United States Department of the Interior

BUREAU OF LAND MANAGEMENT
FISH AND WILDLIFE SERVICE
BUREAU OF RECLAMATION

MEMORANDUM

DATE: April 2021

TO: Stephen Tryon
Director, Office of Environmental Policy and Compliance
US Department of the Interior

THROUGH: Jeff Howland
Project Leader, Lake Havasu National Wildlife Refuge Complex
US Fish and Wildlife Service

THROUGH: William Lodder
ECLM Team Lead, Office of Environmental Policy and Compliance
US Department of the Interior

FROM: Pamela S. Innis
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US Department of the Interior

SUBJECT: Request for Approval of a Non-Time-Critical Soil Removal Action at Areas of Concern and Solid Waste Management Units, Pacific Gas and Electric Topock Compressor Station

I. PURPOSE

The purpose of this Action Memorandum is to document the basis for and approval of the selected non-time-critical removal action under the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA"), 42 U.S.C §§ 9601 *et seq*., to address the release or substantial threat of a release of hazardous substances from the Pacific Gas and Electric ("PG&E") Topock Compressor Station Remediation Site ("Site") in San Bernardino County, California. PG&E is conducting investigative and remedial activities at the Site under CERCLA and the Resource Conservation and Recovery Act ("RCRA"). Past operations conducted by PG&E resulted in a release of hazardous substances in areas on or adjacent to the Havasu National Wildlife Refuge ("HNWR" or "the Refuge") and pose a substantial threat of continued

release. The Refuge land is under the jurisdiction of the Department of the Interior ("DOI") and is managed by United States Fish and Wildlife Service ("USFWS") as a national wildlife refuge.

An Approval Memorandum for an Engineering Evaluation/Cost Analysis ("EE/CA") was signed by DOI and USFWS in October 2018 (DOI 2018) and DOI directed PG&E to proceed with the development of an EE/CA to evaluate non-time critical removal action alternatives to address areas of contaminated soil within Solid Waste Management Units ("SWMUs") and Areas of Concern ("AOCs") within the Site. Specifically, hazardous substances including, without limitation, total chromium, hexavalent chromium, copper, and dioxins, were found at concentrations exceeding human health and ecological risk-based levels and risk-based concentrations ("RBC"s), as determined in the Soil Human Health and Ecological Risk Assessment ("HHERA") (Arcadis 2019) in areas within PG&E property or the Refuge. The waste sites of concern are specifically identified in the EE/CA (Jacobs 2020) as SWMU 1/AOC 1, AOC 9, AOC 10, AOC 11, AOC 14, AOC 16 and AOC 27. These areas are located within or adjacent to active desert washes subject to potential scouring during rain events that could move contamination toward the Colorado River or spread the contamination footprint over a larger area. Additional information is provided in the draft RCRA Facility Investigation/Remedial Investigation Report ("RFI/RI") Volume III (Jacobs 2019) developed by PG&E following completion of the soil investigations performed under the direction and oversight of the DOI and the California Department of Toxic Substances Control ("DTSC").

The recommended non-time-critical removal action ("NTCRA") is authorized pursuant to the response action authority of Section 104(a) of CERCLA as amended, 42 U.S.C. §9604(a). Pursuant to Executive Order 12580, as amended, Section 104 authority is delegated to the Secretary of the Interior to address the release or substantial threat of release of hazardous substances on or from property under DOI's jurisdiction, custody, or control.

II. SITE CONDITIONS AND BACKGROUND

A. Site Description

1. Physical Location

The PG&E Topock Compressor Station ("Compressor Station") is located in eastern San Bernardino County, California, approximately 12 miles southeast of Needles, California, south of Interstate 40, on the northern end of the Chemehuevi Mountains. 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 Refuge and directly south of land under the jurisdiction of the Bureau of Reclamation (Reclamation) and managed by the Bureau of Land Management ("BLM") (See Figure 1). Reclamation lands are managed by BLM in accordance with DM613. Land in the area is also owned or managed by San Bernardino County, BNSF Railway Company ("BNSF"), the Fort Mojave Indian Tribe, and the Metropolitan Water District of Southern California. The Compressor Station is located approximately 1,500 feet from the Colorado River and the California and Arizona state border.

The Colorado River provides water to over 25 million people in the Pacific Southwest. In addition, a system of dams provides significant hydroelectric generation to the electric grid. The Colorado River is a recreational, economic, and cultural resource. The river is an important part of the sacred ancestral territory for many native peoples. Many tribal, Federal, state, and local organizations work together to protect the Colorado River.

There are nine Native American Tribes with ancestral ties to the Topock area. The Tribes are the Chemehuevi Indian Tribe, Cocopah Tribe, Colorado River Indian Tribes, Fort Mojave Indian Tribe, Fort Yuma Quechan Tribe, Hualapai Tribe, Havasupai Tribe, Twenty-nine Palms Band of Mission Indians, and the Yavapai-Prescott Indian Tribe (hereinafter, "the Tribes"). The Tribes believe that the area known as Topock, and specifically the immediate project area, is part of a broader cultural landscape. The Tribes, as sovereign governments, recognize the project to be of significant importance and agree that the primary objectives are remediation of historic contamination of the soil and groundwater of hazardous substances, and prevention of further releases of any harmful materials within the cultural and natural environment of the Colorado River and specifically within the immediate project area (BLM 2010/2017).

The land within one mile of the Site boundary includes industrial, recreational, and wildlife management uses. The industrial sites include the Compressor Station, BNSF Railway, Southern California Gas Company, Transwestern Pipeline Company, Mojave Pipeline Company, Kinder Morgan, Inc, and Southwest Gas Corporation. Recreational facilities are located at the Topock/Golden Shores Marina and Moabi Regional Park. San Bernardino County's Moabi Regional Park sits 1-mile northwest of the Station on a side channel of the Colorado River.

There are no hospitals, schools, or daycare centers located within 5 miles of the Compressor Station. The nearest residential community is Topock, Arizona, approximately one-half mile east across the Colorado River. The town of Golden Shores, Arizona is approximately 5 miles to the northeast across the river. The City of Needles, California is approximately 12 miles northwest along Interstate 40. The closest hospital is located in Needles, California, and the closest schools are located across the river in Golden Shores, Arizona. Downstream along the Colorado River are the cities of Havasu Lake, CA and Lake Havasu City, Parker, and Yuma, Arizona (15, 18, 40, and 137 miles away, respectively).

The HNWR surrounds the Compressor Station and includes land along both the California and Arizona sides of the Colorado River. The terrestrial habitats in the vicinity of the Compressor Station are typical of Mojave Desert uplands, consisting of creosote bush scrub, with Mojave wash, desert riparian, and tamarisk thicket. Creosote bush scrub is the dominant upland plant community. Representative upland avian, mammalian, and reptilian species and upland plant species can be expected at the Site.

2. Site Characteristics

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. The property on which the Compressor Station was

built was owned by the State of California. From 1951 to 1965, PG&E leased the property from the State. In 1965, PG&E gained ownership of the property.

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 was also apparently added to assist in the control of algae, fungi, and/or bacteria.

From 1951 to 1970, facility wastewater containing chromium was discharged to an arroyo west of the Compressor Station known as Bat Cave Wash ("BCW") and was allowed to percolate into the ground and/or evaporate. 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. PG&E replaced the Cr(VI)-based cooling water treatment products with non-hazardous phosphate-based products in 1985, at which time PG&E discontinued operation of the cooling tower blowdown treatment system. 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.

Investigative and remedial activities at the Topock Compressor Station date to the 1980s with the identification of SWMUs and AOCs through a RCRA facility assessment. Based on the risks to human health and the environment and input from Tribes and stakeholders, the specific AOCs and SWMUs discussed below have been selected for a non-time-critical removal action.

AOC 1/SWMU 1

AOC 1 and SWMU 1 are located outside and west of the Compressor Station fence line within Bat Cave Wash (Figure 2). AOC 1 comprises a portion of Bat Cave Wash adjacent to the station including SWMU 1, as well as the portion of Bat Cave Wash extending to the north of SWMU 1 toward the Colorado River. SWMU 1 is the former percolation bed located in Bat Cave Wash. From about 1964 to approximately 1971, the facility discharged wastewater to the percolation bed. Historical aerial photo review indicates that, prior to the establishment of the berms surrounding the percolation bed, discharges to Bat Cave Wash may have extended as far

downstream as the railroad tracks. Bat Cave Wash periodically floods during stormwater runoff events but remains dry throughout most of the year due to arid desert conditions.

AOC 1 is located partially on PG&E property, the Refuge, Bureau of Reclamation property (managed by Bureau of Land Management), BNSF property, and Fort Mojave Indian Tribe property with PG&E as the easement holder. SWMU 1 is located on both PG&E property and the Refuge.

AOC 9

AOC 9 is located in the southeast portion of the Compressor Station, just south of the visitor parking lot and immediately east and outside of the fence line (Figure 3). A small amount of discolored surface soil was encountered just outside the fence line on an extremely steep slope in 2000. About 1.5 cubic yards of the stained soil was removed and shipped offsite for disposal. Site conditions (the steepness and stability of the slope) limited the feasible extent of excavation at that time. AOC 9 is located entirely on property owned by PG&E

AOC 10

AOC 10 is located outside and southeast of the Compressor Station fence line in a small ravine referred to as the east ravine. The ravine runs eastward toward the Colorado River. AOC 10 generally includes all of east ravine as well as the specific areas shown on Figure 3. The ravine is approximately 1,600 feet long and is bisected by three constructed berms. Due to the berms, surface flow within the ravine does not typically reach the Colorado River. AOC 10 may have potentially received runoff from the Compressor station, the access road to the Compressor station, and AOC 9; discharge from stormwater drain pipes; surface debris disposed of on the slopes of the ravine; and incidental overflows of wastewater via the former trench drain at the top of the station access road. AOC 10 is located on both PG&E property and the Refuge.

AOC 11

AOC 11 consists of topographic low areas on the northeast side of the Compressor Station (Figure 3). While the principal drainage pathways leading away from the Compressor Station have been identified, certain channels and storm drains drain into topographic low points or depressions. Runoff from the facility can collect at these low points and infiltrate or evaporate. AOC 11 is internally draining, so runoff into AOC 11 cannot reach the Colorado River due to topographic constraints. A stormwater pipe that captures runoff from I-40 and Park Moabi Road also discharges into AOC 11, immediately south of the I-40 crossing. AOC 11 is located on both PG&E property and the HNWR.

AOC 14

AOC 14 is located approximately 1,000 feet north and outside the Compressor Station fence line and is currently bounded by the BNSF railway tracks to the north, Interstate 40 to the south, Bat Cave Wash to the west, and a former access road to the east (Figure 2). AOC 14 currently contains miscellaneous debris related to construction of the rail line including chunks of asphalt,

railroad ties, and piping. Asbestos-containing material and burned material have also been identified within AOC 14. Former PG&E Topock Compressor Station employees reported that water softening (lime) sludge was disposed of in this area. An asbestos removal action was completed in 1999. Surface water runoff along the western side of AOC 14 flows into Bat Cave Wash (AOC 1). AOC 14 is located on the Refuge and is within the California Department of Transportation ("CalTrans") Right-of-Way.

AOC 16

AOC 16 is located on the southwest portion of PG&E property adjacent to the Compressor Station fence line. AOC is a former sandblasting shelter. The primary sources of contamination at AOC 16 are likely to be used sandblast grit, incidental spills of sandblasting materials, and potentially lead-based paint resulting from sandblasting activities. The quantity of any used sandblast grit released in the area is unknown; however, sandblast grit was observed on the ground in the vicinity of the structure. Runoff from AOC 16 flows into Bat Cave Wash (AOC 1).

AOC 27

AOC 27 is located outside and north of the Compressor Station fence line, south of Interstate 40, and east of Bat Cave Wash (AOC 1) shown on Figure 2. A former PG&E employee indicated that AOC 27, informally known as MW-24 bench, was used as a waste disposal area. Miscellaneous construction debris and burned material are present in AOC 27. The burned debris was observed in the eastern edge of the road cut on the road from AOC 27 to Bat Cave Wash (AOC 1). Runoff from AOC 27 potentially flows into Bat Cave Wash (AOC 1). AOC 27 is located on the Refuge and is within the CalTrans Right-of-Way.

3. Release or Threatened Release into the Environment of a Hazardous Substance, or Pollutant, or Contaminant

Investigative and remedial activities at the Topock Compressor Station date to the 1980s with the identification of solid waste management units through a RCRA facility assessment. Since 1996, there have been multiple phases of investigation at the Site to collect data to evaluate the nature and extent of contamination in up to forty SWMUs, AOCs, and Undesignated Areas ("UAs"). The soil medium, which is the focus of this action, is currently in the RFI/RI phase of the cleanup process. RFI/RI activities have been conducted both within the Compressor Station fence line and at adjacent land outside the Compressor Station fence line. In advance of completion of the RFI/RI Report Volume III, at the request of DOI, on February 27, 2018, PG&E provided the Soil RFI/RI data package to the Topock Technical Working Group, presenting the soil investigation results and comparing them to interim project screening levels for human and ecological receptors.

Metals and dioxins/furans (assessed as dioxins/furans Toxicity Equivalent ("TEQ")) were detected at concentrations significantly exceeding background values, and risk-based screening criteria in SWMU 1, AOC 1, AOC 9, AOC 10, AOC 11, AOC 14, AOC 16, and AOC 27 (areas located on Federal land or in locations where constituents have the potential to migrate to

Federal land). It should be noted that dioxins and furans were not included in the list of analytes until after 2010. Metals with elevated concentrations include total chromium, copper, lead, mercury, molybdenum, and zinc.

A HHERA has been completed for the entire Site and approved by DTSC and DOI in 2020 (Arcadis, 2019, 2020). The objectives of the HHERA were to:

- Help determine the need for remedial action with respect to soil conditions; and,
- Provide a basis for determining levels of constituents that can remain in soil at the Site and still be adequately protective of public health and the environment.

Several complete pathways of exposure to contaminants are present at the Site, both now and potentially in the future. The HHERA generally found no unacceptable risk for most human and ecological receptors. Of the potential human receptors, no unacceptable risk was identified for all relevant potential exposure areas for tribal users, hunters, and commercial and short- and long- term maintenance workers. Of the potential ecological receptors, no unacceptable risk was identified for all relevant potential exposure areas for special-status species, large home-range receptors, herbivorous and insectivorous birds, and herbivorous small mammals. However, for certain human recreators and the desert shrew (insectivorous small mammals), the HHERA identified the potential for unacceptable risk in nine localized areas in the following exposure areas: the SWMU 1 exposure area (within Bat Cave Wash), the AOC 9, and/or the AOC 10 exposure area. The risk drivers or constituents of concern for human recreators and the desert shrew are dioxin/furan TEQ, total chromium (desert shrew only), Cr(VI) (recreator only), and copper (desert shrew only).

The surface and shallow soil may be contacted without substantial intrusive activity. However, the soil at the Site is loose desert sand and is not compacted or densely vegetated. Wind erosion and surface water runoff may mix the material at the surface more readily than in other areas of California. Even so, access to soil deeper than 3 feet would require intentional intrusive activity.

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 these activities and are expected to remain accessible in the future. Potential soil exposure pathways for recreational receptors at the Refuge include incidental ingestion, dermal contact, and inhalation of dust in ambient air.

The principal exposure pathways for ecological receptors in the terrestrial environment are exposure to constituents in surface soil, shallow soil, and subsurface soil via direct contact, incidental ingestion, and/or ingestion of chemically affected biota (PG&E 2008a).

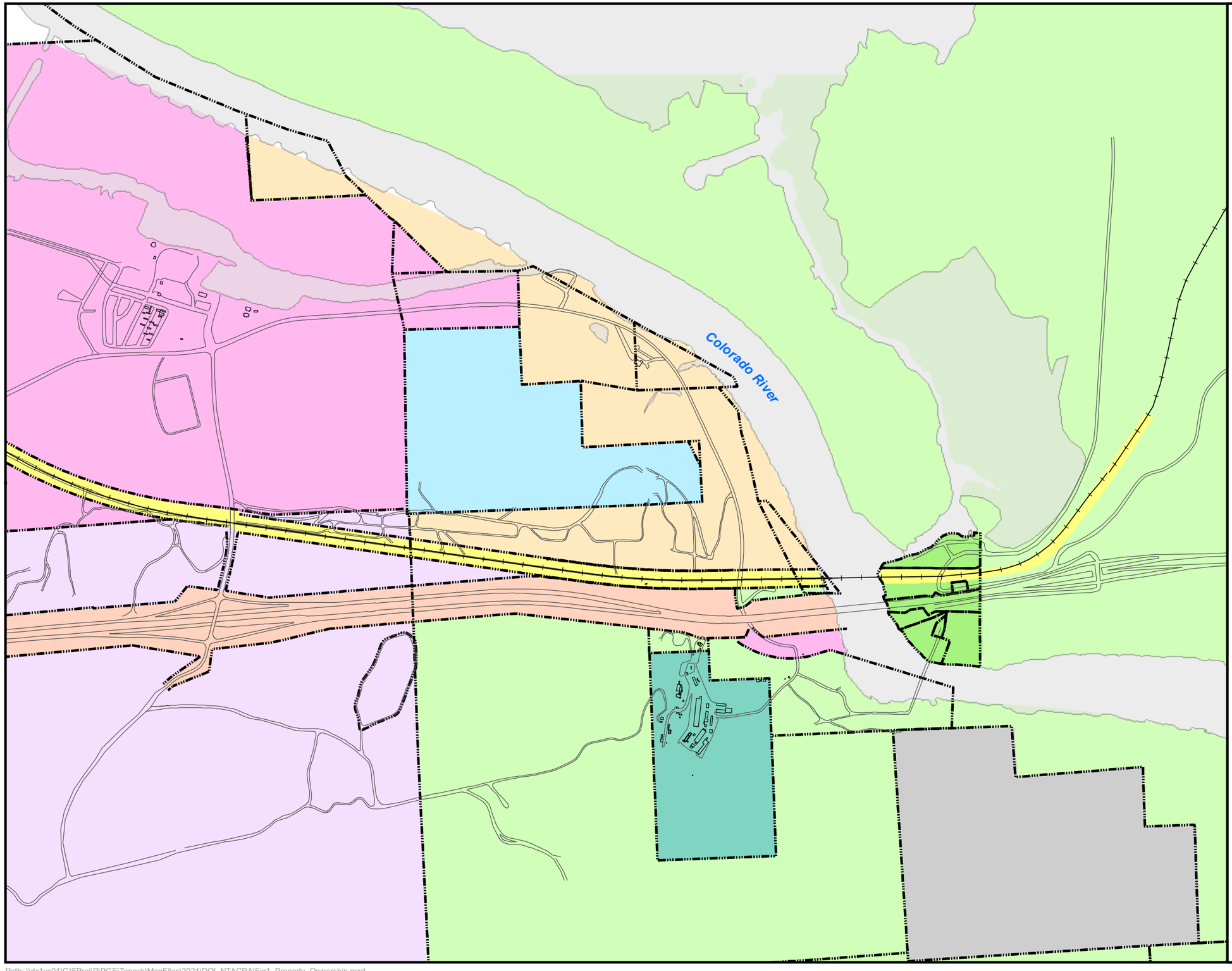
Humans were assumed to contact soil from 0 to 10 feet below ground surface ("ft bgs") and ecological receptors were assumed to contact soil from 0 to 6 ft bgs. Additionally, for the two soil potential exposure areas encompassing wash areas (Bat Cave Wash [AOC1/SWMU1] and AOC 10), two scouring scenarios were evaluated. The 2-foot scouring scenario assumes that the top 2 ft of soil is removed during potential future scouring resulting from surface runoff

following heavy rainfalls. Similarly, in the 5-foot scouring scenario, 5 ft of soil is assumed to be removed during scouring.

4. National Priorities List (NPL) Status

The PG&E Topock Compressor Station is not listed as an NPL site. The Site is listed in CERCLIS EPA ID No. CAT080011729.

5. Figures



LEGEND

Parcel Boundary

Property Owner

- BNSF Railroad
- Bureau of Land Management (owned and managed by BLM)
- Bureau of Reclamation (managed by BLM)
- Caltrans Leased From Underlying Federal Owner
- Fort Mojave Indian Tribe Owner in Fee, With PG&E Easement and Access for Remediation
- Havasu National Wildlife Refuge
- Metropolitan Water Dirstrict of Southern California
- PG&E
- Privately Owned
- San Bernadino County

Note:
1. * = PG&E has a possessory interest on these parcels (650-161-11,650-161-12) for the operation of a compressor station and associated pipelines.

0 345 690 1,380 Feet

N

Figure 1
Property Ownership
PG&E Topock Compressor Station, Needles, California

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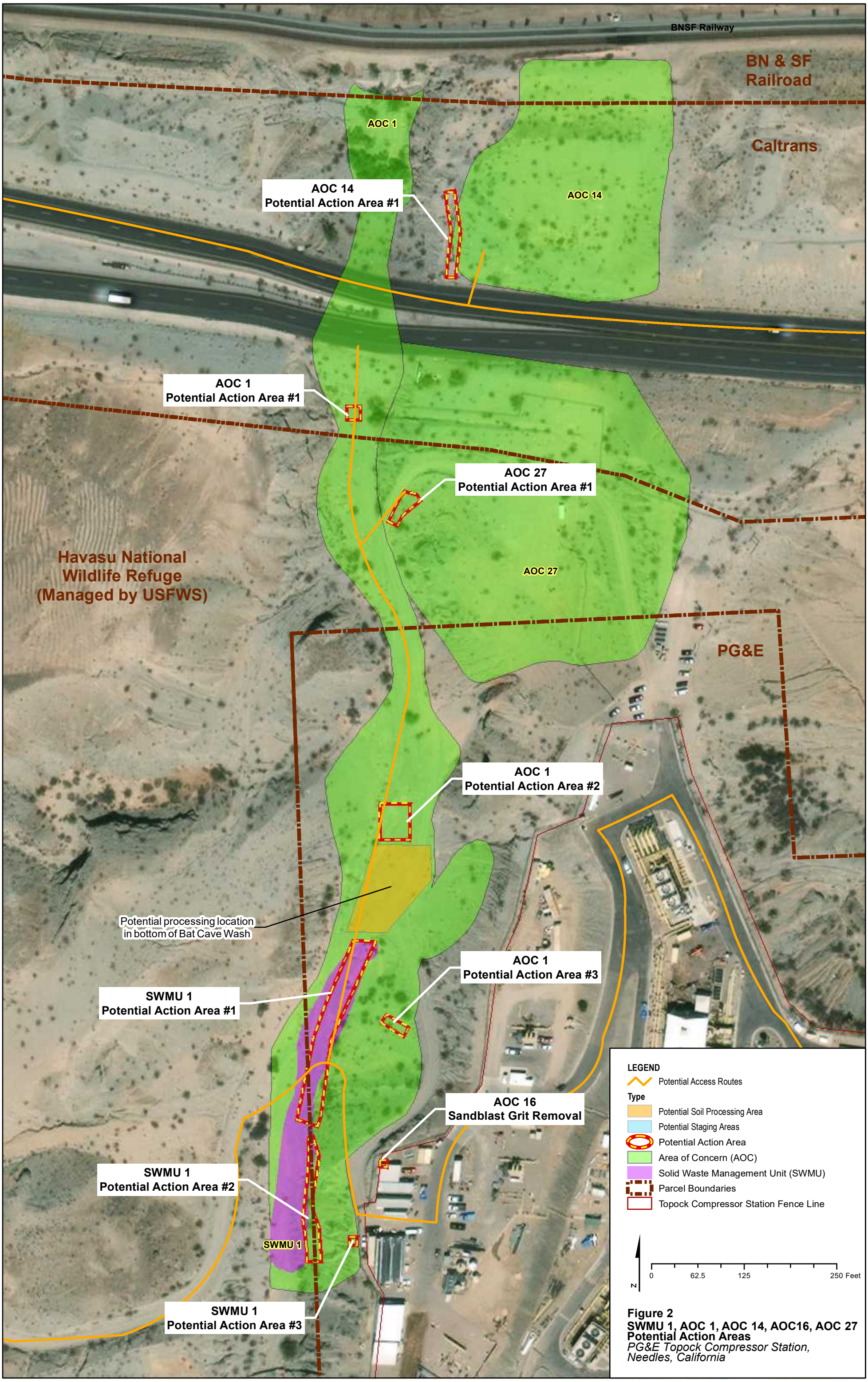

Figure 2
SWMU 1, AOC 1, AOC 14, AOC16, AOC 27 Potential Action Areas
PG&E Topock Compressor Station, Needles, California

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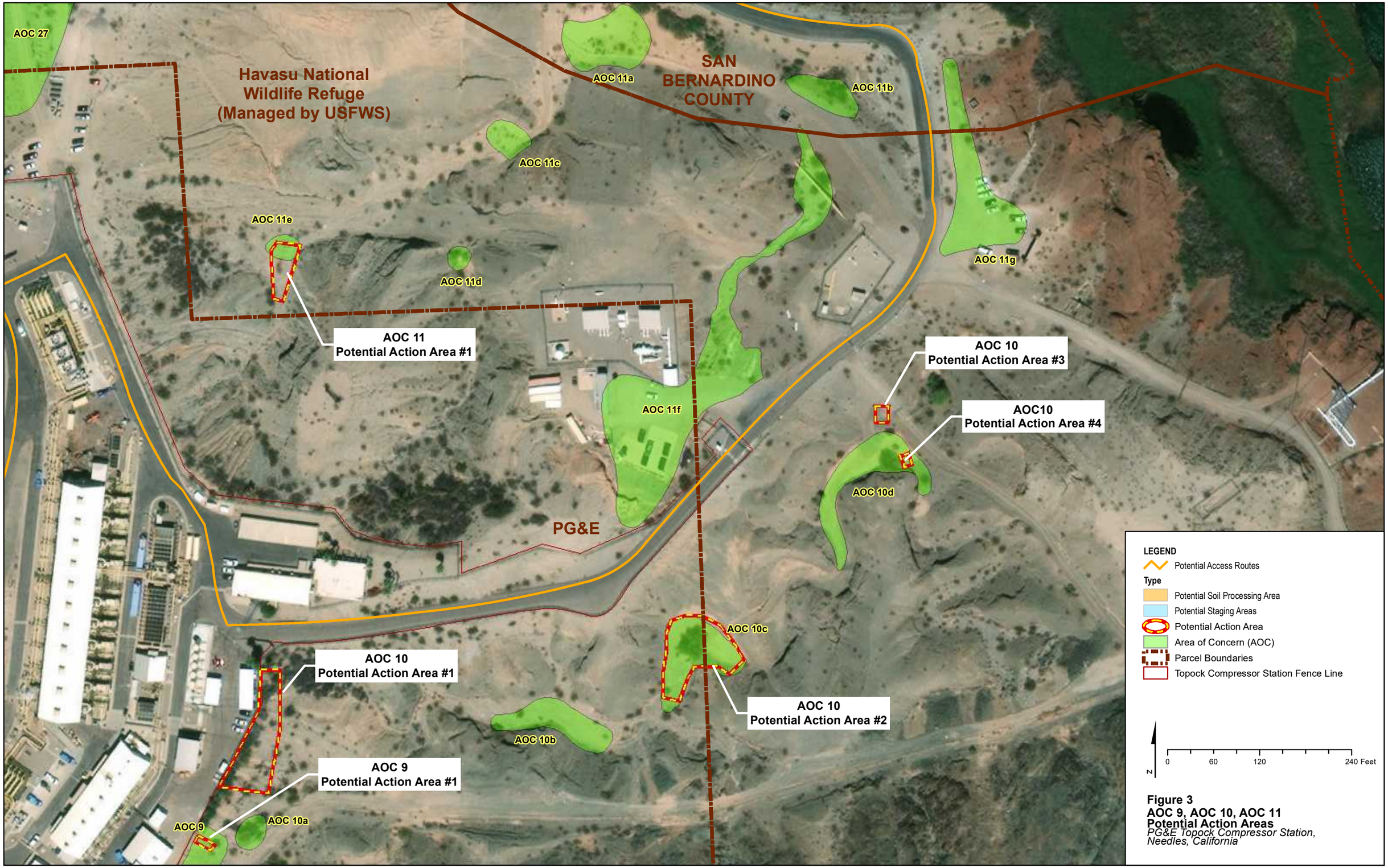

Figure 3
AOC 9, AOC 10, AOC 11 Potential Action Areas
PG&E Topock Compressor Station, Needles, California

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B. Other Actions to Date

1. Previous 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 the Department of Toxic Substances Control ("DTSC")) and the U.S. Environmental Protection Agency ("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 "Facility Investigation" as well as any "Interim Measures" determined to be necessary to address immediate or potential threats to human health and/or the environment.

In the course of implementing groundwater monitoring required under the Corrective Action Consent Agreement, PG&E has documented an extensive plume of groundwater contaminated with Cr(VI) that stretches from the PG&E facility under the Refuge and BOR 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. This monitoring well is 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 "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 authorized PG&E to conduct a time-critical removal 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 gradient and ensure that Cr(VI) did not reach the Colorado River.

On May 20, 2004, BLM issued a second Action Memorandum authorizing PG&E to operate, for a limited period of time, a batch treatment system on the MW20 bench. The purpose of this time-critical 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 authorizing PG&E to install and operate the IM No. 3 system, which included conveyance piping, monitoring wells, a wastewater treatment facility, and associated needed improvements to roads and the IM No. 2 system.

AOC 4

On June 24, 2009, DOI issued an Action Memorandum for a Time-Critical Removal Action to address an area known as the debris ravine or AOC 4. Waste materials identified in the ravine include unconsolidated fill material, wood, metal (cans, machine parts, rebar, etc.), concrete, broken transite panels, and burned debris. Constituents of concern for AOC 4 included Title 22 metals, Cr(VI), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), dioxins/furans and asbestos. The soil removal action was conducted from January to December 2010 using a combination of hand picking and mechanical removal. A total of 11,800 tons of soil and debris were removed from AOC 4. Removed material was directly loaded into covered bins which were then moved to the waste staging area for transportation to off site waste facilities. Rock gabions were installed at the ravine outfall to Bat Cave Wash to limit transport of sediment during and after the removal action.

2. Current Actions

Soil. Environmental investigations have been underway at the Site since 1997. As directed by DTSC, reporting of RCRA Facility Investigation/Remedial Investigation ("RFI/RI") activities and results was separated into three volumes. The first two volumes, covering Site background and history (RFI/RI Report Volume 1) and hydrogeologic characterization/groundwater and surface water investigation results (RFI/RI Report Volume 2), are complete. The first phase of the RFI/RI soil investigation was completed in 2008. The data were reviewed, and data gaps identified. From 2015 to 2017, PG&E conducted additional soil investigations to fill these data gaps. RFI/RI activities were conducted both within the TCS fence line and on surrounding adjacent lands. On June 20, 2017, DOI determined that the soil RFI/RI field work was complete.

At the request of DOI, in 2018 in advance of completion of the RFI/RI Report Volume 3, PG&E submitted a soil investigation data package presenting the soil investigation results and comparing them to interim project screening levels for human and ecological receptors. This information was used in the development of the EE/CA Approval Memorandum. Soil RFI/RI investigation results are presented in the draft RFI/RI report for the Site (Draft RFI/RI Report Volume 3, Jacobs, 2019a).

Groundwater. Groundwater investigations at the Compressor Station date back to the late 1980s. In the course of the groundwater investigation, PG&E documented an extensive plume of groundwater contaminated with hexavalent chromium, extending from the PG&E facility under Federal lands toward the Colorado River with maximum concentrations of hexavalent chromium as high as 15,700 ppb (background concentrations are 32 ppb). Interim Measures were implemented 2004 to ensure that hexavalent chromium and other contaminants in the groundwater did not reach the Colorado River until a permanent remedy could be implemented. Currently a pump and treat groundwater system, referred to as IM-3, is in place for hydraulic control and contaminant removal.

The final groundwater remedy selected by DTSC and DOI is referred to as "In-situ Treatment with Fresh Water Flushing". The remedy involves injection of uncontaminated water upgradient from the plume to "push" the contaminated groundwater through the treatment zone (known as

an in-situ reactive zone or IRZ) created through a network of injection and extraction wells. The IRZ treatment area biochemically converts the hexavalent chromium in contaminated groundwater to trivalent chromium, a less toxic insoluble form of chromium. On April 3, 2018, DOI approved the Basis of Design Report/Final Design Submittal and Construction/Remedial Action Work Plan for the Final Groundwater Remedy and the Supplemental and Errata Information for the Final (100%) Design for the Final Groundwater Remedy. DTSC has certified the Final Subsequent Environmental Impact Report (SEIR) for the Groundwater Remediation Project. The Notice of Determination (NOD) was filed with the State Office of Planning and Research on April 24, 2018 in accordance with the guidelines of the California Environmental Quality Act (CEQA). A project initiation meeting was held on October 2, 2018, initiating the start of construction. The groundwater remedy construction is divided into two phases; the first phase focuses on the IRZ and should be complete in 2021. The second phase centers on the freshwater flushing infrastructure and should be completed in 2025.

3. State and Local Authorities' Roles

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*. Closure activities of former hazardous waste management facilities at the Compressor Station were performed from 1988 to 1993. On February 26, 1996, DTSC and PG&E executed a Corrective Action Consent Agreement pursuant to State law under which DTSC directed PG&E to perform a "Facility Investigation" as well as any "Interim Measures" determined to be necessary to address immediate or potential threats to human health and/or the environment.

III. THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES

Pursuant to Section 104 of CERCLA and consistent with the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"), 40 CFR Part 300, DOI is authorized to respond to the release or substantial threat of release of hazardous substances on or from property under DOI's jurisdiction, custody, or control. DOI is authorized to act to remove or arrange for the removal of such hazardous substances whenever DOI determines that such action is necessary to protect the public health or welfare or the environment. When DOI determines that such action will be done properly and promptly by the owner or operator of the facility, DOI may allow such person to carry out the action.

Pursuant to Section 300.415(b)(2) of the NCP, where DOI determines that there is a threat to public health or welfare or the environment, DOI may take any appropriate removal action to abate, prevent, minimize, stabilize, mitigate, or eliminate the release or threat of release. The following sections evaluate, based on the factors outlined in Section 300.415(b)(2) of the NCP, threats to public health or welfare or the environment posed by the release and threatened release of hazardous substances at and from SWMU1/AOC 1, AOC 9, AOC 10, AOC 11, AOC 14, AOC 16, and AOC 27.

Risk Assessment Findings

Potential human receptors were evaluated as four main categories: worker, recreational user, tribal user, and hypothetical resident. Potential ecological receptors evaluated included plants, terrestrial invertebrates, and representative small and large home range wildlife

Overall, the HHERA found no potentially unacceptable risk to most human and ecological receptors exposed to COPCs/COPECs in soil at the Site, both within the Compressor Station (inside the compressor station exposure area) and the exposure areas outside the Compressor Station. Estimated risks were determined to be acceptable for all relevant exposure areas for the following receptors:

- Human Health Receptors
    - Tribal User and hunter
    - Workers (Commercial and Short- and Long-term Maintenance Workers).

- Ecological Receptors
    - Special-status species (state- and federal-listed threatened and endangered wildlife species and state species of concern), including ring-tailed cat, cave myotis, and pallid bats
    - Large home range receptors (desert kit fox, Nelson's desert bighorn sheep, red-tailed hawk, and Yuma myotis)
    - Herbivorous and insectivorous birds (Gambel's quail and cactus wren)
    - Herbivorous small mammals (Merriam's kangaroo rat).

For the remaining Human Health Receptors (camper, hiker, and OHV rider), and Ecological Receptors (desert shrew (insectivorous small mammals)), the potential for unacceptable risk was identified as being driven by a limited number of compounds (i.e., dioxin/furan toxic equivalent ("TEQ") and Cr(VI)) for human health; dioxin/furan TEQ, total chromium, and copper for ecological receptors) in nine localized areas within SWMU 1, AOC 9, and/or AOC 10. The potential for unacceptable risk was also identified for plants and invertebrates; however, only generic risk-based screening levels were available to estimate HQs and, as discussed in the HHERA, there is low confidence in the ability to predict risk to plants and invertebrates at the Site based on these generic screening levels.

That process revealed a total of nine locations in three exposure areas (SWMU 1, AOC 9, and AOC 10) as associated with unacceptable risk. Those locations are as follows:

Protection of human recreators (four total locations for the 0 to 3 ft bgs interval):

- Dioxin/furan TEQ (based on RBRG of 100 ng/kg for 10-6 risk): SWMU1-25 in OCS / SWMU 1
- Hexavalent chromium (RBRG of 3.1 mg/kg for 10-6 risk): AOC10-20, #10 in AOC 9, and MW-58BR_S in AOC 10.

Protection of desert shrew (seven total locations for the 0 to 0.5 ft bgs interval):

- Dioxin TEQ (RBRG of 190 ng/kg): SWMU1-25 in Bat Cave Wash; PA-20, AOC10-23, and PA-21 in AOC 9; and AOC10c-4 in AOC 10
- Total chromium (RBRG of 145 mg/kg): AOC10-20 in AOC 9
- Copper (RBRG of 145 mg/kg): AOC10-21 in AOC 9.

In total, the nine locations fall within three main exposure areas: SWMU 1 (near SWMU1-25) in Bat Cave Wash, AOC 9 along the Compressor Station fence line (which is within the RFI/RI investigation area known as AOC 10), and AOC 10 within the AOC10c subarea (i.e., drainage depression behind the middle berm in the East Ravine).

A. Threats to Public Health or Welfare

1. Actual or potential exposure to nearby human populations or the food chain from hazardous substances or pollutants or contaminants

The identified AOCs/SWMUS are located in areas adjacent to or within the Refuge managed by USFWS. Recreational activities at the Refuge include hiking, off-roading, sightseeing, bird watching, fishing, hunting, and canoeing. All areas within the Refuge and outside the Compressor Station are considered publicly accessible for such activities and are likely to remain publicly accessible in the future. The Risk-Based Remediation Goals ("RBRGs") for Human Receptors are identified in Exhibit 1. For dioxins TEQ, the HHERA notes that the California Department of Toxic Substances Control Human and Ecological Risk Office supports the use of residential and indoor commercial worker remedial goals equal to 10 times the theoretical potential cancer risk of 1×10^{-6}. Based on tribal input received during the EE/CA comment period and related concerns regarding impacts to the Traditional Cultural Property, the selected RBGs are based on a 10^{-6} cancer risk for soils found in the upper two feet and 10^{-5} cancer risk for soils below two feet. The majority of excess risk outside the Compressor Station is attributed to elevated concentrations of hexavalent chromium and/or dioxins located within SWMU 1 and TCS-4 areas within Bat Cave Wash and in AOC 9 and AOC 10.

Exhibit 1. Human Health Risk-Based Remediation Goals

Soil Engineering Evaluation/Cost Analysis
PG&E Topock Compressor Station, Needles, California

Risk Drivers for Potential Recreational Users	Human Health RBRG	RBRG Basis
Chromium, hexavalent	**3.1 mg/kg**	**Off-highway vehicle rider at 1 x 10^{-6} risk**
Chromium, hexavalent	31 mg/kg	Off-highway vehicle rider at 1 x 10^{-5} risk
Chromium, hexavalent	310 mg/kg	Off-highway vehicle rider at 1 x 10^{-4} risk
Dioxin/furan TEQ	100 ng/kg	Hiker at 1 x 10^{-6} risk
Dioxin/furan TEQ	1,000 ng/kg	Hiker at 1 x 10^{-5} risk
Dioxin/furan TEQ	10,000 ng/kg	Hiker at 1 x 10^{-4} risk

mg/kg = milligrams per kilogram
ng/kg = nanograms per kilogram
RBRG = risk-based remedial goal
TEQ = toxicity equivalent

For each AOC and SWMU, the following human health RBRGs exceedances have been identified.

AOC1/SWMU1

- Hexavalent chromium concentrations range from *levels not detected at the listed reporting limit* (ND) of 0.05 milligrams/kilogram (mg/kg) to 80 mg/kg with concentrations in 22 sample locations in SWMU1 and 12 sample locations in AOC1 exceeding RBRGs.
- TEQ-human concentrations range from ND (0.067) to 12,000 nanograms per kilogram (ng/kg) with concentrations in 7 sample locations in SWMU1 and 16 sample location in AOC1 exceeding RBRGs.

AOC 9

- Hexavalent chromium concentrations range from ND (0.21) to 114 mg/kg with concentrations in 5 sample location exceeding RBRGs.
- TEQ-human concentrations range from ND (0.3) to 190 ng/kg. Concentrations in 4 sample locations exceeded RBRGs.

AOC 10

- Hexavalent chromium concentrations range from ND (0.2) to 2,700 mg/kg with concentrations in 20 sample locations exceeding RBRGs.
- TEQ-human concentrations range from ND (0.14) to 1,600 ng/kg with concentrations in 12 sample locations exceeding RBRGs.

AOC 11

- Hexavalent chromium concentrations range from ND (0.2) to 16 mg/kg. Concentrations in 5 sample location exceeded RBRGs.
- TEQ-human concentrations range from 0.062 to 3,200 ng/kg with concentrations in 8 sample locations exceeding RBRGs.

AOC 14

- Hexavalent chromium concentrations range from ND (0.2) to 20 mg/kg. Concentrations in 6 sample locations exceeded RBRGs.
- TEQ-human concentrations range from 0.074 to 480 ng/kg. Concentrations in 2 sample locations exceeded RBRGs.

AOC 27

- Hexavalent chromium concentrations range from ND (0.2) to 4.8 mg/kg. Concentrations in 2 sample locations exceeded RBRGs.
- TEQ-human concentrations range from 0.12 to 230 ng/kg. Concentrations in 2 sample locations exceeded RBRGs.

It is anticipated that recreational activities will continue or increase in the future and exposure of human receptors (recreators) to the hazardous substance found in these AOCs/SWMU is occurring or may occur. This is indicated by the Conceptual Site Model found in the Risk Assessment Work Plan and RFI/RI and field observations of Off-Highway Vehicular (OHV) traffic and hiking in AOC1/SWMU 1 with access restrictions in place. On this basis, the conditions at the identified AOCs/SWMU pose a threat to human health.

2. Actual or potential contamination of drinking water supplies or sensitive ecosystems

The Compressor Station is located in a sparsely populated, rural area. Land uses near the Site are predominantly open space, interspersed with industrial facilities, recreational uses, and transportation infrastructure. The area surrounding the Compressor Station is bisected by several steep-sided ephemeral streambeds, including Bat Cave Wash and several unnamed washes oriented north/ northeast to their confluences with the Colorado River. The Colorado River provides water to over 25 million people in the Pacific Southwest. In addition, a system of dams provides significant hydroelectric generation to the electric grid. The Colorado River is a recreational, economic, and cultural resource. The contamination pathway from AOC 1 leads from upland terrestrial/wash habitat to the confluence of Bat Cave Wash with the Colorado River.

3. High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface that may migrate

The landforms in the Topock area are characterized by alluvial terraces and incised drainage channels. One of the largest incised channels is Bat Cave Wash, a north-south dry wash (ephemeral) stream adjacent to the Compressor Station. Bat Cave Wash flows only

briefly following intense rainfall events and drains to the Colorado River. AOC 1 and SWMU 1 lie within Bat Cave Wash.

Historically, chemicals of potential concern (COPCs) or chemicals of potential ecological concern (COPECs) in surface soil in SWMU 1 may have been eroded and entrained in stormwater/surface water runoff during flow events and may have been subsequently re-deposited downstream in Bat Cave Wash (AOC 1). The thick vegetation, widening of the channel near the end of Bat Cave Wash, and blockage of flow by National Trails Highway greatly reduce the energy of flow during runoff events, resulting in deposition of entrained soil within the vegetated area in AOC 1.

A historic well that was likely used for water supply in the 1950s and wastewater disposal in the 1960s, TCS-4, is located within AOC 1, just north of the SWMU 1 boundary. Soil samples collected near the TCS-4 well head contained dioxins and furans (dioxin/furan) toxicity equivalent (TEQ), total chromium, hexavalent chromium ("Cr(VI)"), molybdenum, and zinc concentrations well above background concentrations. Additional sampling of pipe wrap material collected from the pipe connected to TCS-4 also contained exceedances for TEQ dioxins and furans as well as asbestos containing material.

4. Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released

Precipitation in the vicinity of the Compressor Station is minimal year-round, with the most rain typically falling in January. The total precipitation for the entire year averages 2.7 inches. During monsoon season (June – September), however, clouds build throughout the day and result in strong afternoon thunderstorms. These events are sporadic with heavy winds and rain. Localized conditions can result in significant flooding and erosion in washes.

Evidence of significant flooding and mass material transport in area arroyos has been demonstrated by the movement of gravel from a nearby BOR quarry and by movement of concrete debris to and within Bat Cave Wash. A significant rain event in the area could result in severe erosion of the contaminated materials on the steep slopes of AOC 9, AOC 10, AOC 14 and AOC 27 and rapid migration of hazardous substances from SWMU 1, AOC 1 and AOC 10 to the Refuge and potentially to the Colorado River.

B. Threats to the Environment

The Ecological Risk Assessment calculated the following risk drivers and potential exposure areas as presenting potentially unacceptable risk to one or more ecological receptors. They are:

- Bat Cave Wash (SWMU 1/AOC 1) – dioxin TEQ for small invertivorous mammals (desert shrew)
- AOC 9 – hexavalent chromium and copper for plants; hexavalent chromium, total chromium, and copper for invertebrates; total chromium, copper, and dioxin TEQ for small invertivorous mammals

- AOC 10 – hexavalent chromium and total chromium for plants; total chromium for invertebrates (baseline and 2-ft scouring scenarios only); and total chromium and dioxin TEQ for small invertivorous mammals.

5. Actual or potential exposure to nearby animals or the food chain from hazardous substances or pollutants or contaminants

The concentrations of hazardous substances detected in AOC 1, AOC 9, AOC 10, AOC 14, and AOC 27 and SWMU 1 soils indicate a substantial potential risk to the environment. The Risk-Based Remediation Goals for Ecological Receptors are identified in Exhibit 2.

Exhibit 2. Ecological Risk-Based Remediation Goals
Soil Engineering Evaluation/Cost Analysis
PG&E Topock Compressor Station, Needles, California

Risk Driver for Shrew	BAF	LOAEL-based Mammalian TRV	Ecological RBRG
Chromium, total	ERA / RAW	ERA / HHERA Work Plan	145 mg/kg
Copper	ERA / RAW	ERA / HHERA Work Plan	145 mg/kg
Dioxin/furan TEQ	EPA 1999	30 ng/kg-day (geomean of rodent studies)	190 ng/kg
Dioxin/furan TEQ	Fagervold et al. 2010	30 ng/kg-day (geomean of rodent studies)	360 ng/kg

BAF = bioaccumulation factor RAW = Risk Assessment Workplan
ERA = ecological risk assessment RBRG = risk-based remedial goal HHERA = Human Health and Ecological Risk Assessment TEQ = toxicity equivalent
LOAEL = lowest observed adverse effects level TRV = toxicity reference value

For each AOC and SWMU, the following ecological RBRGs exceedances were identified.

AOC1/SWMU1

- Total chromium concentrations range from 4.1 to 4,400 milligrams per kilogram (mg/kg) with concentrations in 24 samples locations in SWMU 1 and 15 sample locations in AOC 1 exceeding ecological RBRGs. The maximum detected concentration was in AOC 1, potential action area #2 at Old Well (4 to 5 feet below ground surface (bgs)).
- TEQ-mammal concentrations range from ND (0.067) to 12,000 ng/kg with concentrations in 6 sample location in SWMU 1 and 9 sample locations in AOC 1 exceeding ecological RBRGs. The maximum concentration was found in SWMU 1 (0 to 1-foot bgs).

AOC 9

- Total chromium concentrations range from 8.9 to 398 mg/kg with concentrations in 2 sample locations exceeding RBRGs.

- TEQ-mammal concentrations range from ND (0.3) to 190 ng/kg with concentrations in 1 sample location exceeding RBRGs.

AOC 10

- Total chromium concentrations range from 3.6 to 4,000 mg/kg with concentrations in 22 sample locations exceeding RBRGs.
- Copper concentrations range from 2.6 to 3,100 mg/kg with concentrations in 8 sample locations exceeding RBRGs.
- TEQ-mammal concentrations range from ND (0.14) to 1,600 ng/kg with concentrations in 11 sample locations exceeding RBRGs.

AOC 11

- Total chromium concentrations range from 7.9 to 320 mg/kg with concentrations in 1 sample location exceeding RBRGs.
- TEQ-mammal concentrations range from ND (0.062) to 3,200 ng/kg with concentrations in 4 sample locations exceeding RBRGs.

AOC 14

- Total chromium concentrations range from 8.1 to 420 mg/kg with concentrations in 3 sample locations exceeding RBRGs.
- Copper concentrations range from 1.8 to 1,800 mg/kg with concentrations in 3 sample locations exceeding RBRGs.
- TEQ-mammal concentrations range from 0.074 to 480 ng/kg with concentrations in 1 sample location exceeding RBRGs.

AOC 16

- Copper concentrations in the sand blast grit sample are 1,500 mg/kg, exceeding the RBRGs.

AOC 27

- Total chromium concentrations range from 11 to 290 mg/kg with concentrations in 1 sample location exceeding RBRGs.
- Copper concentrations ranged from 7 to 1,000 mg/kg with concentrations in 2 sample locations exceeding RBRGs.
- TEQ-mammal concentrations range from 0.12 to 230 ng/kg with concentrations in 1 sample location exceeding RBRGs.

Exposure of ecological receptors to the hazardous substance found in AOCs/SWMUs is occurring or may occur in the future. This is indicated by the Conceptual Site Model found in the Risk Assessment Work Plan and RFI/RI. On this basis, it is apparent that conditions at the identified AOCs/SWMU pose a threat to the environment.

6. Actual or potential contamination of sensitive ecosystems

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. AOC 1/SWMU 1, AOC 10, AOC 11, AOC 14, and AOC 27 are located adjacent to and partially on the Refuge managed by USFWS. The 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*). Special status species include the Yuma myotis and pallid bats and the ringtail cat. 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*). Since AOC 14, and AOC 27 are located in an upland wash west of the Colorado River, the only federally listed species that could occur in this area is the desert tortoise. PG&E performed yearly surveys for the desert tortoise until 2012. Currently, preconstruction surveys are performed and PG&E has not found any evidence of recent, active desert tortoise use of the area. However, the contamination pathway from AOC 14, and AOC 27 to AOC 1 lead from upland terrestrial/wash habitat to the confluence of Bat Cave Wash with the Colorado River. In this location, there is a salt cedar (*Tamarix* spp.) thicket with a shallow water table . This salt cedar thicket provides 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 in AOC 1, AOC 10, AOC 14, and SWMU 1 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.

IV. ENDANGERMENT DETERMINATION

Actual or threatened releases of hazardous substances from the in AOC 1, AOC 9, AOC 10, AOC 14, and AOC 27, and SWMU 1, if not addressed by implementing the response action selected in this Action Memorandum, may present an imminent and substantial endangerment to public health, or welfare or the environment. This non-time-critical removal action is necessary to abate, prevent or eliminate the release or substantial threat of release of hazardous substances onto the Refuge lands which are under Federal jurisdiction. Due to the high levels of contamination documented by the 2008 and 2017 sample results, DOI has determined, in accordance with Section 300.415(b)(2) of the NCP, that a non-time-critical response action is necessary.

V. PROPOSED ACTIONS AND ESTIMATED COSTS

A. Proposed Actions

1. Proposed action description

This non-time-critical removal action is intended to stabilize and mitigate the threat of release of contaminated material surrounding and within the Refuge and reduce the overall threat to human health and the environment. This action may not be the final remedy for the identified AOCs/SWMUs. The soil remedial investigation process will continue for the Site.

Several potential removal action alternatives were identified in the EE/CA (Jacobs 2020) that would meet the RAOs. Technology identification considered current knowledge regarding soil treatment and remedial options. The following technologies were compared against the criteria of effectiveness, implementability, and cost as summarized in the EE/CA. The no-action alternative is used as a baseline to compare other alternatives. Measures, such as actions taken to reduce the potential for exposure (e.g. site fencing), are not included as components of no-action alternatives. Environmental monitoring may be included as part of a no-action alternative.

The alternatives evaluated in the EE/CA are:

- No Action
- Excavation and offsite disposal
- Excavation and ex-situ treatment with mechanical separation
- Excavation and ex-situ treatment with soil washing
- Debris removal only

Based on the comparative analysis of the removal action alternatives against the criteria of effectiveness, implementability, and cost as summarized in the EE/CA, the recommended alternative is *Alternative 3 – Excavation, Mechanical Separation, Offsite Disposal of Fines, and Reuse of Coarse Material.* This alternative provides the best balance against all EE/CA evaluation criteria.

The scope of the removal action is limited to soil and other solid-phase matrices including sediment, white powder, black sandy material, and debris on Federal land or in locations where constituents have the potential to migrate to Federal land.

Section 121(d) of the CERCLA requires that onsite remedial actions attain or waive federal environmental Applicable or Relevant and Appropriate Requirements (ARARs), or more stringent state environmental ARARs, upon completion of the remedial action. The 1990 National Oil and Hazardous Substances Pollution Contingency Plan (NCP) also requires compliance with ARARs during removal and remedial actions to the extent practicable.

To assist with the determination of the Removal Action Objectives ("RAOs") and the development and screening of removal action alternatives, ARARs have been identified for the Site. ARARs are cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law. Distinct

from ARARs, the NCP also acknowledges to-be-considered (TBC) criteria that may be helpful in evaluating remedies, but for which compliance is not required (USEPA, 1988). ARARs and TBC criteria fall into three types: chemical-specific, location-specific, and action-specific. The identified ARARs for this removal action are presented in Table 1.

The NTCRA at the Site is being evaluated based on the following NCP factors per 40 CFR § 300.415(b)(2):

- Actual or potential contamination of drinking water supplies or sensitive ecosystems;
- Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants;
- High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate; and,
- Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released.

Chemical-specific ARARs are often used to guide NTCRAs; however, no chemical-specific risk-related ARAR goals were identified due to the completion of the HHERA. Based on the NCP factors, consideration of ARARs, Tribal input, and the information presented in the EE/CA, the following Removal Action Goals (RAGs) and RAOs are identified for the action.

The relevant RBRGs, which are applicable to hexavalent chromium, total chromium, copper, and dioxin/furan TEQ were identified in the HHERA. To support the EE/CA process and implementation of the proposed NTCRA, additional numerical RAGs were identified to support RAO 2. Numerical RAGs are RBRGs and risk-based concentrations [RBCs] calculated in the HHERA. The numerical RAGs are used to identify areas with elevated concentrations of contaminants in soil for potential removal (See Exhibit 3).

Exhibit 3. Numerical Removal Action Goals

Contaminant	Numerical RAG	Basis	Source	Applicable RAO
Chromium, hexavalent	3.1 mg/kg Surface to 2' bgs	Off-highway vehicle rider at 1 x 10^{-6} risk	RBRG calculated in HHERA	RAO 1[a] and RAO 2[b]
Chromium, hexavalent	31 mg/kg 2'-10'	Off-highway vehicle rider at 1 x 10^{-5} risk	RBRG calculated in HHERA	RAO 2[b]
Chromium, total	145 mg/kg	Desert shrew	RBRG calculated in HHERA	RAO 1[a] and RAO 2[b]
Copper	145 mg/kg	Desert shrew	RBRG calculated in HHERA	RAO 1[a] and RAO 2[b]
Dioxin/furan TEQ[c]	100 ng/kg Surface – 2' bgs	Hiker at 1 x 10^{-6} risk	RBRG calculated in HHERA	RAO 1[a] and RAO 2[b]
Dioxin/furan TEQ[c]	190 ng/kg – 2'-10'	Desert shrew	RBRG calculated in HHERA	RAO 2[b]
Lead	36 mg/kg	Cactus wren	RBC calculated in HHERA Appendix RBC	RAOs 2[b]
Mercury	1 mg/kg	Cactus wren	RBC calculated in HHERA Appendix RBC	RAOs 2[b]
Molybdenum	22 mg/kg	Desert shrew	RBC calculated in HHERA Appendix RBC	RAOs 2[b]
Zinc	1,050 mg/kg	Cactus wren	RBC calculated in HHERA Appendix RBC	RAOs 2[b]

Notes:

[a] For RAO 1, the residual 95UCL for the potential exposure area will be compared to the RBRG.

[b] For RAO 2, individual soil samples are and will be compared directly to the RBRG and RBCs to identify significant exceedances.

[c] Dioxin/Furan TEQs for humans and mammals are calculated using the same toxic equivalency factors. The dioxin/furan RAGs are protective of both human recreators and the desert shrew.

95UCL = 95 percent upper confidence limit on the mean
bgs = below ground surface
HHERA = Human Health and Ecological Risk Assessment mg/kg = milligram(s) per kilogram
ng/kg = nanogram(s) per kilogram
RAG = removal action goal
RBC = risk-based concentration
RBRG = risk-based remedial goal
TEQ= toxicity equivalent

Exhibit 4. Removal Action Objectives

Removal Action Objective	Removal Action Goal Implementation
RAO 1: Reduce human and ecological risk related to the COCs in soil on or adjacent to federal land by removing soil at locations identified as driving risk in the HHERA.	In order to meet RAO 1, the recommendations of HHERA will be followed, that is, removal action alternatives will include removal of soil at the following locations identified in the HHERA: Protection of potential human recreators (four total locations for the 0- to 2-ft bgs depth interval): • Dioxin TEQ: SWMU1-25 • Hexavalent chromium: AOC10-20, #10, and MW-58BR_S Protection of desert shrew (up to seven total locations for the 0- to 0.5-ft bgs depth interval): • Dioxin/furan TEQ (based on RBRG of 190 ng/kg): SWMU1-25, PA-20, AOC10-23, PA-21, and AOC10c-4 • Total chromium: AOC10-20 • Copper: AOC10-21 Following the NTCRA, risk will be recalculated for the relevant exposure areas and compared to numerical RAGs, specifically RBRGs defined in the HHERA. Risk calculations will be performed during implementation of the removal action alternative and will include existing soil concentration data for sample locations not removed in the NTCRA and new data from confirmation samples. RAO 1 will be met when the residual 95UCL for the potential exposure area is less than or equal to the RBRG for the identified locations. Where human health drives risk, the RBRG protective of risk at 1×10^{-6} will be applied for the top two (2) feet. .
RAO 2: Address elevated concentrations of contaminants up to 10 ft bgs outside the TCS in or adjacent to wash areas that are within, or have the potential to migrate to, the HNWR during storm events.	In order to meet RAO 2, removal action alternatives will address soil within the HNWR or that may migrate to the HNWR from 0 to 10 ft bgs with elevated concentrations of contaminants exceeding RAGs (specifically, hexavalent chromium, total chromium, copper, lead, mercury, molybdenum, zinc, and/or dioxins/furans). Identification of areas with elevated concentrations were guided in the EE/CA by comparing individual soil concentration results (from existing RFI/RI data) to the numerical RAGs and identifying a factor of exceedance of 10X of this numerical RAG. Removing highly contaminated soils and wastes that contain mobile contaminants also minimizes the potential for further degradation of the groundwater aquifer. Confirmation samples will be collected during the NTCRA and compared to numerical RAGs to confirm the completeness of removal activities.
RAO 3: Remove debris, burnt material, and/or discolored soil associated with elevated hazardous substances as identified during the RFI/RI within SWMUs and AOCs up to 10 ft bgs.	In order to meet RAO 3, removal action alternatives will address visually identified debris, burnt material, and/or discolored soil from 0 to 10 ft bgs. RAO 3 will rely on visual identification of material rather than comparison of soil concentrations to numerical RAGs. Areas with observed debris, burnt material and/or discolored soil are preliminarily identified for the purpose of evaluating removal action alternatives and costing in Section 3.6 and will be refined based on visual observation during the NTCRA. The completeness of the NTCRA will be confirmed through visual observation and confirmation sampling for COCs.

Notes:
95UCL = 95% upper confidence limit on the mean AOC = area of concern
bgs = below ground surface
COC = constituent of concern
EE/CA = Engineering Evaluation/Cost Analysis ft = feet
HHERA = human health and ecological risk assessment
HNWR = Havasu National Wildlife Refuge
ng/kg = nanograms per kilogram
NTRCA = Non-time-critical removal action
RAG = removal action goal
RAO = removal action objective
RBRG = risk-based remedial goals
RFI/RI = RCRA facility investigation/remedial investigation SWMU = solid waste management unit
TEQ = toxicity equivalent
TCS = Topock Compressor Station

Removal of the contaminated soil and debris and disposal in an approved permitted landfill will immediately help to mitigate the human and environmental health risks posed by potential direct contact with contaminated materials.

A Removal Action Work Plan (RAWP) will be prepared by PG&E for approval by DOI. The lists of identified ARARs presented in Table 1were narrowed based on whether the requirement is legally enforceable either at the Site or over Site conditions, whether it would be reasonable to apply the requirement to Site conditions, and lastly whether the Site or removal actions are under its jurisdiction. TBC criteria are also included in Table 2. The RAWP will identify how ARARs and TBCs, for which PG&E is responsible for implementing, will be complied with during implementation of the action.

The removal action will comply with all applicable measures and stipulations of the Programmatic Agreement (PA) and the Cultural and Historic Property Management Plan (CHPMP). The PA recognizes that adverse effects to cultural and historic properties resulting from implementation of the selected removal action should be avoided, minimized, or mitigated to the extent practicable, provided that the selected removal action protects human health and the environment, attains ARARs, and complies fully with all CERCLA and NCP requirements. Tribal consultation will occur on the RAWP to ensure the potential adverse effects are addressed. The Tribes and DTSC will have an opportunity to review the RAWP.

Site preparation would include mobilization and setup of support facilities including access routes, site surveys, vegetation removal, and establishment of soil erosion and sediment controls. Cultural resources and biological pre-construction field verifications would be performed prior to any intrusive work. Coordination with USFWS and California Department of Fish and Wildlife would occur to ensure applicable management measures are implemented during the removal action to avoid and protect sensitive habitats and wildlife in the work areas.

Excavation operations would be performed by qualified excavation personnel with current Hazardous Waste Operations and Emergency Response (HAZWOPER) training, as required by the Occupational Health and Safety Administration. Standard dust control techniques would be used during removal activities to mitigate fugitive dust emissions. Equipment and support facilities (e.g., excavators, loaders, office trailer, storage containers, sanitary facilities, etc.) would be mobilized to the Site and staged at approved locations. Utility clearance surveys, vegetation removal areas, and access routes would be identified in the RAWP. Routes will be improved where necessary to provide access to the areas marked for excavation. Vegetation removal would be minimized to the practical extent needed to complete the removal action.

Excavated soil would be mechanically separated onsite using a sequential combination of equipment such as a bar screen, hopper, trommel, and/or vibratory screening tables. Coarse particles greater than 3/8 inch would be separated, stockpiled, and returned to the excavation areas as backfill. After confirming that the RAGs have been met, the excavated areas would be backfilled and re-graded to the approximate original contours, ensuring appropriate site drainage and maintaining current exposure depth intervals.

An erosion and sediment control plan would be prepared as part of the RAWP. Erosion and sediment control measures would be established to ensure that soil disturbance activities do not adversely impact downgradient surface water bodies and floodplains. Throughout the removal action implementation, erosion and sediment controls would be regularly inspected and maintained until excavation and backfilling are demonstrated complete. Slope stabilization and erosion control measures will depend on the location and extent of removal; however, potential measures may include backfilling and compacting selected areas with non-contaminated fill material derived from the Site to minimize the aesthetic impact of the removal, and applying biodegradable soil stabilization material (e.g., SoilTac) for dust/erosion control as appropriate. Following implementation of the stabilization and erosion control measures, periodic inspection and maintenance shall be conducted as needed to confirm effective slope stabilization and erosion control.

The extent of removal activities will be determined in the field using a combination of visual observations, readily available field screening instruments, and samples collected for laboratory analysis. Field screening instruments and visual observations will also be used to guide segregation of the excavated material, to the extent practicable, into stockpiles to limit the amount of uncontaminated material that is removed. Material stock piling and other support/staging areas will be on PG&E property within and adjacent to the Compressor Station, within the Refuge outside of active wash areas, or at the Soil Processing Yard or Construction Headquarters area identified in the Groundwater Construction/Remedial Action Work Plan. Specific locations for all staging areas and access routes to action areas will be provided in the RAWP.

The final waste profiles used to identify the appropriate permitted landfill facility for disposal shall be dependent on laboratory analysis of samples collected from the stockpiles. Subsequent to waste profiling, the stockpiled material shall either be transported offsite to permitted landfills or left onsite, as appropriate. Possible landfill sites include, but are not limited to, the US Ecology landfill in Beatty, Nevada and the Waste Management landfill in Kettleman City, California.

Following removal action, post-excavation samples shall be collected from the underlying material to characterize the existing soil conditions. After confirming that the RAGs have been met, the excavated areas would be backfilled and re-graded to the approximate original contours, ensuring appropriate site drainage and maintaining current exposure depth intervals.

The scope of work is anticipated to include the following tasks:

- Pre-work plan activities to support work planning and the development of the work plan. It is anticipated that the field tasks associated with this phase may include, but are not limited to:
    - Geotechnical evaluation of the strength of the existing slope and its capacity to safely support the weight of equipment used for removal (involves drilling/sampling/testing).
    - Performance of a topographic survey of slopes before and after the removal action.

    - Performance of a biological survey of the AOCs before and after the removal action.
    - Performance of a cultural resource survey of the AOCs prior to and after the removal action.
    - Coordination with Caltrans to obtain necessary permits, including but not limited to, a traffic control plan to conduct the removal action within the Caltrans Right-of-Way.
- Work plan development for removal action implementation and associated activities.
- Field implementation of the work plan – it is anticipated that the primary field tasks associated with the removal may include, but are not limited to:
    - Installation of control/monitoring measures such as air monitoring, dust suppression and access control
    - Implementation of SWPPP measures
    - Site preparation
    - Soil excavation
    - Confirmation sampling
    - Mechanical separation
    - Stockpile construction and management for fine and coarse soil
    - Sorting/stockpiling/physical and chemical profiling of excavated materials
    - Loading/transporting contaminated materials offsite
    - Coarse material reuse
    - Implementation of post-removal slope stabilization, backfill, erosion control, and access control (if needed)
    - Site restoration.
- A Removal Action Completion report, a cultural resource survey report and a biological survey report are required.

Activities authorized by this Action Memorandum require compliance with OSHA 1910.120 and include the development of Site-specific activities subject to DOI review and/or approval prior to implementation, including a transportation plan and a health and safety plan. DOI may review and/or approve additional plans pursuant to this Action Memorandum.

2. Contribution to remedial performance

This removal action is expected to be consistent with and contribute to any subsequent remedial action selected to respond to contaminated soils that are the subject of the ongoing RFI/RI.

3. Project Schedule

The removal action implementation shall be initiated once this Action Memorandum is approved. Field pre-work activities (e.g., surveys, site walks) and RAWP development will start immediately. It is estimated that total time needed to complete the removal action is approximately twelve months.

4. Estimated Cost

The estimated cost for the preferred alternative of excavation and ex-situ treatment with mechanical separation is $4,626,000. The cost estimate was developed based on the design assumptions presented in the alternative description provided in the EE/CA. The final costs of the selected remedy will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variables. Consistent with USEPA guidance, the cost estimates are order-of-magnitude estimates with an intended accuracy range of plus 50 percent to minus 30 percent. No operation and maintenance is anticipated with this alternative. The need for ongoing monitoring resulting from this action will be evaluated in the Feasibility Study for soil. This removal action will be financed by PG&E.

VI EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

In the event response action is delayed or not taken, hazardous substances will continue to be released, or there is a substantial threat of such release, into Bat Cave Wash, the HNWR and the Colorado River.

VII OUTSTANDING POLICY ISSUES

PG&E shall consider this non-time-critical removal action in revising the RFI/RI and development of the CMS/FS pursuant to the Administrative Consent Agreement entered with DOI and the Corrective Action Consent Agreement entered with DTSC. Updates to the existing HHERA will also be required.

Several federally recognized tribes have identified areas of traditional religious and cultural importance within the Area of Potential Effects (APE) previously established for the remedial investigation underway. The approximate boundaries of the RFI/RI study area are defined by the APE. The location of AOCs identified in this removal action are within the APE. Consultation with the tribes occurred during the extended Tribal comment period on the EE/CA and during meetings regarding resolutions to Tribal EE/CA comments. Additional consultation is anticipated during the RAWP development. The RAWP will be issued for formal Consultation by BLM.

The National Historic Preservation Act (NHPA) requires Federal agencies to consult with any interested Indian tribe or Native Hawaiian organization that attaches religious and cultural significance to historic properties that may be affected by a Federal or federally assisted undertaking. Participants in an undertaking may also develop customized, agency-wide, program-specific, or project-specific procedures as an alternative to regulatory procedures. 36 C.F.R. §§ 800.14(a) and 800.14(b). Compliance with an approved programmatic agreement satisfies the agency's consultation responsibilities until it expires or is terminated. 36 C.F.R. § 800.14(b)(2)(iii).

The parties pursued a programmatic agreement for the Site pursuant to 36 C.F.R. § 800.14(b). The parties completed the PA in 2010, and it was amended in 2017. BLM also developed a CHPMP in 2012. The CHPMP was intended to provide specific measures for how to treat historic properties within the APE during implementation of the Topock Remediation Project to

facilitate consistency and mitigate adverse effects, or adverse cumulative effects, important to the Tribes. (PA, Recitals, pg. 5, line 191; PA(I)(G)(3); ((PA(VII)(A); CHPMP 0.1 and 1.1). Both the PA and the CHPMP explicitly recognize that adverse effects to cultural and historic properties should be avoided, minimized, or mitigated to the extent practicable, "provided that the selected remedy protects human health and the environment, attain ARARs, and fully comply with all requirements of CERCLA and the NCP." (CHPMP 0.1,1.1. and 1.4.1). The PA and the CHPMP are both considered TBCs for the NTCRA. Consultation on the Removal Action Work Plan may identify additional measures necessary to protect cultural and historic properties.

VIII ENFORCEMENT

DOI has determined that PG&E is a responsible party pursuant to Section 107 of CERCLA, 42 U.S.C. § 9607. As defined by CERCLA, PG&E is the owner and operator of a facility from which hazardous substances have been released into the environment. In July 2005, PG&E and DOI entered into the Administrative Consent Agreement to implement response actions at the Site, including any removal actions determined to be necessary to protect public health or welfare or the environment. Pursuant to that Consent Agreement, DOI has requested, and PG&E has agreed, that PG&E shall perform and fund this removal action.

IX RECOMMENDATION

This decision document represents the selected removal action of excavation of contaminated soil and debris, ex-situ treatment with mechanical separation size separation, and disposal in an approved, permitted landfill for target action areas within SWMU 1, AOC 1, AOC 10, AOC 11, AOC 14, AOC 16, and AOC 27, at the PG&E Topock Compressor Station, developed in accordance with CERCLA as amended, and is not inconsistent with the NCP. This decision is based on the administrative record for the Site and the data and endangerment determination contained herein. DOI has determined that PG&E is capable of performing this removal action in a manner consistent with the NCP, contingent on PG&E's full compliance with the requirements of this Action Memorandum and the Administrative Consent Agreement. Conditions at the Site meet the criteria for undertaking the proposed time-critical removal action, as specified by 40 CFR § 300.415(b) of the NCP and your approval of the proposed removal action is recommended.

Management Approval/Disapproval

Department of the Interior – Office of Environmental Policy and Compliance

STEPHEN TRYON Digitally signed by STEPHEN TRYON Date: 2021.10.12 16:06:34 -04'00'

Approval _____ Date _____

Disapproval _____ Date _____

US Fish and Wildlife Service

JEFFREY HOWLAND Digitally signed by JEFFREY HOWLAND Date: 2021.05.18 17:33:05 -07'00'

Approval _____ Date _____

Disapproval _____ Date _____

ACRONYMS, ABBREVIATIONS, AND UNITS OF MEASURE

AOC	Area of Concern
ARARs	Applicable or Relevant and Appropriate Requirements
B(a)P Eq	Benzo(a)pyrene Equivalent
BLM	Bureau of Land Management
BOR	Bureau of Reclamation
Caltrans	California Department of Transportation
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CHHSL	California Human Health Screening Level
CHPMP	Cultural and Historic Properties Management Plan
Cr(T)	Total Chromium
Cr(VI)	Hexavalent Chromium
CSM	Conceptual Site Model
DOI	Department of Interior
DTSC	California Department of Toxic Substances Control
ECV	Ecological Comparison Value
HNWR	Havasu National Wildlife Refuge
IM	Interim Measure
mg/kg	milligrams/kilograms
ng/kg	nanograms/kilograms
NPL	National Priorities List
PAH	Poly Aromatic Hydrocarbons

PCBs	
PG&E	Pacific Gas and Electric
ppb	parts per billion
OSHA	Occupational Safety and Health Administration
RCRA	Resource Conservation and Recovery Act
RFI/RI	RCRA Facility Investigation/ Remedial Investigation
RSL	Regional Screening Level
TAL	Target Analyte List
TCL	Target Compound List
USFWS	United States Fish and Wildlife Service
USC	United States Code
µg/kg	Micrograms per kilogram

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Tables

Table 1. Identified Applicable or Relevant and Appropriate Requirements (ARARs)

Category	Item No.	Citation	Determination	Description and Applicability
Location-Specific	1	Federal Land Policy and Management Act (FLPMA) (43 USC § 1701, et seq.)	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. Figure 2-1 shows property managed by BLM.
	2	National Wildlife Refuge System Administration Act (16 USC § 668dd-ee, 50 CFR § 27)	Applicable	This Act governs the use and management of the Havasu National Wildlife Refuge portion of the Topock Site. It requires that the USFWS evaluate ongoing and proposed activities and uses to ensure that such activities are appropriate and compatible with the mission of the National Wildlife Refuge System, as well as the specific purposes for which the HNWR was established. Prior to the selection of a removal action by DOI/USFWS, that removal action must be found by the Refuge Manager to be both an appropriate use of the HNWR and compatible with the mission of the HNWR and the Refuge System as a whole. Any removal action proposed to be implemented on the HNWR that was not selected by DOI/USFWS would be subject to the formal appropriate use/compatibility determination process. Portions of the Site are located in the HNWR (Figure 2-1).
	3	Fish and Wildlife Conservation Act (16 USC §§ 2901-2911)	Relevant and Appropriate	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.
	4	Fish and Wildlife Coordination Act (16 USC § 661-667e)	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.
	5	National Historic Preservation Act (54 USC § 300101, et seq., 36 CFR Part 800)	Applicable	This statute and the implementing regulations require that a federal agency undertaking a removal action at or near historic properties must take into account the effects of such undertaking on the historic properties. The federal agency must determine, based on consultation, if an undertaking's effects would be adverse and seek ways that could avoid, mitigate, or minimize such adverse effects on a National Register 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. Measures to avoid or mitigate adverse effects of any selected removal action that are adopted by the agency through federal consultation must be implemented by the removal action to comply with the National Historic Preservation Act. Properties on and near the Site that are eligible for or listed on the National Register of Historic Places include Native American cultural resources and elements of the historic "built environment." In recognition of this, all removal activities will be conducted in ways that avoid, minimize, or mitigate adverse effects to cultural and historic properties within the Area of Potential Effects in accordance with the Programmatic Agreement (BLM, 2010, as amended 2016), the Cultural and Historic Properties Management Plan (BLM, 2012), the Cultural and Historic Properties Treatment Plan (AE, 2018), and in consultation with the Tribes.

Category	Item No.	Citation	Determination	Description and Applicability
	6	National Archaeological and Historical Preservation Act (16 USC § 469, et seq.)	Applicable	This statute requires the evaluation and preservation of historical and archaeological data that might otherwise be irreparably lost or destroyed through any alteration of terrain as a result of federal construction projects or a federally licensed activity.
	7	Archaeological Resources Protection Act (16 USC § 470aa-ii, et seq., 43 CFR Part 7)	Applicable	This statute provides for the protection of archeological resources located on public and tribal lands. The Act establishes criteria that must be met for the land manager's approval of any excavation or removal of archaeological resources if a proposed activity involves soil disturbances.
	8	Historic Sites Act (54 USC § 320101 et seq., 36 CFR Part 65)	Applicable	Pursuant to this Act, federal agencies must 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. There are no designated historic landmarks within the Site, although Public Law 106-45, 113 Stat. 224 (1999), provides for a cooperative program "for the preservation of the Route 66 corridor" through grants and other measures.
	9	Native American Graves Protection and Repatriation Act (25 USC § 3001 et seq., 43 CFR Part 10)	Applicable	This Act regulates the removal and trafficking of human remains and cultural items, including funerary and sacred objects. If removal activities result in the discovery of Native American human remains or related objects, these requirements must be met. Portions of the Site contain archaeological areas that may contain human remains.
	10	Religious Freedom Restoration Act (42 USC § 2000bb, et seq.)	Relevant and appropriate	Under 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 compelling 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 removal 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.
	11	American Indian Religious Freedom Act (42 USC § 1996, et seq.)	Relevant and appropriate	This Act requires that the United States protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise their traditional religions.
	12	Resource Conservation and Recovery Act (42 USC § 6901, et seq., 40 CFR § 264.18)	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.
	13	Floodplain Management and Wetlands Protection (40 CFR § 6.302(a) & (b))	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.

Category	Item No.	Citation	Determination	Description and Applicability
Action-Specific	14	Clean Water Act. Stormwater Management (33 U.S.C. § 1342, 40 CFR Part 122, 40 CFR Part 125)	Relevant and appropriate	These regulations define the necessary requirements with respect to the discharge of stormwater under the National Pollutant Discharge Elimination System (NPDES) program. These regulations will apply if proposed removal actions disturb more than 1 acre of soil and result in stormwater runoff that comes in contact with any removal activity, or if proposed removal actions involve specified industrial activities. NPDES requirements regulate discharges of pollutants from any point source into waters of the United States.
	15	Federal Water Pollution Control Act (Clean Water Act) (33 USC § 1344, 40 CFR § 230.10)	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. Minimization measures will be implemented to minimize impacts to wetland and non-wetland waters of the United States within the PAAs. All efforts will be taken to avoid jurisdictional resources to the extent practicable. Although the USACE did not provide a list of measures that may be taken to reduce impacts to jurisdictional waters and wetlands for the Topock groundwater remedy, the CDFW requires compliance with Avoidance and Minimization Measures (AMMs) in lieu of a Lake or Streambed Alteration Agreement pursuant to CERCLA Section 121(e) for all work conducted in CDFW jurisdictional washes (CDFW, 2013). Any soil removal action in CDFW jurisdictional washes will adhere to the same AMMs.
	16	Endangered Species Act (16 USC § 1531, et seq., 50 CFR Part 402)	Applicable	The Endangered Species Act and its implementing regulations makes it unlawful to remove or “take” threatened and endangered plants and animals and protects their habitats by prohibiting certain activities. Examples of endangered species in or around the Topock Site may include, but are not limited to, southwestern willow flycatcher, desert tortoise, Colorado pikeminnow, razorback sucker, and bonytail chub. Removal action selected for the 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 U.S. Fish and Wildlife Service under section 7 of the Endangered Species Act. Mitigation measures will be implemented in accordance with the Programmatic Biological Assessment (CH2M, 2007b) and the Bird Impact Avoidance and Minimization Plan (BIAMP) (CH2M, 2014d) to avoid project-related risks to endangered species that could result from removal actions.
	17	Migratory Bird Treaty Act (16 USC §§ 703-712)	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, part of which makes up 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 removal activities. The BIAMP specifies measures to avoid project-related risks to avian wildlife that could result from project activities. The BIAMP will be implemented during removal action.
	18	California Code of Regulations (CCR) Title 27, Environmental Protection	Applicable	Title 27 regulates discharges of wastewater to land, including but not limited to, evaporation ponds, percolation ponds, or subsurface leach fields. Any disposal of wastewater to the existing TCS evaporation ponds must meet the Waste Discharge Requirements (WDRs) Order No. R7-2018-0022. If it becomes necessary to amend the WDRs for the ponds to accept wastewater from the proposed removal action, a revised Report of Waste Discharge (ROWD) would be required.

Category	Item No.	Citation	Determination	Description and Applicability
	19	Hazardous Waste Control Law and Regulations (22 CCR Division 4.5, Chapters 11, 12, 14, 18)	Applicable	The California Hazardous Waste Control Law and Regulations establish requirements for hazardous waste generators; operators of hazardous waste treatment, storage, or disposal units; and for corrective action taken in response to releases of hazardous waste from regulated units. Hazardous waste generators must determine if their waste is hazardous, manage the waste in accordance to specified requirements for accumulation in tanks and containers, use a hazardous waste manifest for offsite transportation of hazardous waste, send hazardous waste to an appropriately permitted offsite treatment or disposal facility, and retain specified records. These requirements will apply to all hazardous waste generated by onsite remedial activities. Units constructed to treat hazardous waste as part of the remediation must comply with additional operational and closure requirements. The management of excavated or displaced materials will be in accordance with the Groundwater Remedy Soil Management Plan (CH2M, 2015b).
	20	Mohave Desert Air Quality Management District, Rule 403 – Fugitive Dust	Applicable	This rule sets the standards to minimize fugitive dust emissions from remedial actions. For example, • Must take “every reasonable precaution” to minimize dust emissions from soil disturbing activities (e.g., excavation, grading, land clearing). • Must take “every reasonable precaution” to keep their operations from depositing visible particulate matter on public roadways (clean equipment prior to travel on paved streets, remove any deposited material promptly. • If peak winds are less than 25 miles per hour (mph) and 15-minute average wind speed is less than 15 mph: – Must not conduct transport, handling, construction or storage activities that cause fugitive dust that remains visible beyond the property line, and – Must not cause PM concentrations in excess of 100 micrograms per cubic meter, measured as the difference between upwind and downwind samples collected on high volume samplers at the property line for a minimum of 5 hours.
	21	Requirement for Land Use Covenants (22 CCR § 67391.1)	Relevant and Appropriate	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 that are not suitable for unrestricted use of the land. This is an ARAR with respect to privately-owned land at the Topock Site. A Land Use Covenant and Agreement was made between PG&E and DTSC for PG&E property (APN 0650-161-08) at the Site. Removal action selected for the Site will be conducted in compliance with the Environmental Restrictions of the Covenant.
	22	Clean Air Act (42 USC §§ 7401, et seq.) National Ambient Air Quality Standards (40 CFR § 50)	Relevant and Appropriate	These ambient air quality standards define levels of air quality to protect the public health. National Ambient Air Quality Standards are not enforceable in and of themselves, but they may be used as guidance if removal activities create potential air quality impacts.

Category	Item No.	Citation	Determination	Description and Applicability
	23	Federal Noxious Weed Act of 1974 Public Law 93-629 (7 USC 2801, et seq.)	Applicable	Requires the use of integrated management systems to control or contain undesirable plant species. Applicable to on-Site response activities to control, eradicate, or prevent or retard the spread of such weeds.

Notes:

AMM = Avoidance and Minimization Measures
ARAR = applicable or relevant and appropriate requirements
BIAMP = Bird Impact Avoidance and Minimization Plan
BLM = U.S. Bureau of Land Management
CCR = California Code of Regulations
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
CFR = Code of Federal Regulations
COPC = constituent of potential concern
CrVI – hexavalent chromium
DOI = U.S. Department of the Interior
DTSC = California Department of Toxic Substance Control
ECV = ecological comparison values
ESL = environmental screening level
FLPMA = Federal Land Policy and Management Act
HERO = DTSC Human and Ecological Risk Office
HHRA = human health and risk assessment
HNWR = Havasu National Wildlife Refuge
mph = miles per hour
NCP = National Oil and Hazardous Substance Pollution Contingency Plan
NPDES = National Pollutant Discharge Elimination System
PAH = polycyclic aromatic hydrocarbons
PG&E = Pacific Gas and Electric Company
RBRG = risk-based remediation goals
RCRA = Resource Conservation and Recovery Act
ROWD = Report of Waste Discharge
TBC = to-be-considered
TCS = Topock Compressor Station
TEQ = toxicity equivalent
USC = U.S. Code
USEPA = U.S. Environmental Protection Agency
USFWS = U.S. Fish and Wildlife Service

Table 2. Other Advisories, Criteria, or Guidance To Be Considered (TBCs)

Category	Item No.	Citation	Description and Applicability
Chemical-Specific	1	Risk-Based Remediation Goals (RBRGs) for Risk Drivers in Soil at Topock Site [a]	Final Human Health and Ecological RBRGs were estimated for two significant contributors to soil risks at the Topock Site, namely total chromium, CrVI, copper, and dioxin/furan TEQ.
	2	Risk-Based Concentrations (RBCs) for Soil Management Purposes [a]	Final Human Health and Ecological RBCs were estimated for purposes of soil management at the Topock Site.
	3	Soil Ecological Comparison Values (ECVs) [b]	Soil ECVs were developed for Topock COPCs (metals and polycyclic aromatic hydrocarbons [PAHs]) using both lowest observed adverse effect levels or concentrations and no-adverse effect levels or concentrations based on target toxicity values (i.e., values below which no unacceptable risk is expected) for the protection of the ecological receptors at the PG&E Topock Site based on the representative receptors selected for the ecological risk assessment.
	4	Ambient or Background Soil Concentrations at Topock Site [c,d,e]	Ambient or background levels of inorganic chemicals in soils in/around the PG&E Topock Site were calculated to assist in remedial planning, risk assessment, as well as remedial and soil management decision making.
	5	DTSC HHRA Note Number 2, Dioxin-TEQ Soil Remediation Goals for Sites in California [f]	The DTSC Human and Ecological Risk Office (HERO) recommends the following remedial goal for soils contaminated by dioxins and dioxin like-compounds: • Dioxins/furans TEQ Humans – 50 ng/kg
	6	DTSC HHRA Note Number 3, DTSC-modified Screening Levels [g]	The DTSC HERO HHRA Note Number 3 presents recommended screening levels for constituents in soil, tap water, and ambient air.
	7	USEPA "Regional Screening Levels for Chemical Contaminants at Superfund Sites" [h]	Establishes comparison values for residential and commercial/industrial exposures to soil, air, and tap water for screening chemicals at Superfund sites.
	8	San Francisco Bay Regional Water Quality Control Board Environmental Screening Levels for residential direct exposure	Conservative screening levels for chemicals found at sites with contaminated soil and groundwater. These levels are intended to help expedite the identification and evaluation of potential environmental concerns at contaminated sites. ESLs address a range of media (soil, groundwater, soil gas, and indoor air) and a range of concerns (e.g., impacts to drinking water, vapor intrusion, and impacts to aquatic habitat).
	9	Occupational Safety and Health Act (29 U.S. Code (USC) § 651, et seq.; 29 CFR § 1910.1026)	Sets standards for workers engaged in activities associated with remedial actions under the National Contingency Plan, including occupational exposure to hexavalent chromium. Pursuant to the NCP preamble, Occupational Safety and Health Act standards are not ARARs but may be included as TBCs.
Location-Specific	10	U.S. Department of Interior, Bureau of Land Management, *Approved Resource Management Plan and Final Environmental Impact Statement*, May 2007	The Resource Management Plan provides further direction on how FLPMA requirements will be satisfied.
	11	Executive Order 8647 (6 CFR 593)	This Executive Order establishes the HNWR for the primary purpose of providing migratory bird habitat. Any response action selected must be appropriate and compatible with this purpose, as determined by the Refuge Manager.
	12	Appropriate Use Policy 603 FW 1	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.
	13	Compatibility Policy 603 FW 2	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.

Category	Item No.	Citation	Description and Applicability
	14	Lower Colorado River National Wildlife Refuges, Comprehensive Management Plan (1994-2014)	The Comprehensive Management Plan provides further direction on how compliance with the National Wildlife Refuge System Administration Act, as amended, shall be achieved.
	15	Programmatic Agreement and Amendment among the Bureau of Land Management, Arizona Historic Preservation Officer, California State Historic Preservation Officer, and the Advisory Council on Historic Preservation for the Topock Remediation Project in San Bernardino County, California and Mohave County, Arizona (BLM, 2010, 2017)	The Programmatic Agreement (PA) is a Topock-specific document that requires the Federal Agencies, in consultation with the Tribes, State Historic Preservation Offices of Arizona and California, Advisory Council on Historic Preservation, PG&E, and other interested parties to ensure that PG&E shall conduct all removal activities in ways that avoid, minimize, or mitigate adverse effects to cultural and historic properties within the Area of Potential Effects (APE) to the maximum extent practicable. In addition, the Federal Agencies will ensure that PG&E shall restore the areas affected by all removal activities to the conditions existing prior to the removal to the extent practicable. During a removal action, the Discovery Protocol (Stipulations IX(A)-(D)) and the Monitoring Protocol (Appendix C) of the PA shall be implemented. In addition, Tribal access to areas within the APE for religious, cultural, or spiritual purposes shall be implemented in accordance with the Tribal Access Plan for lands under federal management and with the Access Plan for the lands not under federal management.
	16	Cultural and Historic Properties Management Plan, PG&E Topock Compressor Station, Needles, California (BLM, 2012)	The CHPMP is a Topock-specific document prepared under the PA that specifies measures to avoid or mitigate adverse effects to cultural and historic properties within the APE. PG&E shall conduct all removal activities in compliance with these specified measures.
	17	Cultural and Historic Property Treatment Plan for the Topock Compressor Station Groundwater Remediation Project, San Bernardino County, California and Mojave County, Arizona (AE, 2018)	The Cultural and Historic Property Treatment Plan is a Topock-specific document prepared under the PA that identifies measures to avoid, minimize, or mitigate adverse effects to the maximum extent practicable on the Topock Maze, the Traditional Cultural Property, and individual sites that have been determined eligible for listing on the National Register of Historic Places (NRHP), such as the trail site (CA-SBR-29943). PG&E shall implement the Treatment Plan contemporaneously with all removal activities. All unevaluated sites are treated as eligible for the NRHP and shall be avoided to the maximum extent practicable. In accordance with the PA, should unanticipated adverse effects occur as a result of a removal action, the Treatment Plan shall be modified to include measures to minimize or mitigate the adverse effects.
	18	National Register Bulletin 38	Guidelines for evaluating and documenting traditional cultural properties.
	19	Preservation Brief 36	Guidelines for planning, treating, and managing historic landscapes.
	20	Executive Order 11593	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	Executive Order 13175	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.
	22	Executive Order 12898	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.”

Category	Item No.	Citation	Description and Applicability
	23	Executive Order 13352	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."
	24	Indian Sacred Sites (Executive Order 13007)	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."
	25	Executive Order 11988 – Floodplain Management	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.
	26	Executive Order 11990 – Responsibilities of Federal Agencies to Protect Wetlands	Executive Order 11990 requires that potential impacts to wetlands be considered, and as practical, destruction, loss, or degradation of wetlands be avoided.
Action-Specific	27	Executive Order 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds	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.
	28	Executive Order 13112 – Management of Invasive Species	Requires that each Federal agency whose action may affect the status of invasive species to take certain actions to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause.

Notes:

[a] Arcadis. 2019. Final Soil Human Health and Ecological Risk Assessment Report, Topock Compressor Station, Needles, California. October.

[b] Arcadis. 2018. Topock Compressor Station – Technical Memorandum 3: Ecological Comparison Values for Metals and Polycyclic Aromatic Hydrocarbons in Soil. May 28.

[c] CH2M. 2009c. Final Soil Background Investigation at Pacific Gas and Electric Company Topock Compressor Station, Needles, California.

[d] CH2M. 2017a. Ambient Study of Dioxins and Furans at PG&E Topock Compressor Station, Needles, California, October 13.

[e] CH2M. 2019. Determination of Thallium Ambient/ Background Concentration at PG&E Topock Compressor Station, Needles, California, August 13.

[f] DTSC. 2017. Human Health Risk Assessment (HHRA) Note Number 2: Soil Remedial Goals for Dioxins and Dioxin-like Compounds for Consideration at California Hazardous Waste Sites – (April 2017).

[g] DTSC. 2019. Human Health Risk Assessment (HHRA) Note Number 3: DTSC-modified Screening Levels (DTSC-SLs) – (April 2019). https://dtsc.ca.gov/human-health-risk-hero/

[h] USEPA. 2019. Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites. May. https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables