCRA is not necessary to protect human health and the environment.
5.	How many solid waste management units were identified at the Site that may potentially be sources of contamination? How many areas of concern were identified? Are any of these solid waste management units or areas of concern a potential threat to groundwater? Is it possible that contamination from these units may have impacted groundwater?	SWMUs and AOCs are construed to be facilities where a release or threatened release of a hazardous substance has occurred, as defined under CERCLA. The RFI/RI Volume (CH2MHILL, 2007a.) identifies fourteen SWMUs and twenty AOCs at the Topock Compressor Station. In response to DTSC's comment on the 2007 Soil Part B Work Plan, one additional SWMU and five additional AOCs were added to the Part B investigation program, resulting in current totals of fifteen SWMUs and twenty-five AOCs identified to date. The groundwater remedy addresses the cleanup of constituents found throughout the contamination plume, including contaminants that may be continuing to enter groundwater. The nature and extent of soil

		COPCs and constituents of potential environmental concern ("COPECs") associated with former compressor station practices at or affecting the AOCs and SWMUs will be evaluated as part of the ongoing soil investigation to determine whether unacceptable risks or impacts to groundwater occur currently or could occur in the future, and whether soil remediation is required and should be implemented.
6.	Please explain what is the current and immediate threat to the water resource and the Colorado River at the site? Is there a current real and direct threat to the Colorado River? Is the Colorado River being impacted right now? Is the Interim Measures No. 3 keeping the contamination from the Colorado River?	The Cr (VI) groundwater plume extends from the former percolation bed in Bat Cave Wash to the floodplain area north of the railroad tracks and, under natural conditions, flows from west/southwest to east/northeast. Within the plume, Cr (VI) is typically present at all depth intervals of the alluvial portion of the aquifer but is generally limited to deep wells in the fluvial portion of the aquifer near the river and as such is not reaching the river. The Interim Measures (IM) groundwater extraction system has maintained a consistent landward gradient in the plume floodplain area year round, preventing the plume from discharging to the river. Based on data collected during the monitoring period of the RFI/RI, no Site-related contamination of the Colorado River has been observed.
7.	What happened from 1973 when PG&E stopped injecting blowdown to the bedrock until 1985 when PG&E reportedly stopped using hexavalent chromium? Is this the same chemical that was the serious problem at the PG&E Hinkley facility that contaminated the drinking water wells in the Hinkely community? Is this the same chemical that the Hollywood movie was based on about PG&E?	Beginning in May 1970, treated wastewater was discharged to an injection well (PGE-08) located on PG&E property, and discharges to Bat Cave Wash generally ceased. The well facilitated the injection of wastewater into the subsurface at depths in excess of 405 below ground surface (bgs). By 1971, PG&E had constructed the first of four single-lined evaporation ponds, and used this pond as a discharge location when operational problems were encountered with the injection well. In 1973, PG&E discontinued use of injection well PGE-08, and wastewater was discharged exclusively to the four, single-lined evaporation ponds, located about 1,600 feet west of the

		compressor station. PG&E replaced the Cr (VI)-based cooling water treatment products with phosphate-based products in 1985. Use of the four, single-lined evaporation ponds continued until 1989. In 1989, the single-lined ponds were replaced with four new, Class II (double-lined) ponds, located approximately 1.2 miles to the northwest. Hexavalent chromium was a common chemical additive for cooling water in various industries prior to the 1980s and was used at both the Topock and Hinkley compressor stations. The Hinkley site was the subject of a motion picture.
8.	What was the basis for the decision to accelerate the groundwater cleanup? Who made it? Was this a decision by only DTSC? Did DOI also approve and agree to this approach?	The idea of separating the soil and groundwater investigations was discussed with stakeholders in the Consultative Working Group ("CWG") as early as May 2004 when concerns about groundwater contamination were elevated due to the detection of Cr (VI) in a new well near the Colorado River. In the interest of expediting the groundwater cleanup, DTSC and the DOI decided to separate the soil and groundwater investigations.
9.	If the pending soil investigation will evaluate the potential for soil contamination to leach into groundwater, then how can DTSC/DOI proceed with any groundwater remedy at this time? Until DTSC/DOI knows the complete and full potential for contamination to leach from the soil into the groundwater, DTSC/DOI will not know what the appropriate and complete groundwater remedy or project will be. What is the complete list of contaminants that were found in soil so that I can know what possible contaminants may potentially leach from soil into the groundwater in the future?	The groundwater remedy addresses the cleanup of constituents found throughout the contamination plume, including contaminants in soil that may be continuing to enter groundwater. The nature and extent of soil COPCs and COPECs associated with former compressor station practices will be evaluated as part of the ongoing soil investigation to determine whether unacceptable risks or impacts to groundwater occur currently or could occur in the future, and whether soil remediation is required and should be implemented to address those or other risks found to be present.
10.	Is it possible that hexavalent chromium is actually discharging to	There was no discernable difference between results in samples collected

	the Colorado River but is not being detected due to laboratory detection limits and the fact that sampling techniques in the Colorado River allow for a mixing zone and potential dilution with the fast moving Colorado River water before a sample is collected? Is DOI able to state that the existing bedrock groundwater contamination in East Ravine is NOT in direct contact with the Colorado River? Is this contamination discharging into the Colorado River? Has the full and complete extent of the groundwater contamination been defined? Is there a greater potential direct threat to the Colorado River from the groundwater contamination at East Ravine since the bedrock is in direct contact with the Colorado River and no continuous reducing conditions exist in this area?	upstream or downstream of Bat Cave Wash in the Colorado River. None of the Cr (VI) and Cr (T) concentrations from the RFI/RI samples collected from the Colorado River exceeded the chemical-specific ARARs criteria of 11 and 50 µg/L, respectively. Two new surface water sampling locations were added to the surface water monitoring program in response to Cr (VI) results for samples in East Ravine wells. Samples have been collected from these locations since April 2009. Consistent with surface water samples collected from other monitoring locations adjacent to the Colorado River, sample results at these two new locations and previously established surface water sampling locations were less than analytical reporting limits during April 2009 and July 2010 monitoring. Additionally, no detections of chromium were found in samples of undiluted pore water entering the Colorado River at 64 sample locations. Elevated chromium in groundwater in the East Ravine appears to be primarily in the uppermost 20 to 50 feet of the saturated bedrock. Due to the low porosity and limited fracturing present within the bedrock formations, mass of chromium in bedrock likely represents less than one percent of the total plume mass for the Topock Site. Additional investigation to determine the source and confirm the full extent of Cr (VI) in East Ravine bedrock will be conducted as the remedial action is designed to ensure that the remedy is protective and complies with ARARs.
11.	If the extent of groundwater contamination is not known, an appropriate groundwater remedy cannot be determined.	The hydrogeologic and groundwater characterization in the East Ravine has been incorporated into the conceptual site model for this remedial action. Uncertainties that exist regarding the extent of East Ravine contamination do not preclude DOI from determining that the Selected Remedy will be protective. Hydraulic containment is included in the Selected Remedy as the primary component for the East Ravine

		bedrock and includes containment involving pumping from a group of wells near the eastern (downstream) end of the East Ravine. In addition to pumping for hydraulic control, technologies that may be applicable to East Ravine bedrock include freshwater injection for flushing and injection of carbon amendments for *in-situ* reduction of Cr (VI). Additional investigations to determine the source and confirm the full extent of Cr (VI) in East Ravine bedrock will be utilized to complete the design of the portion of the remedy for East Ravine.
12.	Do organic rich conditions exist at all locations under the river? Are they continuous? Will these organic rich conditions remain stable over 100 years? Do organic rich conditions exist downstream in the area of bedrock contamination where the bedrock is in direct contact with the Colorado River?	The fluvial sediments in the floodplain are relatively recent in origin and contain abundant organic material from several sources. Following the construction of Parker Dam in 1938, the river channel near Topock began to accumulate silt. The river level rose approximately 27 feet, and the channel near Topock became a braided stream. Organic material, probably from vegetation in the Topock marsh area, was incorporated into the fluvial sediments. Some of these organic-rich sediments were deposited directly on the floodplain. In addition, dredging operations resulted in placement of additional organic-rich river bottom materials on the floodplain. The reducing conditions observed in the floodplain sediments are likely caused by microbial breakdown of the organic carbon present (regardless of the source) in these shallow fluvial deposits. Field measurements of redox potential and other chemical data and field observations of collected core indicate that organic-rich sediments in the fluvial deposits result in naturally-reducing conditions. The reducing zone has been found to be continuous and robust in each of the many areas studied. Uncertainties remain in the distribution and extent of reducing zones, particularly south of the bridge where fluvial unconsolidated materials appear to thin and

		may be absent in some areas. Concerns also exist with respect to bridge piers that may have disrupted natural reducing zones. Moreover, the extent to which current reducing conditions provide a permanent barrier to Cr (VI) contaminant migration is uncertain. It is impossible to prove that such conditions will be able to persist hundreds or thousands of years into the future. The Selected Remedy addresses this concern. Enhancement of the floodplain reducing zone through in situ injection of carbon-amended water will augment the naturally occurring reducing conditions, and the treatment zone barrier along the National Trails Highway prevents the upland plume from migrating into the floodplain in the future.
13.	How did contamination of groundwater in the East Ravine get there? What was the source of this contamination? Are there any other areas that have not been investigated that may have potential groundwater contamination?	See response to Comments B-11.
14.	The desire to downplay this contamination by PG&E when the full extent is not know in addition to the location of this contamination related to immediate direct and substantial potential endangerment to impacting the Colorado River is serious cause for concern. Additional interim measures should have been taken by DTSC to protect the Colorado River. Why is DTSC/DOI using PG&E's estimate? What is DTSC/DOI estimate? With the BP oil spill in the Gulf of Mexico we can see how Corporate management will downplay the extent of contamination. Further as evidenced by PG&E's previous activities at Hinkley, we should be very cautious when evaluating any statements or information provided	See response to Comment B-11. Based on data collected during the monitoring period of the RFI/RI, no site-related contamination of the Colorado River has been observed. Over 700 surface water samples were collected from 43 locations in the Colorado River to determine the occurrence and extent of COPCs in surface water for the RFI/RI. None of the average concentrations for the samples from the shoreline, in-channel, and pore water study surface water locations exceeds the most stringent chemical-specific ARAR. There was no discernable difference between results in samples collected upstream or downstream of Bat Cave Wash in the Colorado River. None of the Cr (VI) and Cr (T) concentrations from the RFI/RI samples collected from the Colorado River exceeded the chemical-specific ARARs

	by PG&E.	criteria of 11 and 50 µg/L, respectively. At DOI's direction, PG&E is continuing to investigate the nature and extent of East Ravine groundwater contamination and will design and implement the remedial action to reflect the results of this additional investigation.
15.	You indicated that the extent of groundwater contamination has not been completely defined. Therefore, how can you do this?	See Response to Comment B-11 and 14.
16.	Three additional chemical contaminants exist in the groundwater (in addition to Cr (VI)). However, you are now saying that you are not going to deal with these contaminants and you will further evaluate them during the soil investigation. Why? So in fact you are saying that the proposed groundwater remedy is only for one chemical (hexavalent chromium) that will be converted to another contaminant (chromium) and left in the ground? This is completely misleading to the public since it is presented as a "groundwater remedy" when in fact it is not a complete groundwater remedy. There is not a valid reason to be proceeding in this manner. A complete groundwater remedy should be considered. Not a piecemeal approach. In addition, since a complete groundwater remedy is not known, the IM3 facility should be expanded and more pumping and treating of contaminated groundwater should occur if there is a concern that contamination is entering the Colorado River. Also as stated in this section if DTSC/DOI needs to evaluate the presence of additional chemicals during the soil investigation then the potential	The RFI/RI Volume 2 Report and Volume 2 Addendum concluded that, in addition to Cr (VI), three constituents in groundwater—namely molybdenum, selenium, and nitrate—may be associated with SWMU 1/AOC 1; however, the groundwater risk assessment concluded that these three constituents were not present in groundwater at levels of potential concern to future human health or the environment. Also see response to comment B-9.

	impacts to groundwater from this soil contamination is NOT known and therefore, a complete groundwater remedy can not be determined at this time.	
17.	One commenter asked for clarification on the extent to which Cr (III) was presently beneath the river.	A hydrogeologic investigation was performed near the shore of the Colorado River in Arizona in March and April 2008. The purpose of the investigation was to supplement the site conceptual model, to complete the groundwater characterization of the potential eastern extent of the groundwater plume, and further characterize the hydrogeologic conditions beneath the river channel downstream of the chromium plume observed in the California floodplain. The results of the investigation are documented in the *Installation Report for Wells on the Arizona Shore of the Colorado River at Topock Arizona,* dated August 12, 2008 (CH2M HILL, 2008). Reducing conditions are present in the vast majority of shallow and mid-depth fluvial wells, along with pore water and slant well samples beneath the river bottom. Under the reducing conditions prevalent beneath the river, chromium will be present in the reduced [Cr (III)] state.
18.	Don't you think the Cr (VI) might have actually reached the river, but it was diluted by the large river volumes? If Cr (VI) gets into the Colorado River, and the concentrations are below the 11 ppb standard, is that acceptable to DOI? Is it acceptable to the Tribes? Is it a desecration to the river? Is it acceptable to the public?	Cr (VI) was not detected in any shoreline surface water samples collected during the July 1997 through October 2007 monitoring period, except for one sampling event. During June 2002 surface water sampling, Cr (VI) was reported at concentrations ranging from 15.9 to 25.7 µg/L in six samples collected from the Colorado River at locations both upstream and downstream of Bat Cave Wash. According to the data quality review for the June 2002 monitoring, there was indication of false-positive results caused by unidentified interference for these samples. DTSC concurred that no action should be taken or project decisions should be made based on the results. All RFI/RI shoreline surface water samples collected from the Colorado River, other than the June

		2002 event, have been "non-detects" for Cr(VI), at the analytical reporting limit. No detections of chromium were found in samples of undiluted pore water entering the Colorado River at 64 sample locations. The Cr (VI) groundwater plume extends from Bat Cave Wash to the floodplain area north of the railroad tracks. Reducing conditions [conditions that change Cr (VI) to Cr (III)] have been documented in most shallow to mid-depth fluvial wells and sediments near and underlying the river and Cr (VI) is generally limited to deep wells in the fluvial portion of the aquifer near the river. Cr (VI) concentrations in the floodplain have been below analytical detection limits. Stable isotope data from floodplain monitoring wells indicate that the decrease in Cr (VI) concentration does not occur by dilution, and laboratory testing of fluvial anaerobic core samples provides direct evidence of the reduction reaction. The Federal Water Pollution Control Act (33 USC §§ 1251-1387, 40 CFR 131.38) specifies the allowable concentration of discharge to surface water of 11 µg/L. Cr (VI) concentrations water passing through the in-situ reduction zone and the floodplain are not expected to exceed the current conditions (less than detection limits).
19.	Our economy here on the reservation -- our way of life on the reservation -- is wholly dependent on water; and the surface water of the Colorado River is the primary resource that we have here. One of our sources of wealth, but also, an enormous component of our culture deals with this resource of water. It always has been. We have been assured for many years that there's no contamination in the river; and yet we see acceptable levels at 11 -- at 11. So I guess the question is: When was that changed; and if there's a known detection in the	Cr (VI) and dissolved Cr (T) have not been detected in any in-channel surface water samples at analytical reporting limits during the RFI/RI period, except for one occurrence. The reference to 11 µg/L comes from the Federal Water Pollution Control Act (33 USC §§ 1251-1387, 40 CFR 131.38) and is a promulgated criteria for Cr (VI) as a priority toxic pollutant in the State of California for inland surface waters and enclosed bays and estuaries.

	river, why is it at 11? Why isn't it at zero, if there's no 11 detection in the water? The same with the groundwater as well.	

C. RISK ASSESSMENT

	Comment	**DOI Response**
1.	The Hualapai Tribe believe that the plants are sacred. Willows are still used as materials for basket making by members of the Hualapai Tribe, where willow shoots are split with the teeth. In the DOI Proposed Plan (p. 6): "…there are no ecological receptors currently at risk of adverse effects." Have plants been sampled and analyzed for chromium-6? Has the DOI considered plants as a potential contaminant pathway? Do the willows at Topock contain chromium-6?	A comprehensive groundwater risk assessment ("GWRA") was conducted to understand potential health threats and ecological risks posed by groundwater impacted by hazardous substance releases from the Compressor Station. The GWRA was conducted in accordance with the agency approved Risk Assessment Work Plan, and was accepted by DTSC and DOI in December 2009. The following related human health scenarios and pathways were included in the GWRA: • Indirect Human Exposure to Chemicals in Groundwater Through Ingestion of Plants and Animals: An evaluation of the potential secondary exposure pathways, specifically human exposure through the ingestion of plants and animals that have been exposed to the groundwater (through irrigation and direct ingestion), was also conducted and presented as Appendix K in the GWRA. • Plant and Animal Exposure to Chemicals in Groundwater through Root Uptake and Subsequent Ingestion of the Plants by Animals: Potential exposure of shallow-rooted wetland plants and deep-rooted plants (phreatophytes) to chemicals of potential concern (COPCs) in groundwater was evaluated. In addition, potential exposure of herbivorous mammals to COPCs

		(originating in groundwater) via ingestion of plant tissue was evaluated. These scenarios are presented in Appendix I in the GWRA. The related key conclusions of the GWRA are summarized as follows: • Indirect Human Exposure to Chemicals in Groundwater through Ingestion of Plants and Animals: The quantification of human exposure to impacted groundwater through ingestion of plants and animals exposed to the groundwater indicates that secondary exposure pathways are not significant to overall health risks. Instead, potential risks to human health from exposure to contaminated groundwater are dominated by the direct exposure routes: ingestion and dermal contact with groundwater. Accordingly, the analyses presented in the GWRA support the determination that there would be no adverse human health effects associated with the ingestion of homegrown produce that has been irrigated with groundwater containing the hexavalent chromium. Potential incidental exposures that could occur through the use of plants for non-consumptive purposes (e.g., splitting willow stems with one's teeth) would be insignificant compared to exposures that could result from daily ingestion of homegrown produce that has been irrigated with the groundwater, and thus would also be well below any health-based level of concern. • Plant and Animal Exposure to Chemicals in Groundwater through Root Uptake

		and Subsequent Ingestion of the Plants by Animals: The exposure pathway from chemically-affected groundwater to shallow or deep-rooted plants is insignificant; that is, surface water, not groundwater, is expected to be the primary source of moisture for shallow-rooted wetland plants, and concentrations in groundwater at the site are lower than concentrations that are toxic to deeply-rooted plants. Further, toxicity to herbivorous mammals resulting from potential exposure to COPCs is not predicted given the low concentrations in groundwater and the low concentrations predicted in plant tissue. Additionally, the ecological risk assessment included three exposure pathways in addition to the groundwater-to-surface water pathway. The potential pathways evaluated included (1) shallow-rooted wetland plant exposure to chemicals in groundwater via root uptake; (2) deep-rooted plant (i.e., phreatophyte) exposure to chemicals in groundwater via root uptake; and (3) transfer of hexavalent chromium, molybdenum, nitrate, and selenium in groundwater to plant foliage via root uptake and translocation, then potential ingestion of these COPCs in plant tissue by herbivorous mammals. The GWRA concluded that there is no significant ecological exposure pathway for contact with impacted site groundwater and there are no ecological receptors currently at risk of adverse effects due to the presence of COPCs in the groundwater. These additional pathways and receptors were evaluated and were found to be potentially complete but insignificant.
2.	Is the East Ravine groundwater contamination in direct contact with ecological receptors? Has this been	See response to Comment B-11 and C-1. The groundwater sampling results indicate that Cr (VI) is not reaching the Colorado

	evaluated? How can the human and ecological risk assessments make these evaluations if the extent of groundwater contamination has not been defined or the potential discharge to the surface waters or uptake from plants?	River; therefore, there is not a complete pathway for ecological receptors.
3.	One commenter asked if there would be a risk assessment performed for the East Ravine.	Data collection efforts as part of the East Ravine investigation will assist in determining whether there are other sources (i.e., sources other than the historical releases to Bat Cave Wash) that have impacted groundwater at the site and whether additional supplemental risk evaluations need to be conducted.

D. CORRECTIVE MEASURES STUDY/FEASIBILITY STUDY

	Comment	**DOI Response**
1.	One commenter objected to the in-situ treatment of Cr (VI) by which it is reduced to Cr (III) arguing that this is the conversion of one type of contamination to another type of contamination and does not actually remove the contamination. The commenter argued that this gives the appearance and/or illusion of actually doing something that we are to trust may take place somehow below the ground surface that we are not able to see in the hopes that subsurface conditions are continuous, homogenous, without variation and as expected in the laboratory.	Reduction of Cr (VI) to Cr (III) is a core technology behind in-situ and ex-situ groundwater treatment with the key difference being that the former uses in-place biological processes instead of above-ground chemical treatment in a water treatment plant. In the Selected Remedy, the in-situ barrier is installed across the flow path of the Cr (VI) plume, thereby allowing groundwater to move through the barrier below grade, reducing the Cr(VI) to a lower soluble and less toxic Cr(III). Reduction of Cr (VI) to Cr (III) results in the formation of Cr (III) oxides that have a low solubility under the neutral and alkaline pH encountered in site groundwater. The feasibility of in-situ treatment at the PG&E Topock Site has been studied through the conduct of two separate pilot studies, the results of which are contained in the Floodplain Reductive Zone In-Situ Pilot Test Final Completion Report, dated March 5, 2008, and the Upland Reductive Zone In-Situ Pilot Test Final Completion Report, dated May 3, 2009. The pilot testing has shown that in-situ treatment is technically implementable at this site. Operation of the Selected Remedy will require a high level of oversight during

		implementation to ensure that the system is optimized and modified as remediation progresses.
2.	A RAO of 32 micrograms per liter for hexavalent chromium only? What about all the rest of the contamination?	The primary contaminant of groundwater is Cr (VI). The calculated non-carcinogenic risk-based remediation goal for Cr(VI) is 46 µg/L based on the hypothetical child receptor. The RAO of 32 µg/l was established because it is the natural background concentration for Cr (VI) in groundwater. The chromium plume is defined as that part of the alluvial where Cr (VI) concentrations exceed natural background levels. Selenium, molybdenum, and nitrate were found to exceed a hazard index of 1 and contribute to a hazard quotient greater than 1 at localized areas within the plume. Due to comparatively lower risk contributions at the site, these constituents will be monitored throughout the remediation process. In addition, the Selected Remedy includes institutional controls that prohibit use of the groundwater until cleanup objectives are achieved.
3.	What is the background level of hexavalent chromium currently in the Colorado River? Does this mean that DOI will allow PG&E to discharge hexavalent chromium contamination in and allow it to enter the Colorado River as long as the level in the Colorado River is less than 32 micrograms per liter? Does this mean that if I have a groundwater well that currently has non-detectable levels of hexavalent chromium in it, that PG&E will be allowed to increase the level of hexavalent chromium in my groundwater well to 32 micrograms per liter? What about the other chemicals that DTSC will be allowing PG&E to dump into the Colorado River? Has any Dioxin compounds been reported in soil samples onsite? What is the current background groundwater level of chromium in the floodplain adjacent to the Colorado River?	Background concentrations in surface water were not calculated; instead concentrations in upgradient samples and downgradient samples were compared in the RFI/RI. Cr (VI) was not detected in any shoreline surface water samples collected, except for one sampling event. During June 2002 surface water sampling, Cr (VI) was reported at concentrations ranging from 15.9 to 25.7 µg/L in six samples collected from the Colorado River at locations both upstream and downstream of Bat Cave Wash. See response to Comment B-18 for further information. The RAO of 32 µg/l was established because it is the natural background concentration for Cr (VI) in groundwater. The chromium plume is defined as that part of the alluvial aquifer where Cr (VI) concentrations exceed natural background levels. The Cr (VI) plume extends from Bat Cave Wash to the floodplain. Reducing conditions have been documented in most shallow to mid-depth fluvial (floodplain) wells and sediments near and underlying the river. In this area, Cr (VI) is naturally converted to Cr (III). Dioxins were found in samples taken at the

		Debris Ravine (AOC 4) and have been addressed in a Time-Critical Removal Action. See response to Comment D-4.
4.	What is the current background level of chromium and hexavalent chromium in the Colorado River? And how does that compare to what you will be allowing PG&E to dump into the river? What about a non-degradation protection policy? Does one exist? What is the 11 micrograms per liter you reference related to? Chromium? Or hexavalent Chromium? If it only relates to one of them, then what is the amount that PG&E will be allowed to discharge for the other? Does a limit exist? What will be the level that PG&E will be allowed to increase the amount of Chromium or Hexavalent Chromium in the Colorado River?	See response to Comment D-3. The Federal Water Pollution Control Act (33 USC §§ 1251-1387, 40 CFR 131.38) specifies the allowable concentration of discharge to surface water of 11 µg/L for Cr (VI). The Selected Remedy does not allow for any discharge of chromium to the Colorado River.
5.	The estimated time of up to 110 years to achieve RAOs is much too long. The length of time can be significantly reduced by adding pump and treat to the alternative. What would the time period be to complete the remediation if upland in-situ, flood-plain in-situ and pump and treat was used? If this alternative was used would the groundwater gradient and movement of groundwater contamination be away from the Colorado River?	It is estimated that the Selected Remedy will take 10 to 110 years to achieve the RAOs, with 110 years being the high end of the estimate based on the simulated time to remove 98 percent of the Cr (VI) mass within the plume. For the pump and treat option, Alternative F, it is estimated that 15 to 150 years would be required to achieve the RAOs.
6.	How is this ranking of "high level of operation and maintenance" related to the specific remedy selection criteria of protect human health and the environment, attain media cleanup goals and control sources of releases. This is evidence of incorrect analysis of screening criteria.	Overall protection of human health and the environment considers all assessments conducted under the other evaluation criteria including short-term impacts. Operation and maintenance of a treatment system is considered a short-term impact. A "high level of operation and maintenance" poses a potential increased risk to site workers and increased ongoing impacts to the surrounding environment throughout the operational period of the system.
7.	If Alternative "B" Monitored Natural Attenuation" does not satisfy the requirements established by the California State Water Resources	The Regional Water Quality Control Board has determined that Resolution 92-49 provides that monitored natural attenuation is "unacceptable as a stand-alone cleanup alternative." The

	Control Board Resolution 92-49, then it is not appropriate to include monitored natural attenuation as part of the Selected Remedy. T If pump and treat is included as a component of the remediation, monitored natural attenuation would not be needed and the time to complete the remediation would be significantly quicker.	Resolution does not prohibit monitored natural attenuation as a component of a broader remedy. The variable nature of the geologic materials beneath the site may result in recalcitrant zones that are resistant to *in situ* treatment and flushing. These zones would likely be resistant to pump and treat as well since the geologic formation in these areas is less permeable, inhibiting groundwater flow. Under either scenario, monitored natural attenuation is necessary to address any residual chromium that may remain in these recalcitrant zones.
8.	What is the definition of "high" and "Medium" [in the evaluation of remedial alternatives]?	Alternatives were evaluated on the basis of engineering judgment as high, medium, or low relative to the other process options. This is a common practice in the evaluation of remedial alternatives as these terms are easy to understand where medium is the average, normal or middle position relative to the other two.
9.	Pump and treat is ranked high for implementability since it has been proven to work. Therefore, pump and treat should be a continued component of any proposed remedial activity.	Implementability is not the only factor considered when selecting a remedy. DOI evaluated the alternatives against the nine CERCLA criteria and determined that Alternative E achieved the RAOs while substantially reducing, through treatment, the principal threat at the site, will do so in a reasonable time frame, and will do so with fewer adverse effects to cultural resources and biological resources than other alternatives considered.
10.	One commenter asked for an explanation about the disparity in the cost for the clean up under the Selected Remedy versus other alternatives.	The costs developed for the CMS/FS were for alternative comparison and do not represent bid- or construction-level engineering cost evaluations. The costs for Alternatives A and B were the lowest and Alternatives C, D, E, and H were the next most costly. Alternatives F, G, and I were the most expensive of the alternatives considered in the CMS/FS. The costs of each alternative are estimated to a level of accuracy of +50 to -30 percent, consistent with the preliminary nature of the design development.
11.	One commenter asked the cost for 30 years to clean the ground water plume with pump and treat method.	The net present value of the pump and treat alternative is between $187,000,000 and $401,000,000.
12.	Another commenter asked about the timeframes for the alternatives.	Estimated Time to Achieve Remedial Action Objectives: *Alternative A*: No Action – 220 to 2,200 years

		Alternative B – Monitored Natural Attenuation – 220-2,200 years *Alternative C* – High volume In-situ Treatment – 10 to 60 years *Alternative D* – Sequential In situ Treatment – 10 to 20 years *Alternative E* – In-situ Treatment with Fresh Water Flushing – 10 to 110 years *Alternative F* – Pump and Treat – 15 to 150 years *Alternative G* – Combined Floodplain In-situ / Pump and Treat – 10 to 90 years *Alternative H* – Combined Upland In-situ / Pump and Treat – 10 to 70 years *Alternative I* – Continued Operation of Interim Measure Groundwater Treatment – 100 to 960 years
13.	A commenter expressed concern about making the contamination problems worse by damaging bedrock.	Bedrock contamination appears to be limited to the East Ravine, which comprises approximately 1% of the total Cr (VI) plume according to current estimates. The proposed wells for the investigation and cleanup of East Ravine will be designed and installed to monitor groundwater or capture Cr (VI) and are not expected to exacerbate the contamination. Continued monitoring of the groundwater will occur after remedy implementation.
14.	A commenter questioned whether the Alternative E treatment is different because of the plume's proximity to the river.	Alternative E includes extraction wells near the Colorado River to provide hydraulic capture of the plume, accelerate cleanup of the floodplain, and flush the groundwater with elevated Cr (VI) through the IRZ line.
15.	A commenter asked if there had been a study comparing Alternative E with a pump and treat remedy.	Section 5.5 of the CMS/FS provides a comparative analysis of alternatives identifying the advantages and disadvantages of each alternative relative to one another, including a comparison between Alternative E and a pump and treat remedy (Alternative F). The Proposed Plan provides an abbreviated version of this comparison.
16.	A commenter stated that it was not appropriate to exclude an alternative based on one agency's determination. He noted that DOI has the ability to waive an ARAR. He stated that a longer timeframe for cleanup might be prefereable if it involves less impact.	In order to be selected by the lead agency under CERCLA, a remedial alternative must be found to be protective of human health and the environment and comply with applicable or relevant and appropriate requirements (ARARs). In this instance, DOI solicited the Regional Water Quality Control Board's interpretation of its

		regulations that had previously been identified as ARARs and concurred with that interpretation. There is no basis in the administrative record for waiving these ARARs.
17.	A few commenters noted that the FS cost estimates do not include "soft costs" such as agency reimbursements and 5-year review costs. They expressed interest in getting a sense of the total costs for the remedy and asked if DOI could obtain these costs from PG&E or if the Tribe would need to make a FOIA request to get them.	The cost estimates developed for the CMS/FS were for alternative comparison and do not represent bid- or construction-level engineering cost evaluations. The conceptual cost estimates did include line items (under the O&M costs) for regulator/stakeholder oversight and 5-year reviews. Additional costs such as agency reimbursements would be considered similar for remedies having similar implementation periods.
18.	A commenter asked how DOI evaluates the relatively small portion of the plume represented by the East Ravine bedrock as balanced against the disturbance of installing wells to address the contamination. She asked if DOI would insist on cleanup if there is only a small impact to groundwater.	The Selected Remedy must protect human health and the environment and attain ARARs including water quality standards that support the designated beneficial uses of the Colorado River. DOI will minimize the disturbance from the remedy to the extent practicable while at the same time implementing the remedy in a manner that fulfills the requirements of CERCLA.
19.	A commenter asked if the East Ravine remedy, given its conceptual nature, is part of the soil or groundwater remedy.	The Selected Remedy includes hydraulic containment of groundwater contamination in the East Ravine that will involve pumping groundwater from a group of wells near the eastern end of the East Ravine. Groundwater will then be carbon amended and reinjected in the alluvial aquifer along with amended alluvial groundwater. The East Ravine remedy is part of the groundwater remedy for the Site.
20.	When Cr (VI) is converted to Cr (III), arsenic, iron, and manganese will take the place of Cr (VI). Do you know how much arsenic, iron, and manganese will be there? What about your hypothetical future groundwater users, won't they be exposed to arsenic, iron, and manganese?	The expected range of concentrations and longevity of by-products was presented in the CMS Appendix G. Concentrations of byproducts such as manganese and arsenic are likely to temporarily increase within portions of the treatment zone. Once groundwater flows back into the more oxidizing environment of the natural alluvial aquifer, dissolved iron, manganese, and arsenic are expected to return to their natural concentrations.

E. SELECTION OF THE PREFERRED REMEDY

	Comment	**DOI Response**
1.	Our concern continues to be the	DOI agrees that, among the alternatives

	potential risk to the Colorado River – a major water supply. We strongly support the recommendation to utilize Alternative E – In-Situ Treatment with Fresh Water Flushing for the Topock remediation due to its effectiveness in achieving the Remedial Action Objectives relative to costs, while substantially reducing the amount of hexavalent chromium in the groundwater in a reasonable timeframe with fewer adverse effects to cultural and biological resources than other alternatives analyzed. Selection of Alternative E for the Topock groundwater remediation meets the remedy selection criteria and will protect the Colorado River.	evaluated, the Selected Remedy is protective of human health and the environment and strikes the best balance in terms of cost effectiveness, time required to achieve Remedial Action Objectives, and minimizing impacts to cultural and biological resources.
2.	At this time our most significant concern has to do with the failure to protect our continued health and well being by your stated proposal to allow significant increased levels of hexavalent chromium in both the groundwater and release in to the surface waters of the Colorado River, where none or minimal levels had been detected before. The water in this region is our most precious resource and one that is both finite and irreplaceable. Any proposal to release increased levels of chromium contaminant or any contaminant for that matter in to any existing water resources is unacceptable. Further, conversion or other proposed strategies for essentially leaving the bulk of minimally treated and unconfirmed conversion below 100% is unacceptable as well. We believe it incredible that we as the tribal people from this area that are most directly affected by the chromium contamination have been available as a valuable project resource yet we were shut out of the process and not given an	The Selected remedy will not increase levels of Cr (VI) in the groundwater or allow it to be released into the Colorado River. The Selected Remedy includes extraction wells near the Colorado River which will provide hydraulic control to prevent contaminants from reaching the Colorado River. Extraction near the river will also help to draw carbon-amended water across the floodplain accelerating the treatment of existing Cr (VI) in the alluvial zone of the floodplain aquifer east of National Trails Highway. Conversion of hexavalent chromium to trivalent chromium does not leave contamination in place or untreated but instead converts a known carcinogen into a benign form of chromium without requiring the invasive and significant impacts to cultural and biological resources that other alternatives would have required. Through the Consultative Workgroup process that has been in place for several years, as well as regular and ongoing tribal consultation, tribal governments and individuals have been active participants in the remedy selection process at this site for many years.

	opportunity to participate or comment prior to this time. We are deeply concerned and believe your proposed remedy needs to be reworked and reconsidered in the light of our attached comments and expressed concerns. We expect a response to our questions and concerns and hope they will enlighten you with insights that you may not have previously considered in developing your proposed remedy.	
3.	The organic layer next to the river has been converting Cr (VI)) to Cr (III) in a natural manner. As part of the preferred Alternative E, many wells will be poked through this natural organic layer. What if these wells upset the natural balance of the organic layer? If the Cr (VI) needs to be pumped away from the Colorado River, the wells should be further away from the river so that the organic layer is not disrupted.	The line of wells along National Trails Highway would be used either as injection or extraction wells to circulate groundwater and distribute the organic carbon source, expanding the area where Cr (VI) is converted to Cr (III). The number of extraction wells near the river will be minimized but these wells are needed to provide hydraulic control to prevent contamination from reaching the river and to draw carbon-amended water across the floodplain to accelerate treatment of the existing Cr (VI) in the alluvial zone of the floodplain.
4.	The Proposed Plan says that "byproducts are expected from the in-situ treatment." What are these byproducts? Are the byproducts just as toxic and carcinogenic as Cr (VI)? Will the plants take up these byproducts? Will these by products discharge to the river?	Impacts to the stability of native minerals incorporated in the aquifer solids resulting from the in-situ treatment process are unavoidable. These impacts can temporarily mobilize certain naturally-occurring metals within the treatment zone (primarily iron, manganese, and arsenic). There is potential for these metals to exceed background concentrations during implementation of in-situ treatment. Under ideal geochemical and hydrologic conditions, arsenic and manganese byproducts should not be significant. However, because of uncertainty in the complexity of aquifer lithology and geochemistry, large-scale implementation of in-situ treatment could result in elevated concentrations of arsenic and manganese that persist for longer than expected periods of time in some portions of the aquifer. Careful monitoring during the initial phases of in-situ treatment will detect these conditions, if they occur, and specific contingencies will be in place to address any potential threat to the Colorado River or the aquifer.

5.	This groundwater remedy being proposed is limited and restricted and does not address all the groundwater contamination. This groundwater remedy only addresses one chemical in the groundwater plume of contamination in a very limited area since the entire extent of groundwater contamination is not known at this time. Further remediation of the other chemicals in groundwater in addition to any potential new chemicals are proposed to be addressed in an unspecified future unspecified time when PG&E may decide to do so DOI is allowing PG&E to minimize groundwater remedial actions by NOT requiring PG&E to completely remediate the entire groundwater plume of contamination that was caused by PG&E dumping hazardous materials and hazardous substances onto the ground surface. DOI should be requiring the highest possible protection for the Colorado River and PG&E should be required to remove all contamination that they caused as a direct result of their activities.	The comment is correct in that the Selected Remedy addresses Cr (VI) in groundwater. The human health risk assessment concluded that other contaminants detected in the groundwater were not present at levels of potential concern to future human health or the environment. Also see response to comment B-9.
6.	We disagree with the selection of this alternative. Alternative G and H combined would provide a higher safety factor for the protection of the Colorado River since it will maintain a landward groundwater gradient away from the Colorado River, and would actually reduce the mass of the contamination and not just convert one form of contamination to another. Remediation would be completed in a shorter period and would not allow any by-product contamination or other groundwater contamination to enter the Colorado River	The Selected Remedy was selected based on a careful evaluation of CERCLA's nine remedy selection criteria. The in-situ treatment zone along National Trails Highway will be constructed using a line of wells that can be used either as injection or extraction wells to circulate groundwater and distribute the organic carbon source, creating an in-situ "treatment barrier" for groundwater to flow through. The extraction wells near the river will provide hydraulic control to prevent contaminants from reaching the river while drawing carbon-amended water across the floodplain to accelerate treatment. The Selected Remedy will protect human health and the environment and attain ARARs with fewer adverse effects to cultural resources and biological resources than other alternatives considered.

7.	What alternative provides the greatest protection for the Colorado River in terms of drinking water, agricultural and recreational activities, and provides the greatest protection and safety for the current living people and the future generations?	As stated in the CMS/FS, with regard to verifiable river protection, Alternatives C, D, E, F, G and H were considered equally protective. See response to E-9 for further information
8.	What will happen to the current groundwater contamination that exists under the Colorado River that is beyond the proposed zone of in-situ treatment near the Colorado River? Will this contamination be treated? Or will it be ignored and allowed to potentially migrate and enter the Colorado River?	The Selected Remedy includes extraction wells near the Colorado River to provide hydraulic capture of the original plume, including the portion under the Colorado River, and to accelerate cleanup of the floodplain.
9.	For this alternative what is the direction of flow for the contamination? Is it toward the Colorado River? Or will it be away from the Colorado River?	Under natural conditions, groundwater flows from west/southwest to east/northeast across the site. The Selected Remedy includes extraction wells near the Colorado River and injection wells west of the plume to accelerate groundwater flow. The injection wells will induce a hydraulic gradient toward the east to accelerate the movement of the site groundwater through the IRZ, where it would be treated. Extraction wells near the river will provide hydraulic control to prevent water originating in the plume from reaching the river.
10.	What does substantially reducing mean? Are you saying that this alternative will not completely treat all the contamination?	The Selected Remedy is expected to reduce the mass of Cr (T) and Cr (VI) in groundwater at the site to achieve compliance with ARARs in groundwater. The Remedial Action Objective of 32 µg/L of Cr (VI) is based on the background level found in the region. Extraction wells in the floodplain will capture any potential byproducts. There will be on going groundwater monitoring to ensure protection of the Colorado River.
11.	What does controlling the movement of contaminated groundwater mean?	Controlling movement of contaminated groundwater refers to tracking the movement/flow of groundwater utilizing conventional groundwater monitoring methodologies and modifying flow through increased injection or extraction.
12.	The Proposed Plan states that residual contamination may remain above the	The variable nature of the geologic materials beneath the site may result in some localized

	RAO (32 micrograms per liter because complete information is not know about subsurface conditions. Why? This supports our previous comment that aggressive pump and treat needs to be a key component of any remedy selection. Protection of the Colorado River is primary.	areas being resistant to in-situ treatment and flushing. These areas would also prove resistant to pump and treat. The tighter portions of the formation have low-permeability and do not readily "give up" pore water and the associated constituents. DOI's preferred alternative includes monitored natural attenuation and institutional controls as long term components to address residual hexavalent chromium that may remain in portions of the aquifer formation after a majority has been treated by in-situ treatment.
13.	Where will this land use restriction extend to? Will restrictions be placed on wells in Arizona that may wish to pump at higher levels or rates directly adjacent to the Colorado River and deep in the aquifer? Will restrictions be placed on pumping rates? Will I be able to pump 1,000 gallons per minute at Topock Marina? Or at a house someone builds adjacent to the Colorado River? Will Park Moabi be limited the amount of water that they can pump?	Land use restrictions have been established in the land management plans adopted by the BLM Lake Havasu Field Office for BLM-managed land, and the Fish and Wildlife Service for the Havasu National Wildlife Refuge. The restrictions in each plan are applicable to the land managed by the respective agency.
14.	Will dredging of all portions of the Colorado River be allowed? Will fishing be restricted in the Colorado River adjacent to the site? Will recreational activities be limited in the Colorado River? Will native plants be allowed to be collected by Tribal members in the area of the contamination?	Implementation of the remedy, including institutional controls, will not include any restriction on use of the Colorado River for recreational activities including fishing. If required by BOR, dredging activities will be coordinated with the other Federal agencies and PG&E to ensure continued operation of the treatment system. See response to Comments A-1 and C-1.
15.	A commenter expressed concern that the application of the Selected Remedy may take 29 to 100 years to correct the toxic plume of Cr VI. She asked if this was the best alternative in terms of time for remediation.	Although some of the other remedies considered in the CMS/FS may have achieved RAOs in a shorter amount of time, the Selected Remedy balances the time required to achieve RAOs against the objective of minimizing adverse effects to cultural resources and biological resources. DOI believes that the Selected Remedy strikes the proper balance in this regard, will substantially reduce through treatment the amount of hexavalent chromium in the groundwater, and will do so in a reasonable time frame
16.	A commenter asked about the 30 year	The Selected Remedy includes extraction wells

	period for the remediation noting that there should be more concern for people of today and the immediate future. He expressed a preference for a more aggressive alternative that would take less than thirty years.	near the river that will provide hydraulic control to prevent contaminants from reaching the river. Estimates indicate that the floodplain will be cleaned up in approximately 2 years.
17.	A commenter asked if extraction of all contaminated groundwater would remove all Cr (VI) contamination.	Total Chromium [Cr (T)] and Cr (VI) are naturally occurring metals in groundwater at background concentrations for Cr (T) of 34.1 µg/L and Cr (VI) of 31.8 µg/L.
18.	A commenter asked where water extraction would occur.	The Selected Remedy includes a series of extraction and injection wells for the in-situ treatment along the length of National Trails Highway, as well as extraction wells near the Colorado River to maintain hydraulic control to prevent contaminants from reaching the River.
19.	A commenter asked about new structures and expressed concerns about the pipelines.	Pipelines will be constructed to convey fresh water from the source to the injection wells. Previously disturbed areas will be used for infrastructure to the extent practicable, subject to DOI's obligation to implement the remedy in a manner that fulfills the requirements of CERCLA.
20.	A commenter asked about the fallback position if the preferred remedy fails.	Components built into the Selected Remedy are designed to prevent a "failure" of the remedy from threatening human health or the environment. Ongoing monitoring of groundwater will enable the agencies to evaluate the effectiveness of in-situ treatment as well as the hydraulic control of the plume. If conditions indicate that the Selected Remedy needs to be augmented, or that a different remedy needs to be selected, DOI will initiate the appropriate steps to address those conditions.
21.	A commenter suggested that adding fresh water might only serve to contaminate more groundwater. He stated that this contamination is affecting lives.	Potential sources of injection water will be tested for contaminants prior to being considered for use in the injection component of the Selected Remedy.
22.	A commenter noted concerns about removing water from the River as part of the remediation effort mentioning preexisting tribal rights to the water and that water is a Trust Asset.	No consumptive use of water will be associated with the in-situ treatment and freshwater flushing elements of the Selected Remedy because all extracted water will be returned to the Colorado River Basin via reinjection wells within the Colorado River accounting surface. The extraction well location and/or extraction rates

		will be adjusted during remedy design, based on a hydrologic analysis, to ensure that groundwater extraction does not have substantial adverse affects on the production rates of existing nearby wells. Very small, localized effects on the groundwater table near the freshwater extraction wells are, however, possible. The use of water in implementing the Selected Remedy will be subject to existing water rights and the system by which such rights are established and exercised.
23.	A commenter asked who would sign the ROD for DOI and BLM.	Authority to sign CERCLA Records of Decision on land under the jurisdiction of DOI has been delegated by the Secretary of the Interior to the Assistant Secretary for Policy Management and Budget.
24.	What will happen when the wells become clogged with calcite? Will you drill more wells? How many more? 300, 400, 500 wells – when will it end? Why not use the wells you already have, why drill more? Will you inject acid into the wells when they clog?	Wells installed as part of the Selected Remedy may become clogged and required rehabilitation. Fouling of wells, particularly injection wells, through scaling, biological growth, corrosion or gas entrapment is likely over the lifetime of the proposed project. Routine maintenance and periodic replacement of wells will be required to maintain functioning wells. The lifetime of wells and replacement frequency in practice will depend on various site-specific factors, including well construction, lithology, groundwater chemistry, and how operations are conducted. Wells will be constructed and operated according to industry best practices to maximize well lifetime and limit the number of replacement wells required. Site experience with re-injection wells for treated effluent from IM-3 has shown deterioration in injection capacity over time, with projected lifetimes on the order of 10 years. Extraction and monitoring wells will be less susceptible to fouling, and it is anticipated that they will require less frequent replacement. Collectively, this site- and function-specific information will affect the number of wells to be replaced during the operation and maintenance period of the project. A plan for operation and maintenance of the wells will be developed to address this and input from the tribes will be solicited.
25.	A commenter asked if the river water criterion of 11 µg/L is acceptable to all	The Federal Water Pollution Control Act (33 USC §§ 1251-1387, 40 CFR 131.38) specifies the

	the agencies.	allowable concentration of discharge to surface water of 11 μg/L including the Colorado River. No Cr (VI) has been detected in the main channel of the river.
26.	A commenter asked if direct pathways might exist or could be formed during construction that could channel Cr (VI) to the river, considering global climate change and other unknown factors. She asked about the possibility of Cr (III) re-converting to Cr (VI) in the future.	During the CMF/FS, DOI conducted a detailed technical assessment of the possibility of reconversion of Cr (III) to Cr (VI). Two key factors are expected to limit such re-conversion after *in-situ* reduction: the limited solubility of Cr (III) and the lack of availability and reactivity of an adequate oxidizer (MnO2). Together, these factors are expected to limit any reoxidized Cr (VI) concentrations to levels similar to ambient background but not likely at levels of health risk concern.
27.	The Colorado River is a water supply for many, many people throughout the upper and lower basin. The Colorado River supply goes to a region of about 5,000 square miles and about 18 to 20 million people. Our concern is really protecting the water supply as far as the issues associated with the region; and the impacts to that culturally is always a concern, but it would be a greater concern not to support and move forward with the cleanup. It's critical that this takes place. We understand by all the history and the documentation that the threat is not imminent based upon what's already been explained. However, given the potential of seismic activity within the region and the area and the impact to the river and the life that it touches throughout its travels, the threat is there. As a result, we would support moving forward with the recommended cleanup; and that recommended cleanup seems to be the best of all of the alternatives for the reasons that's been stated.	Once the ROD is issued, DOI will direct PG&E to proceed with design. The design of the treatment system will take approximately one year and an initial start up period will take approximately one year as well. Once the system is fully functional, the groundwater models suggest that the plume in the floodplain area will take approximately two years to clean up. This will reduce the potential future threat of Cr (VI) contamination to the Colorado River.
28.	I wish there was some other means or another way of addressing it where you didn't have to put in a hundred and	The Selected Remedy was chosen, in part, because it balances the need to achieve compliance with RAOs in a reasonable amount of

	seventy more wells in addition to the hundred fifty that are already out there and the other maximum number of intrusions that will occur through pipelines, water lines, debris in the water from those areas that were mentioned earlier.	time with the objective of minimizing effects to cultural and biological resources to the maximum extent practicable. Monitored natural attenuation or the no-action alternative, alone, could not achieve RAOs in a reasonable amount of time.
29.	On your presentation, you said that water would be -- possibly be extracted from Park Moabi for infusion; and what is going to be the impact on Park Moabi, the recreation facilities that are there? Are you going to be building pumping stations there that are going to detract and interrupt the facilities at Park Moabi?	The source for fresh water will be further evaluated during the design. Park Moabi is one of the potential sources for fresh water. If it is determined that Park Moabi is the preferred source, the only impact to that area would be a well installation with the associated well head and piping from the well to the Topock Site. No pumping station will be installed.
30.	What is going to prevent injection of water into the plume from expanding the contaminated area rather than cleaning up or also cleaning up with the expansion of the contaminated area?	The Selected Remedy's injection of fresh water west of the plume will accelerate groundwater flow through the treatment zone along the IRZ line. Fresh water injection also serves to constrain westward movement of the carbon amended water and flush much of this water eastward toward the extraction wells. Injection of fresh water will not expand the contaminated area.
31.	Has this process that you're planning on using been used successfully someplace else? And if not, what kind of protection do you have for the groundwater and the river and the soil around if something does fail because accidents do occur? I guess that's something that I think needs to be looked at.	In-situ remediation is a well studied option for cleanup of contaminated groundwater. The goal of in-situ remediation schemes is to reduce the carcinogenic, soluble, and mobile Cr (VI) to the less toxic and less mobile Cr (III), which forms minimally soluble precipitates. The main advantage of in-situ treatment is that it allows ground water to be treated without being brought to the surface. Pilot testing has shown that in-situ treatment is technically implementable at the Topock site.
32.	I really want to say that I see that there's been a lot of hard work and a lot of consideration being put into these proposals. Technically, I see no problem with it. It's a simple chemical process of remediation. You're turning something that's really bad to something that is, relatively speaking, manageable. The chemistry of the process seems	DOI agrees with your observations.

	simple enough, and the implementation seems feasible; and I simply am here to applaud your efforts, and let's get it done.	
33.	What are the long-term management strategies to handle this project now and in the future? Especially if you're talking about the proposed remedies going on for years and they're supposed to be monitored. What will happen?	DOI will maintain federal oversight of the Selected Remedy until cleanup is complete. For the purposes of the groundwater cleanup, a long-term operation and maintenance plan will be developed by PG&E and subject to the approval and oversight by the agency. The obligations established by the Selected Remedy, including the long term operation and maintenance plan, will be adopted in a consent decree and enforceable in federal court.
34.	Potential 500 gallons of water per minute to recycle the plume should not come from the freshwater wells in Arizona. These private wells could go dry. Other wells even further away but on the same aquifer could have their water tables diminished. How will these private citizens be compensated for their loss of water and irrigation potential? Who will compensate them when they can no longer live on their land?	The offsite source of fresh water for this alternative could be the same as the water source for the Topock Compressor Station and is assumed to be available over the implementation period. The Topock Compressor Station is currently purchasing its water from wells in Arizona owned by Southwest Water Inc. Southwest Water would need to ensure that groundwater supplies were adequate for all users prior to approving further allotments to PG&E. Future water supply may be from the Colorado River or from wells on the California side of the river. The use of water to implement the Selected Remedy will be subject to existing water rights and the process by which such water rights are established and exercised.

F. TRIBAL CONCERNS/IMPACTS

	Comment	**DOI Response**
1.	While the Hualapai Tribe believes that the water should be kept clean, we also believe that there should be an emphasis on protection of cultural resources. The Department of the Interior (DOI) Proposed Plan seems to put a greater emphasis on cleaning up the groundwater. The Proposed Plan does not mention that the DOI owns almost all of the land surrounding the Topock Compressor Station, and the	DOI recognizes that the Site is located within an area of traditional cultural importance and spiritual significance to certain Native American tribes with ancestral ties to the region. Cultural resources are subject to the protections provided by numerous Federal statutes, regulations, and Executive Orders. Protection of historic properties and cultural resources, in particular those listed, or eligible for listing, in the National Register of Historic Places, requires that DOI, in consultation with State Historic

	plume is mostly under DOI land. You would think the DOI would be most concerned about protection of natural and cultural resources; however, there appears to be a tacit acceptance by the DOI that damage will be done to cultural resources.	Preservation Offices, the Advisory Council on Historic Preservation, the tribes, and other consulting parties, identify adverse effects on historic properties associated with remedial action at the Site and seek ways to avoid, minimize, or mitigate such effects. CERCLA also requires that DOI select a remedial action that satisfies two "threshold criteria;" protection of human health and the environment and compliance with applicable or relevant and appropriate requirements (ARARs). The Selected Remedy satisfies these threshold criteria while also balancing the need to avoid or mitigate adverse effects to cultural resources to the extent practicable.
2.	The Hualapai Tribe believes that the land should be returned to its original condition after the work has been completed. However, there is no mention of restoration or how they would properly abandon the huge number of wells at the site (up to 300 wells). All of the activities at the Topock site—wells, buried pipes, and roads—have taken place in an area that is sacred to us. What would you say if we drilled a bunch of wells next to your grandmother's grave? You would not be happy either. The least we can do is look into the future, and describe what the site will look like to our grandchildren.	The Programmatic Agreement and the Selected Remedy require restoration of impacts caused by the Selected Remedy to conditions existing prior to the implementation of the Selected Remedy, to the extent practicable.
3.	Groundwater contamination at Topock has created a negative public perception of Colorado River water quality and therefore places an undue economic burden upon the Tribes for actions that were, and largely still are not within our control. In order to alleviate these impacts, we strongly advocate incorporating quarterly sampling and analyses for hexavalent chromium of surface and groundwater at both the Chemehuevi and Colorado River Indian Tribes' Reservations into the Topock Remediation Project	With one isolated exception unrelated to the Topock Compressor Station, years of surface water monitoring at the Site have not detected hexavalent chromium in the Colorado River above background levels. The Department will work with the tribes and stakeholders to ensure the long-term monitoring of the Colorado River provides the assurance that the remedy continues to protect the water. See response to Comment B-19.

	("Project") monitoring schedule. This groundwater sampling should be conducted by independent laboratories, and funding should also be provided for the Tribes themselves to conduct parallel sampling to assure their membership, and the public at large, that the Colorado River remains uncontaminated downstream from the Topock Remediation Project site. Quarterly sampling of our waters that provides clear evidence to the public that our waters are not contaminated with hexavalent chromium will greatly lessen economic impacts as well as alleviate water quality concerns among Tribal members.	
4.	So that I can have an appreciation of the proximity of each Tribe to the contamination and the potential impacts, please indicate how far each Tribe is from the contamination? So that I understand the number of Tribal people this may impact what is the enrolled member population currently living on this land? What Tribes are upstream and not potentially impacted from the contamination and what tribes are downstream and potentially impacted. What are the concerns of the upstream non-impacted tribes related to the concerns of the downstream impacted tribes?	DOI and DTSC have engaged in regular communication and formal consultation with nine Native American Indian Tribes concerning the status of the Topock project and the process by which the Selected Remedy was evaluated and chosen. Although the membership enrollment of the tribes varies and not all tribes are along the Colorado River, these are all Yumen speaking tribes and share similar ancestral ties to the river. DOI understands from our discussions with various Tribes that different beliefs regarding the Topock area exist. All Tribes do agree, however, that the Colorado River must be protected. It is DOI's intent to ensure the protection of human health and the environment while respecting and taking into account, to the extent possible, the beliefs and concerns of all potentially affected people.
5.	When the work is completed, how will you reclaim the land? How will you reclaim 400 drill holes into the ground? This is important to the Hualapai Tribe, and has not been discussed at all.	The Programmatic Agreement and the Selected Remedy require restoration of impacts caused by the Selected Remedy to conditions existing prior to the implementation of the Selected Remedy, to the extent practicable. Through consultation with the tribes, DOI will continue to seek input from tribes and stakeholders on measures that can be taken to restore impacted areas to ensure the sustainability of the natural environment, such as use of native species or appropriate contouring of impacted land surfaces.

6.	One commenter asked about HAZWOPR training for tribal monitors.	PG&E has offered HAZWOPR training for tribal monitors in the past.
7.	We know the cleanup has to occur; but yet, on the other hand, we want it done in the most respectful manner. We want it done in a least harmful way that will at least give us a sense of, not total comfort, but that we would be able to at least be able to live with what is going to occur there. So we ask that if it's going to be done, that there be proper mitigations done to address the cultural concerns and issues that will affect our people, that continue to affect our people day in, day out.	DOI acknowledges and respects the tribal perspectives regarding the history of your ancestors in this area, the importance of the cultural and spiritual resources and values that you have in this area and the preference to minimize or mitigate impacts caused by ongoing activities related to the Topock cleanup including the implementation of the Selected Remedy. We appreciate the continued involvement and input from all tribal members and stakeholders on this project. Through implementation of the Programmatic Agreement signed by BLM, the Advisory Council on Historic Preservation, and the Arizona and California State Historic Preservation Officers, the Department will proceed with government-to-government and Section 106 consultation on the design and implementation of the remedy to continue to solicitor tribal views on ways to minimize or mitigate adverse effects from the remedy and will, to the extent practicable, require avoidance or mitigation of adverse effects.
8.	I think Alternative B should have been the chosen remedy, which we know is currently keeping it from entering the river because of the diagram you showed earlier. There is a natural occurring cleanup that's taking place by the earth itself and the land below it. And the only reason why this other alternative is being chosen is because the -- everybody else wants it cleaned up real quick and, you know, get it out of there. And that's why you're having the intrusion of having more wells. They have a hundred fifty out there now. They're going to be proposing So I think those mitigation impacts are important, that they need to be considered and negotiated and discussed with the affected Tribes, not only our tribe, but the other tribes that have been participating in this process,	DOI acknowledges that natural attenuation is occurring at the site and recognizes that this alternative would minimize impacts to both ecological and cultural resources. However, CERCLA requires the lead agency to select a remedy that is protective of human health and the environment and attains compliance with ARARs. Alternative B (monitored natural attenuation, standing alone), did not satisfy these threshold requirements. The Department has determined that the Selected Remedy satisfies the threshold criteria and balances the other factors and remedy selection criteria in the most appropriate manner. The Department will continue to work with all the tribes and stakeholders to minimize or mitigate the overall impacts to ecological and cultural resources during the implementation of this remedy.

	which there are eight other tribes, including the Fort Mojave, that have reverence for the area, the sacred area, where we go after we leave this earthly existence.	
9.	You know, water's sacred. Without water, there's no life. You don't live. You know, we need to clean the water. You know, the whole nation needs to have clean water. Not only us. But everyone. We need to think about cleaning all our waters. But we're not going to clean it by opening it up and recycling poison.	The Department recognizes the importance of the Colorado River and its life giving waters for all people. See response to Comment F-12 and F-14.
10.	We support PG&E correcting the damage caused by allowing pollutants to enter the groundwater of our ancestral land, but we want to be sure that correcting the damage is not itself doing more damage. We want to be sure that the gentlest means of remediation - the one that's most respectful of the earth and the river - is selected. That alternative unfortunately has not been selected by the regulators as the preferred alternative; so we have a situation where an engineered alternative, one that could introduce many more wells, more facilities, and people into this sacred area. Alternative E would put, in the worst case scenario, 170 new wells in addition to the 150 wells that are currently in the ground, to say nothing of the damage done by the remediation to date. On behalf of my people, we therefore ask that specific mitigation measures be negotiated with the Fort Mojave Indian Tribe as a means to ensure respect for our cultural landscape, the safe passage of our deceased to the next world, and to secure a future for the cultural practice of the Fort Mojave Indian Tribe. Fort Mojave Indian Community Tribal members will not accept anything less	DOI acknowledges and respects the tribal perspectives regarding the history of your ancestors in this area, the importance of the cultural and spiritual resources and values that you have in this area and the preference to minimize or mitigate impacts caused by ongoing activities related to the Topock cleanup including the implementation of the Selected Remedy. We appreciate the continued involvement and input from all tribal members and stakeholders on this project. Through implementation of the Programmatic Agreement signed by BLM, the Advisory Council on Historic Preservation, and the Arizona and California State Historic Preservation Officers, the Department will proceed with government-to-government and Section 106 consultation on the design and implementation of the remedy to continue to solicitor tribal views on ways to minimize or mitigate adverse effects from the remedy and will, to the extent practicable, require avoidance or mitigation of adverse effects.

	in exchange for having to live with this revised Alternative E.	
11.	I would like to see some definite period of time established in which the water will be cleaned up. How is this project going to be monitored for the period of time it takes to clean up the water? What requirements will be established to make sure PG&E completes the cleanup? What happens if PG&E files for bankruptcy again or refuses to perform the cleanup? Water is a very limited resource here and it needs 4to be cleaned up in a reasonable period of time.	The Department will ensure that the remedy is implemented and the continued operation of the remedy will occur until the RAOs are achieved. This is a requirement of the ROD and PG&E will be required to perform the cleanup until remedial action objectives (RAOs) are achieved. PG&E will be required to provide a bond or some other form of performance guarantee that ensures the money necessary to complete the required remediation work will be available now and in the future. While the estimated time necessary to attain RAOs throughout the entire plume of contamination is as long as 110 years, DOI expects that RAOs will be attained in the floodplain in approximately two years. Extraction wells in the floodplain will protect the River from contaminants and injection wells to the west of the plume will accelerate the pace at which contaminants move through the is-situ treatment zone.
12.	The Tribe here by resolution has passed its -- made known its wishes that health and human safety is primary in our concern. I know a major component of what has been discussed by some of the other tribes; notably, Fort Mojave is that they have cultural concerns. But their cultural concerns seem to be at the expense of our lives down here. And that's something that I hope that the agencies will consider is that our lives are more important.	DOI believes that Alternative E balances impacts to the ecological and cultural resources while protecting human health and the environment. We will ensure that the remedy is implemented and monitored in such a way as to ensure continued protection of the Colorado River.
13.	It is a fact that the cultural information you need is not anywhere being fully considered as it needs to be. I believe additional study, consultation, and more full community discussion are needed before any final remedy is put in place. I understand that much has changed in the process and none of it to the benefit of me or my tribe. Especially when the chromium contamination will not be removed and	The investigation of Site contamination, and the development and evaluation of alternatives have been the subjects of extensive discussion, consultation, and analysis for more than a decade. The Consultative Workgroup process established by DTSC, within which DOI has actively participated for the past six years, has enabled representatives of Tribes, local governments, and other stakeholders to participate actively in these discussions. In addition, DOI, through the BLM, has consulted actively with Tribal governments to

	instead a gradual release of the chromium will be allowed in the river and surrounding area.	identify, and avoid or mitigate to the extent practicable, potential effects on cultural and historic resources related to proposed remediation activities, including the Selected Remedy. The Selected Remedy does not allow for any discharge of Cr (VI) to the Colorado River. Instead, Cr (VI) will be treated to remove contamination from the groundwater in a manner that minimizes effects to cultural and biological resources to the extent practicable.
14.	Only one (1) sentence addresses the significance of the Colorado River as a critical water supply of major importance to millions of people of Arizona and Southern California. Why? In fact the Colorado River represents a greater significant feature to the Mohave culture than the Topock Maze. The name Mohave is composed of two Indian words "aha" which means water and "Maca" meaning alongside. The historic Mohave were known as Pipa Aha Macav, the people by the water. To suggest that other features such as the Topock Maze somehow has a greater or any significance in the Mohave Culture is incorrectly supporting and enabling the invention of Tribal Cultural Traditions. This is also allowing PG&E to limit their remedial efforts by supporting limited, unverified, undocumented facts and comments from a few Tribal individuals that do not represent the documented views of the Tribal Government and their tribal members. This is not a justification to limit complete and full removal and remediation of each and every chemical illegally dumped onto the soil and allowed to enter and contaminate the groundwater that now moves under the Colorado River.	The Colorado River is one of our greatest natural resources in the western United States. It provides drinking and agricultural waters and recreational opportunities to millions of people as well as habitat for many species of plants and animals. The Selected Remedy will protect the Colorado River, will attain compliance with applicable or relevant and appropriate requirements (ARARs), while also minimizing adverse effects to cultural and biological resources to the extent practicable.
15.	What procedures have been adopted if human remains or artifacts are	The Programmatic Agreement adopts protocols to ensure that requirements applicable to the

	encountered? What would happen if the entire area was found to contain artifacts or remains?	discovery of human remains or artifacts are fully satisfied, including provisions for stopping work when necessary. Recordation of artifacts would occur and artifacts will be removed if possible.

G. COMMUNITY CONCERNS/IMPACTS

	Comment	**DOI Response**
1.	Why is considerable text and discussion given to Tribal Cultural Resources and little to minimal discussion provided relative to the importance of the Colorado River as the single most important source of drinking, agricultural and recreational water supply to Arizona and Southern California? There appears to be a purposeful decision to downplay the importance of the Colorado River as a water supply in favor of discussions related to Tribal cultural resources. Why is this the case?	Protecting public health and welfare and the environment from risks posed by the release of hazardous substances is the central purpose of CERCLA response action. The Selected Remedy has been chosen by DOI to protect the Colorado River and remediate contaminated groundwater at the Site. In addition, the presence of important cultural resources at the Site requires that DOI consult with the Advisory Council on Historic Preservation, the SHPOs, and interested tribal governments to avoid or mitigate effects on such resources to the extent practicable.
2.	In relation to the protection of human health and the environment and preventing any possibility of contaminated groundwater entering the Colorado River and potentially impacting the lives of millions of people in Southern California, how has and will DOI rank the protection of human health and environment related to impacts on religious values and cultural resources when evaluating and selecting a remedy? What is more important? Will DOI weight the protection of cultural resources greater than the protection of the drinking water supply for millions of people in Arizona and Southern California?	Protection of human health and the environment is one of two threshold criteria that must be satisfied by any remedial action selected under CERCLA. The Selected Remedy satisfies this criterion while also acknowledging and respecting the important cultural resources that will be affected by the remedial action and seeking ways to avoid or mitigate, to the extent practicable, such effects.

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