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April 19, 2007

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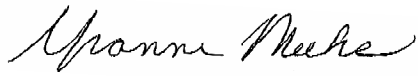
Subject: Topock Compressor Station – Revised Technical Memorandum on Ecological Conceptual Site Models, Assessment Endpoints, and Receptors of Concern

Dear Dr. Eichelberger and Ms. Marr:

Enclosed is a revised technical memorandum prepared as part of the RCRA Facility Investigation (RFI/RI) process to support the soil ecological risk assessment and soil investigation at the Pacific Gas and Electric (PG&E) Topock Compressor Station. The revised technical memorandum describes ecological assessment endpoints for the areas of concern (AOCs) and suggests representative receptors that may be potentially exposed to contaminants in soil and are therefore useful for ecological risk assessment. This information will also support the development of comparison levels for soil for use in making sampling decisions. This revised technical memorandum incorporates input received from you during our telephone conference call on March 29, 2007, as well as comments received from you via electronic mail on April 2nd and 3rd, 2007.

If you have any questions regarding this revised memorandum, please call me at (805) 546-5243.

Sincerely,

A handwritten signature in cursive script that reads "Yvonne Meeks".

Yvonne Meeks
Topock Project Manager

Enclosures:

Technical Memorandum: Topock Compressor Station – Ecological Conceptual Site
Models, Assessment Endpoints, and Receptors of Concern

cc: (via email)

Lynn Wellman, USFWS
Aaron Yue, DTSC
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MEMO

To:
Yvonne Meeks, PG&E

Copies:

From:
Bridgette DeShields, ABBL

Date:
April 19, 2007

ARCADIS BBL Project No.:
12647

Subject:
Topock Compressor Station – Ecological Conceptual Site Models, Assessment
Endpoints, and Receptors of Concern

The purpose of this technical memorandum is to describe ecological assessment endpoints for the areas of concern (AOCs) associated with the Pacific Gas and Electric (PG&E) Topock Compressor Station and to suggest wildlife receptors that may be potentially exposed to contaminants in soil. This information will support both the development of Comparison Levels for soil for use in making sampling decisions and the Ecological Risk Assessment for soil (PG&E, 2007).

Background

PG&E is conducting investigative and remedial activities at the Topock Compressor Station located in San Bernardino County, California, 15 miles southeast of Needles (Figure 1 from Programmatic Biological Assessment). This station began operations in December 1951, compressing natural gas supplied from the southwest United States for transport through pipelines to PG&E's service territory in central and northern California. This site is currently active and will continue operating into the foreseeable future.

Historically, chromium was added to cooling water, and from 1951 to 1964, untreated wastewater was discharged to Bat Cave Wash. In 1996, PG&E entered into a Corrective Action Consent Agreement with the California Department of Toxic Substances Control (DTSC) to govern the investigation and remediation of the site. In July 2005, a Consent Agreement was executed with U.S. Department of Interior

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agencies that outlined the process by which PG&E would comply with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements for remediation of the site.

There are seven AOCs and two undesignated areas outside the developed area of the compressor station (AOCs 1, 4, 9, 10, 11, 12, and 14, and undesignated areas Potential Pipeline Disposal area and the Former 300B Pipeline Liquids Tank area). These AOCs and undesignated areas are in the uplands which consists mainly of creosote bush scrub. AOC 1 is the largest and encompasses Bat Cave Wash. AOCs 4, 9, 10, 11, 12, 14, the Potential Pipeline Disposal area, and the Former 300B Pipeline Liquids Tank area complete the list of areas included in the soil investigation. Figure 6-1 from the RCRA Facility Investigation/Remedial Investigation (RFI/RI) Soil Investigation Work Plan (Work Plan) shows each AOC location on the site.

Ecological Setting

The soil investigation study area is located in the Mojave Desert west of the Colorado River. The Compressor Station borders the Havasu National Wildlife Refuge (HNWR) and Bureau of Reclamation lands. General information on the biotic communities in the Mojave can be found in Brown (1994). The study area, that includes the seven AOCs and two undesignated areas, is sparsely vegetated with widely-distributed creosote bushes. Other species that occur within this plant community include burrobush, allscale, split grass, spineflower, desert trumpet, beavertail cactus, golden cholla, and brittlebush (CH2M HILL, 2007).

Upland species lists were developed using the Programmatic Biological Assessment (PBA) (CH2MHill, 2007), California Natural Diversity Database (CNDDDB), and Havasu National Wildlife Refuge Species Lists (2001a, 2001b, and 2003). These lists are representative but not exhaustive and include animal (Table 1) and plant (Table 2) species present and potentially present at the upland areas of the site. Special status species that may occur at the site were identified using CNDDDB Endangered and Threatened Animals List and CNDDDB Endangered, Threatened, and Rare Plant Lists (2006a and 2006b). Conservation status is noted in Tables 1 and 2. For species potentially present, the list was reviewed to evaluate habitat availability and suitability based on habitat descriptions in the PBA, all of which is indicated in Tables 1 and 2.

The principal drainage toward the Colorado River from the study area is Bat Cave Wash (CH2MHill, 2007). Bat Cave Wash is mainly Mojave wash habitat, and is an ephemeral drainage that extends from the Chemehuevi Mountains toward the Colorado River north of the Topock Compressor Station. The wash may periodically flood during stormwater runoff events, but remains dry throughout most of the year due to arid desert conditions. The wash floor is relatively barren of vegetation and consists of sand, gravel, and cobblestone substrate. Although the drainage occurs within the creosote bush scrub plant community, several native tree species are associated with the wash including palo verde, acacia, mesquite, and smoke tree (CH2MHill, 2007).

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Down-slope of Bat Cave Wash is the Colorado River riparian corridor. The current boundary of AOC-1 is in creosote bush scrub and is more than a quarter of a mile upslope from a salt cedar community that offers riparian habitat (Figure 6-1 of the Work Plan; Figure 6 of the PBA). While the extent of chemically-affected soil is not expected to reach the riparian corridor based on the results of the RCRA Facility Investigation (RFI) (CH2M Hill, 2005), representative, but not exhaustive, riparian species lists are provided in Tables 3 and 4 to support the inclusive Scoping Assessment stage of the Ecological Risk Assessment.

The salt cedar (*Tamarix* sp.) community provides potential habitat for the southwestern willow flycatcher (SWFL) among other riparian species, although tamarisk is an exotic, invasive species that has displaced native riparian plants. The SWFL is a state- and federally-listed endangered species. Dense tamarisk thickets are considered suitable nesting, roosting, and foraging habitat for the SWFL. The tamarisk community near the confluence of Bat Cave Wash and the Colorado River may be used for roosting and foraging during migration, but human disturbance may decrease the habitat value for this species (Garcia and Associates [GANDA], 2005, as cited in CH2M Hill, 2007). There has been no positive identification of an SWFL during the 2005 and 2006 protocol surveys of the Area of Potential Effects (APE) (CH2M Hill, 2007), within which the AOCs and undesignated areas are located.

Conceptual Site Model

The conceptual site models (CSMs) serve as the basis for the ecological risk assessments that will be conducted. They are the framework for relating potential receptors to contaminated media and determining the degree of completion of exposure pathways. Two CSMs were developed, one for Bat Cave Wash (Figure 1) and one for the remaining AOCs (4, 9, 10, 11, 12, 14, and Former 300B Pipeline Liquids Tank area) (Figure 2). Because the only potential concern at the Potential Pipeline Disposal area is buried metal piping potentially covered with asbestos containing material, no ecological exposures are anticipated and no CSM was prepared for this area.

The CSM for Bat Cave Wash examines whether an exposure pathway to the riparian area along the Colorado River and the river itself may be complete. This potential pathway is the subject of a separate evaluation that will be conducted for groundwater and will be submitted under separate cover.

Sources of Chemical Contamination

The primary source of contamination for Bat Cave Wash is the discharge of untreated wastewater containing chromium and potentially other chemicals of potential concern to surface soil. The remaining AOCs and Pipeline Liquids Tank area have potential sources from the discharge of untreated wastewater, disposal of waste to surface soil, and leaking from the aboveground tank. Incidental releases inside the facility fence line may have been a source of dissolved or suspended chemicals to AOCs 4, 9, and 10, via

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intermittent stormwater runoff. Surface soil is the primary source medium for all seven AOCs and undesignated areas.

The constituents of potential concern (COPCs) for each AOC are based on the Final RFI/RI (CH2M Hill, 2006a) as summarized in the Draft RFI/RI Soil Investigation Work Plan Part A (CH2M Hill 2006b) and are presented in Table 5. Potential release of organic compounds will be first evaluated in the lower yard of the compressor station. It is assumed that organic compounds will not be detected, but if found they will be evaluated at other AOCs.

Transport Mechanisms

Percolation and/or infiltration serve as the primary transport route for chemicals in each CSM to reach media other than surface soil. If chemicals reach groundwater, the potential for discharge to surface water will be examined. Food chain transport is another possible release mechanism and results from ingestion of terrestrial biota tissue. Chemicals adhering to surface soil, the primary source medium, may be moved laterally via entrainment and surface runoff. However, potential chemical transport via surface soil runoff to the riparian area is unconfirmed and will be examined in the upcoming soil investigation at AOC-1.

Exposure Media

Surface soil (defined as 0-6 feet below ground surface)¹ is the primary medium of concern for all areas included in the CSMs. Potential groundwater discharge to surface water will be evaluated in a separate assessment. Wastewater and various other wastes contact surface soil and, via transport mechanisms, may affect terrestrial biota tissue and greater depths of soil.

The following potential pathways from exposure media to receptors will be examined: direct dermal contact, incidental ingestion of soil, and ingestion of terrestrial biota tissue. To assess the exposure pathways, organisms are divided into categories of plants, invertebrates, fish, reptiles, birds, and mammals. Potential exposure routes are evaluated for each category as: “potentially complete exposure pathway” (X), “potentially complete exposure route not evaluated” (O), or “incomplete pathway” (open box).

¹ Based on review of the soil data presented in the Final RFI/RI (CH2M Hill, 2006b), the maximum detected concentrations of COPCs are found in the upper six feet of soil at the AOCs, and elevated concentrations relative to background are also typically found in this depth interval. Therefore, this depth interval will be used for assessing exposure to ecological receptors including deeply rooted plants.

Selection of Assessment Endpoints

Ecological assessment endpoints are explicit expressions of environmental values that are to be protected and involve multiple species that are likely to be exposed to differing degrees and to respond differently to the same contaminant (United States Environmental Protection Agency [EPA], 1997). Assessment endpoints for ecological risk assessments should be selected based on the ecosystems, communities, and species potentially present at the site and depend on:

- contaminants present and their concentrations;
- mechanisms of toxicity of the chemicals to different groups of organisms;
- ecologically relevant receptor groups that are potentially sensitive or highly exposed to the chemicals; and
- potentially complete exposure pathways.

In accordance with the EPA (1997) guidance, the following assessment endpoints were developed to identify the ecological values at the project site.

- sufficient rates of survival, growth, and reproduction to sustain plant populations (e.g. creosote bush scrub);
- sufficient rates of survival, growth, and reproduction to sustain avian populations;
- sufficient rates of survival, growth, and reproduction to sustain mammalian populations; and
- sufficient rates of survival, growth, and reproduction to sustain invertebrate populations.

In addition to the above assessment endpoints, sufficient rates of survival, growth, and reproduction to sustain reptile populations was identified as an important environmental value. However, toxicity data for reptiles are insufficient to support quantitative evaluation of effects.

Measurement Endpoints

Measurement endpoints are measurable ecological characteristics that are related to the valued characteristic chosen as the assessment endpoint (EPA, 1997). The following table describes the measurement endpoints related to each assessment endpoint.

Assessment Endpoint	Corresponding Measurement Endpoint
Sufficient rates of survival, growth, and reproduction to sustain plant populations (e.g. creosote bush scrub).	Comparison of contaminant concentrations in soil with relevant plant toxicity data obtained from the literature.
Sufficient rates of survival, growth, and reproduction to sustain invertebrate populations.	Comparison of contaminant concentrations in soil with relevant invertebrate toxicity data obtained from the literature.
Sufficient rates of survival, growth, and reproduction to sustain avian populations.	Calculated hazard quotients (HQs) for selected indicator receptors. HQs will be based on estimated exposure doses compared with toxicity reference values.
Sufficient rates of survival, growth, and reproduction to sustain mammalian populations.	Calculated hazard quotients (HQs) for selected indicator receptors. HQs will be based on estimated exposure doses compared with toxicity reference values.

Selection of Indicator Receptors

A subset of indicator receptors was chosen from the list of species potentially present at the site. These receptors were chosen to represent a cross-section of feeding guilds for each assessment endpoint so that sufficient rates of survival, growth and reproduction for their representative populations could be evaluated. The following criteria were considered in selecting potential indicator species for the project area (EPA, 1997):

- species has been observed at the site;
- upper trophic level predator;
- important prey species;
- important to structure or function of the ecosystem;
- potential for exposure to contaminants;
- susceptible to bioaccumulation of contaminants;
- toxicological literature available;

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- likely to exhibit toxic effects; and
- species of special conservation concern or similar species.

The indicator receptors chosen are as follows:

- Granivorous bird: Gambel's quail (*Callipepla gambelii*)
- Insectivorous bird: cactus wren (*Campylorhynchus brunneicapillus*);
- Carnivorous bird: red-tailed hawk (*Buteo jamaicensis*);
- Insectivorous mammal: desert shrew (*Notiosorex crawfordi*);
- Carnivorous mammal: desert kit fox (*Vulpes macrotis*); and
- Granivorous mammal: Merriam's kangaroo rat (*Dipodomys merriami*).

Each of the selected indicator species was identified by the biological assessment as being potentially present in the project area. The receptors were selected to represent avian and mammalian populations that reside or forage in the upland creosote bush scrub and Bat Cave Wash near the compressor station.

In addition to the above indicator receptors, the coachwhip, a carnivorous reptile, was also considered for assessment. However, as EPA noted in the Eco-SSL Guidance (2003), toxicity data for amphibians and reptiles are insufficient to support establishing risk-based thresholds.

Selection of Granivorous Avian Receptor

Gambel's quail is a common resident of the Mojave Desert and occurs at Havasu National Wildlife Refuge. It is a granivorous bird that forages on the ground in open habitats. Succulent forbs and grasses are preferred when available, but forb, shrub, and grass seeds are the primary adult diet (CDFG, 2005). Escape cover provided by trees or shrubs is a habitat requirement. Gambel's quail are most commonly seen near water and Miller and Stebbins (1964; as cited in CDFG, 2005) did not observe a covey more than 1.5 miles from water.

Gambel's quail was selected to represent granivorous birds for the following reasons:

- It is an abundant, year round resident of HNWR, and suitable habitat is available in the study area;

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- It feeds on seeds that it gleans from the ground resulting in a relatively high incidental soil ingestion rate, a potential route of exposure to chemicals of potential ecological concern (COPECs).
- COPEC bioaccumulation data are available for plants;
- It is similar to the California quail, for which exposure parameters are readily available; and
- Toxicity reference values are available for birds.

Selection of Insectivorous Avian Receptor

The cactus wren is an insectivorous bird that forages on the ground and in low vegetation for insects, spiders, other small invertebrates, cactus fruits, other fruits, nectar, and seeds (Bent, 1948, and Anderson and Anderson, 1973 both cited in CDFG, 2005). Vegetation is used for cover, and nests are also used for roosting. Nesting is usually in cactus or other thorny shrub. The cactus wren territory averages 4.8 acres and the home range may be the same as the territory (CDFG, 2005).

There are other insectivorous birds associated with the site, but the cactus wren was selected for the following reasons.

- It is listed as uncommon but occurring year round in HNWR, and suitable habitat is available in the study area;
- It preys on insects which may accumulate COPECs;
- COPEC bioaccumulation data are available for invertebrates;
- It forages on the ground during which the intake of COPECs could occur through incidental soil ingestion;
- It is similar to the marsh wren, for which exposure parameters are readily available;
- Toxicity reference values are available for small birds; and
- It is a suitable indicator receptor for potential effects on the insectivorous bird feeding guild including the southwestern willow flycatcher (SWFL).

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Selection of Carnivorous Bird Receptor

Red-tailed hawks are moderately large soaring birds that inhabit open or semi-open areas. They prey on ground-dwelling vertebrates such as hares, mice, small birds, amphibians, and reptiles. They may be exposed to COPECs through bioaccumulation in prey that forage on the ground and ingest soil incidentally through food. Red-tailed hawks lay one clutch per year with one to three eggs. Most red-tailed hawks attempt to breed at two years. They are territorial throughout the year and have a home range size that can vary from less than 1 to over 10 square kilometers (km²)(CDFG, 2005).

A number of birds are known to be at the site, but the red-tailed hawk was selected for the following reasons:

- It is listed as common and nesting by HNWR, and suitable habitat exists near the project site;
- It preys on ground mammals in which bioaccumulation of COPECs may occur; and
- A substantial amount of literature for exposure parameters and toxicity values for birds are available.

Selection of Insectivorous Mammalian Receptor

The desert shrew is insectivorous, foraging on the ground. There is little data on food preferences in the wild, but in the laboratory food consumed included worms, grasshoppers, cockroaches, and other invertebrates (Hoffmeister and Goodpaster, 1962, as cited in CDFG, 2005). The desert shrew will drink water when available, but otherwise obtains water from food. This species occupies a wide variety of habitats, including desert wash, desert scrub, desert riparian, mixed chaparral, and pinyon-juniper habitats. Home range data are limited for shrews and are not available for the desert shrew; however, the home range of the dusky shrew, a similar species, averages 0.1 acre (CDFG, 2005).

The desert shrew was selected for the following reasons:

- It is listed in HNWR surveys as being present in the area;
- It may be exposed to COPECs via incidental ingestion while foraging on the ground;
- Exposure parameters are available or can be estimated from the available data from species with similar feeding habits; and
- Toxicity values for small mammals can be used.

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Selection of Carnivorous Mammal Receptor

The desert kit fox is carnivorous, preying on black-tailed hare, desert cottontails, rodents, birds, and reptiles. They are residents of arid regions, and live in annual grasslands or grassy open stages of vegetation dominated by scattered brush, shrubs, and scrub. They are provided cover by the dens they dig in open, level areas of sandy soil. Home range size has been reported as approximately 9.8 km² and 12.3 km², for females and males, respectively (Zoellick, 1992). Pups are born February through April with an average of four per litter.

The desert kit fox was chosen as a receptor for the following reasons:

- It is a state-protected fur bearing mammal and is listed on HNWR mammalian surveys;
- It may be exposed to COPECs via the food chain;
- It plays an important role in providing cover for other species by its burrowing activity;
- It is similar to the red fox, for which exposure parameters are readily available; and
- Toxicity data are available for larger mammals (*i.e.*, dogs).

Selection of Granivorous Mammal Receptor

The kangaroo rat is granivorous but may also feed on leafy vegetation and arthropods seasonally. It is found in desert scrub and alkali desert scrub, sagebrush, Joshua tree, and pinyon-juniper habitats. They are solitary animals and receive cover by burrows they dig in sandy soil. Kangaroo rats may breed several times per year but once is normal. They normally have a litter size of four young. Home range size has been reported of 13-19 per hectare in creosote scrub populations (CDFG, 2005).

The kangaroo rat was chosen as a receptor for the following reasons:

- It is listed by HNWR as being present in the area;
- It forages on the ground where intake of COPECs in the soil may occur;
- It is an important prey species for desert consumers;
- Its burrows provide important cover for other animals; and

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- Exposure parameters and toxicity information for small mammals are available.

Closing

The assessment and measurement endpoints discussed above will be used to evaluate potential ecological effects associated with exposure to site-specific contaminants. A complete species list for this project site was developed and five indicator receptors were selected. These receptors will be used in calculating risks associated with exposure to COPECs in soil. Using these indicator receptors, applicable exposure parameters and toxicity reference values, protective preliminary site-specific soil comparison levels will be calculated. The soil comparison levels, along with other criteria described in the soil investigation work plan, will be used to evaluate the need for further soil investigation following the completion of the first round of sampling.

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TABLE 1
REPRESENTATIVE UPLAND ANIMAL SPECIES
 PACIFIC GAS AND ELECTRIC TOPOCK COMPRESSOR STATION
 NEEDLES, CALIFORNIA

Common Name	Scientific Name	Conservation Status	Habitat	Feeding Guild	Confirmed Present	Potentially Present	Comments
Birds							
Bald eagle	<i>Haliaeetus leucocephalus</i>	State Endangered	Large trees and/or cliffs	Raptor	No	No	
Brewer's blackbird	<i>Euphagus cyanocephalus</i>	No status	Open trees and shrubs	Insectivore; Herbivore	Yes	Yes	
Cactus wren	<i>Campylorhynchus brunneicapillus</i>	No status	Desert succulent shrub, desert wash, and Joshua tree habitats.	Invertivore, frugivore	Yes	Yes	Included in Havasu species list; uncommon.
California condor	<i>Gymnogyps californianus</i>	State and Federally Endangered	High desert canyon lands and plateaus. Caves, ledges, or large trees necessary for nesting. High perches necessary for roosting	Carnivore; carrion	No	No	No suitable habitat. Site is not within reintroduction areas.
Canyon wren	<i>Catherpes mexicanus</i>	No status	Canyons and cliffs	Insectivore	Yes	Yes	
Common raven	<i>Corvus corax</i>	No status	Open terrain with cliffs	Omnivore	Yes	Yes	
Gambel's quail	<i>Callipepla gambelii</i>	No status	Desert Habitats	Herbivore	Yes	Yes	Common and nesting in Havasu
Greater roadrunner	<i>Geococcyx californianus</i>	No status	Trees and arid open land	Carnivore	Yes	Yes	Common and nesting in Havasu
Mourning dove	<i>Zenaida macroura</i>	No status	Open woodland or desert	Herbivore	Yes	Yes	Common and nesting in Havasu
Red-tailed hawk	<i>Buteo jamaicensis</i>	No status	Adaptable	Carnivore	Yes	Yes	Common and nesting in Havasu
Rock dove	<i>Columba livia</i>	No status	Urban areas, adaptable	Omnivore	No	No	
Turkey vulture	<i>Cathartes aura</i>	No Status	Open with large tree and cliffs	Carnivore; carrion	Yes	Yes	
Reptiles							
California kingsnake	<i>Lampropeltis getulus californica</i>	No status	All habitats except mountain	Carnivore	Yes	Yes	Included in Havasu species list
Chuckwalla	<i>Sauromalus obesus</i>	No status	Rocky outcrops and rocky hillsides	Herbivore	Yes	Yes	Included in Havasu species list
Coachwhip	<i>Masticophis flagellum</i>	No status	Wide range of habitats: desert, prairie, scrubland, juniper-grassland, woodland, thornforest, farmland, creek valleys, and swamps; usually in dry open terrain	Carnivore	Yes	Yes	
Desert horned lizard	<i>Phrynosoma platyrhinos</i>	No status	All desert scrub types and grass/forb stages of pine/juniper woodlands.	Invertivore/herbivore	Yes	Yes	Included in Havasu species list
Desert iguana	<i>Dipsosaurus dorsalis</i>	No status	Creosote scrub, sandy creosote flats	Herbivore	Yes	Yes	
Desert tortoise	<i>Gopherus agassizii</i>	State and Federally Threatened	Mohave Desert scrub	Herbivore	No	No	No suitable habitat or foraging vegetation (PG&E, 2006)
Ground snake	<i>Sonora semiannulata</i>	No status	Hillsides or flats with or without rocks, usually where there is fine wind-blown sand.	Invertivore	Yes	Yes	Included in Havasu species list

TABLE 1
REPRESENTATIVE UPLAND ANIMAL SPECIES
PACIFIC GAS AND ELECTRIC TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

Common Name	Scientific Name	Conservation Status	Habitat	Feeding Guild	Confirmed Present	Potentially Present	Comments
Mohave rattlesnake	<i>Crotalus scutulatus</i>	No status	Desert, Grassland/herbaceous, Shrubland/chaparral, Woodland - Conifer, Woodland - Hardwood, Woodland - Mixed	Carnivore	No	No	
Pine-gopher snake	<i>Pituophis melanoleucus</i>	No status	All habitats - absent from densely forested areas	Carnivore	Yes	Yes	Pine-gopher snake included in Havasu species list
Side-blotched lizard	<i>Uta stansburiana</i>	No status	Desert scrub, desert wash, creosote	Invertivore	Yes	Yes	Included in Havasu species list
Sidewinder	<i>Crotalus cerastes</i>	No status	Wide variety of habitats most frequently desert washes and flats with scrub cover and windblown sand.	Carnivore	Yes	Yes	Included in Havasu species list
Speckled rattlesnake	<i>Crotalus mitchellii</i>	No status	Rocky areas and slopes in desert and chaparral habitats; occasionally in pine-juniper and woodland habitats.	Carnivore	Yes	Yes	Included in Havasu species list
Spotted leaf-nosed snake	<i>Phyllorhynchus decurtatus</i>	No status	Rocky and sandy flats and slopes to 3000 ft. Most abundant in areas of mixed sandy and rocky soil with some brush cover	Carnivore	Yes	Yes	Included in Havasu species list
Western blind snake	<i>Leptotyphlops humilis</i>	No status	Wide variety of habitats at low elevations.	Insectivore	Yes	Yes	Included in Havasu species list
Western diamondback rattlesnake	<i>Crotalus atrox</i>	No status	Flats and foothills, prefers brushy areas, riparian habitats.	Carnivore	Yes	Yes	
Western long-nosed snake	<i>Rhinocheilus lecontei lecontei</i>	No status	Grasslands, arid brushlands.	Carnivore	Yes	Yes	Included in Havasu species list
Western whiptail lizard	<i>Cnemidorphorus tigris</i>	No status	Valley foothills (hardwoods, mixed conifer, pine-juniper)	Invertivore	Yes	Yes	
Zebra-tailed lizard	<i>Callisaurus draconoides</i>	No status	Sandy and gravelly desert flats, creosote scrub	Invertivore	Yes	Yes	
Mammals							
American badger	<i>Taxidea taxus</i>	No status	Drier open stages of most shrub, forest, and herbacious habitat	carnivore	Yes	Yes	
Black-tailed hare	<i>Lepus californicus</i>	No status	Cropland/hedgerow, Desert, Grassland/herbaceous, Savanna	herbivore	Yes	Yes	
Bobcat	<i>Lynx rufus</i>	No status	Brushy stages of low/mid elevation conifer, oak, riparian, etc.	Carnivore	Yes	Yes	

TABLE 1
REPRESENTATIVE UPLAND ANIMAL SPECIES
PACIFIC GAS AND ELECTRIC TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

Common Name	Scientific Name	Conservation Status	Habitat	Feeding Guild	Confirmed Present	Potentially Present	Comments
California ground squirrel	<i>Spermophilus beecheyi</i>	No status	Found in a wide variety of habitats. Usually in open areas in many plant communities	herbivore	No	No	
California myotis	<i>Myotis californicus</i>	No status	Desert, chaparral, woodland, and forest from sea level up to ponderosa pine, mixed conifer, and jeffery pine.	Invertivore	Yes	Yes	Included in Havasu species list
Cave myotis	<i>Myotis velifer</i>	CSC; no federal status	Desert scrub, desert wash, desert succulent scrub, and desert riparian	Insectivore	Yes	Yes	Included in Havasu species list
Coyote	<i>Canis latrans</i>	No status	open brush, scrub, herbaceous habitats.	carnivore	Yes	Yes	
Deer mouse	<i>Peromyscus maniculatus</i>	No status	All habitats	herbivore/ invertivore	Yes	Yes	
Desert cottontail	<i>Sylvilagus audubonii</i>	No status	Grasslands, open forests, desert shrub.	herbivore/ granivore	Yes	Yes	
Desert kit fox	<i>Vulpes macrotis</i>	State status: protected furbearing mammal	Annual grasslands or grassy open stages of veg w/scattered brush.	carnivore	Yes	Yes	
Desert shrew	<i>Notiosorex crawfordi</i>	No status	Desert wash, desert scrub, desert riparian, mixed chaparral, and pinyon/juniper habitats.	Invertivore	No	Yes	
Desert woodrat	<i>Neotoma lepida</i>	No status	Joshua tree, pinyon-juniper, most desert habitats.	herbivore/ granivore	Yes	Yes	
Marriam kangaroo rat	<i>Dipodomys merriami</i>	No status	desert scrub and alkali desert shrub, sagebrush, Joshua tree, prefers sparse habitat.	granivore	Yes	Yes	
Nelson's bighorn sheep	<i>Ovis canadensis nelsoni</i>	BLM: Sensitive/ FS: Sensitive	Desert mt. ranges, alpine dwarf shrub, low sage, desert shrub, etc.	herbivore	Yes	Yes	
Pallid bat	<i>Antrozous pallidus</i>	CSC; no federal status	Common in open dry habitats with rocky areas for roosting.	Invertivore	Yes	Yes	Included in Havasu species list
Raccoon	<i>Procyon lotor</i>	No status	All habitats except alpine and desert w/out water.	Carnivore, Frugivore, Granivore, Invertivore, Piscivore	Yes	Yes	
Stripped skunk	<i>Mephitis mephitis</i>	No status	Earlier successional stages of conifer and dec. forest, intermed canopy.	Carnivore, Frugivore, Invertivore	Yes	Yes	
Whitetail antelope squirrel	<i>Ammospermophilus leucurus</i>	No status	Desert scrub	omnivore	Yes	Yes	
Yuma myotis	<i>Myotis yumanensis</i>	Federal species of concern	Wide variety of habitats, optimally open forest and woodlands with a source of water over which to feed.	Insectivore	Yes	Yes	Included in Havasu species list

TABLE 1
REPRESENTATIVE UPLAND ANIMAL SPECIES
 PACIFIC GAS AND ELECTRIC TOPOCK COMPRESSOR STATION
 NEEDLES, CALIFORNIA

Common Name	Scientific Name	Conservation Status	Habitat	Feeding Guild	Confirmed Present	Potentially Present	Comments
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Notes:

* Confirmed present based on information from Havasu National Wildlife Refuge

FS: Federal status

CSC - Department of Fish and Game California special concern species; possibly vulnerable to extinction (have declining populations).

TABLE 2
REPRESENTATIVE UPLAND PLANT SPECIES
 PACIFIC GAS AND ELECTRIC TOPOCK COMPRESSOR STATION
 NEEDLES, CALIFORNIA

Common Name	Scientific Name	Family	Conservation Status	Habitat	Confirmed Present	Potentially Present
Catclaw acacia	<i>Acacia greggii</i>	Fabaceae	No status	Wash	Yes	Yes
White burrobush	<i>Ambrosia dumosa</i>	Asteraceae	No status	Creosote Bush Scrub	No	No
Cushenbury milk-vetch	<i>Astragalus albens</i>	Fabaceae	Federally Endangered	Rocky areas, Elevation Range 3600 to 5400 feet	No	No
Lane mountain milk-vetch	<i>Astragalus jaegerianus</i>	Fabaceae	Federally Endangered	Shrub association	No	No
Cattle-spinach (also known as allscale)	<i>Atriplex polycarpa</i>	Chenopodiaceae	No status	Creosote Bush Scrub	Yes	Yes
Sweetbush	<i>Bebbia juncea aspera</i>	Asteraceae	No status	Creosote Bush Scrub	Yes	Yes
Foothills palo verde	<i>Cercidium microphylla</i>	Fabaceae	No status	Wash	Yes	Yes
Straw-bed pincushion	<i>Chaenactis carphoclinia</i>	Asteraceae	No status	Wash Annuals	Yes	Yes
Brittle spiny flower (also known as spineflower)	<i>Chorizanthe brevicornu</i>	Polygonaceae	No status	Creosote Bush Scrub	Yes	Yes
Soft-prairie clover (also known as dalea)	<i>Dalea mollissima</i>	Fabaceae	No status	Creosote Bush Scrub	No	No
Barnaby smokethorn	<i>Dalea spinosa</i>	Fabaceae	No status	Wash	No	No
White brittlebush	<i>Encelia farinosa</i>	Asteraceae	No status	Creosote Bush Scrub	Yes	Yes
Parish's daisy	<i>Erigeron parishii</i>	Asteraceae	Federally Threatened	Limestone substrate; rocky slopes	No	No

TABLE 2
REPRESENTATIVE UPLAND PLANT SPECIES
 PACIFIC GAS AND ELECTRIC TOPOCK COMPRESSOR STATION
 NEEDLES, CALIFORNIA

Common Name	Scientific Name	Family	Conservation Status	Habitat	Confirmed Present	Potentially Present
Skeleton weed	<i>Eriogonum deflexum</i>	Polygonaceae	No status	Wash Annuals	Yes	Yes
Trumpet buckwheat (also known as desert trumpet)	<i>Eriogonum inflatum</i>	Polygonaceae	No status	Creosote Bush Scrub	Yes	Yes
Cushenbury buckwheat	<i>Eriogonum ovalifolium var. Vineum</i>	Polygonaceae	Federally Endangered	Limestone areas, elevation range 4500 to 6300 feet	No	No
Barrel cactus	<i>Ferocactus cylindraceus</i>	Cactaceae	No status	Creosote Bush Scrub	Yes	Yes
White cheesebush	<i>Hymenoclea salsola</i>	Asteraceae	No status	Creosote Bush Scrub	Yes	Yes
Desert-lavender	<i>Hyptis emoryi</i>	Lamiaceae	No status	Wash	No	No
Small flower ratany	<i>Krameria erecta</i>	Kramerianaceae	No status	Creosote Bush Scrub	No	No
Bristley langloisia	<i>Langloisia setosissima</i>	Polemoniaceae	No status	Wash Annuals	No	No
Creosote bushes	<i>Larrea tridentata</i>	Zygophyllaceae	No status	Dry hills and well-drained areas	Yes	Yes
Pepper grass	<i>Lepidium densiflorum</i>	Brassicaceae	No status	Wash Annuals	Yes	Yes
Arizona lupine	<i>Lupinus arizonicus</i>	Fabaceae	No status	Wash Annuals	Yes	Yes
Beavertail cactus	<i>Opuntia basilaris</i>	Cactaceae	No status	Creosote Bush Scrub	Yes	Yes
Straw-top cholla (also known as golden cholla)	<i>Opuntia echinocarpa</i>	Cactaceae	vulnerable	Creosote Bush Scrub	Yes	Yes
Cushenbury oxytheca	<i>Oxytheca parishii Var. Goodmaniana</i>	Polygonaceae	Federally Endangered	Limestone talus, 1300-2000 m	No	No
Smoke tree	<i>Psoralea spinosa</i>	Fabaceae	Arizona state protected status: salvage assessed	Wash	Yes	Yes

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TABLE 2
REPRESENTATIVE UPLAND PLANT SPECIES
 PACIFIC GAS AND ELECTRIC TOPOCK COMPRESSOR STATION
 NEEDLES, CALIFORNIA

Common Name	Scientific Name	Family	Conservation Status	Habitat	Confirmed Present	Potentially Present
Notch-leafed phacelia	<i>Phacelia crenulata</i>	Hydrophyllaceae	No status	Wash	Yes	Yes
Honey mesquite	<i>Prosopis glandulosa</i>	Fabaceae	No status	Wash	Yes	Yes
Common Mediteranean grass (also known as split grass)	<i>Schismus barbatus</i>	Poaceae	No status	Wash Annuals	No	No
Brown-plume wire-lettuce	<i>Stephanomeria pauciflora</i>	Asteraceae	No status	Wash	Yes	Yes

TABLE 3
REPRESENTATIVE RIPARIAN ANIMAL SPECIES
 PACIFIC GAS AND ELECTRIC TOPOCK COMPRESSOR STATION
 NEEDLES, CALIFORNIA

Common Name	Scientific Name	Conservation Status	Habitat	Feeding Guild	Confirmed Present	Potentially Present	Comments
Birds							
American Coot	<i>Fulica americana</i>	No status	Dense Emergent Aquatic Vegetation	Omnivore	Yes	Yes	
Arizona Bell's vireo	<i>Vireo bellii arizonae</i>	State Endangered	Dense Vegetation	Insectivore	Yes	Yes	
Belted kingfisher	<i>Ceryle alcyon</i>	No status	Riparian or Aquatic	Carnivore	Yes	Yes	
Brown-crested flycatcher	<i>Yiarchus tryannulus</i>	LC; DFG-CSC	Riparian Thicket	Insectivore	Yes	Yes	Nests locally according to Havasu
California brown pelican	<i>Pelecanus occidentalis californicus</i>	State and Federally Endangered	Uncommon transient at many Arizona lakes and rivers.	Piscivore	No	Yes	
Crissal thrasher	<i>Toxostoma crissale</i>	LC, DFG-CSC, FWS-BCC	Dense Thickets	Omnivore	Yes	Yes	Common and nesting in Havasu
Gambel's quail	<i>Callipepla gambelii</i>	No status	Desert Habitats	Herbivore	Yes	Yes	Common and nesting in Havasu
Gila woodpecker	<i>Melanerpes uropygailis</i>	State Endangered	Riparian trees	Insectivore Herbivore	Yes	Yes	Common and nesting in Havasu
Great blue heron	<i>Ardea herodias</i>	LC, CDF sensitive	Requires trees for nesting	Carnivore	Yes	Yes	Common and nesting in Havasu
Great egret	<i>Casmerodius albus</i>	LC, CDF sensitive	Requires trees for nesting	Carnivore and Insectivore	Yes	Yes	Common and nesting in Havasu
Great-tailed grackle	<i>Quiscalus mexicanus</i>	No status	Open near Water	Omnivore	Yes	Yes	Common and nesting in Havasu
Least Bell's vireo	<i>Vireo bellii pusillus</i>	State and Federally Endangered	Dense Vegetation	Insectivore	Yes	Yes	
Lesser nighthawk	<i>Chordeiles acutipennis</i>	No status	Riparian and open low lands	Insectivore	Yes	Yes	Common and nesting in Havasu

TABLE 3
REPRESENTATIVE RIPARIAN ANIMAL SPECIES
PACIFIC GAS AND ELECTRIC TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

Common Name	Scientific Name	Conservation Status	Habitat	Feeding Guild	Confirmed Present	Potentially Present	Comments
Mallard	<i>Anas platyrhynchos</i>	No status	River, Riparian Vegetation	90% herbivore	Yes	Yes	Common and nesting in Havasu
				10% Insectivore			
Northern rough-winged swallow	<i>Stegidopteryx serripennis</i>	No status	Trees or cliffs	Insectivore	Yes	Yes	Common and nesting in Havasu
Pied-billed grebe	<i>Podilymbus podiceps</i>	No status	Open water and Vegetation	Omnivore	Yes	Yes	Common and nesting in Havasu
Song sparrow	<i>Melospiza melodia</i>	LC in Alameda and San Pablo counties	Riparian	Herbivore	Yes	Yes	Common and nesting in Havasu
				Carnivore			
Sonoran yellow warbler	<i>Dendroica petechia sonorana</i>	LC; DFG-CSC, FWS-BCC	Riparian woodlands, coastal/desert lowlands	Insectivore/ herbivore	No	No	
Southwestern willow flycatcher	<i>Epidonax tailli extimus</i>	Federally Endangered	Dense riparian vegetation	Insectivore	Yes	Yes	Listed as nesting locally in Havasu, but uncommon
Western yellow-billed cuckoo	<i>Coccyzus americanus occidentalis</i>	State Endangered	Densely foliated deciduous trees esp. willows; Large blocks of Riparian woodland	Insectivore	Yes	Yes	
Yellow-breasted chat	<i>Icteria Virens</i>	LC, DFG-CSC	Riparian thickets	Insectivore Herbivore	Yes	Yes	Listed as nesting locally in Havasu, and common
Yumma clapper rail	<i>Rallus longirostris yumanensis</i>	Federally and State Endangered	Fresh water and brackish marshes	Insectivore	Yes	Yes	Listed in Havasu as nesting locally, but uncommon

TABLE 3
REPRESENTATIVE RIPARIAN ANIMAL SPECIES
 PACIFIC GAS AND ELECTRIC TOPOCK COMPRESSOR STATION
 NEEDLES, CALIFORNIA

Common Name	Scientific Name	Conservation Status	Habitat	Feeding Guild	Confirmed Present	Potentially Present	Comments
Reptiles							
Pine-gopher snake	<i>Pituophis melanoleucus</i>	No status	All habitats - absent from densely forested areas	Carnivore	Yes	Yes	Included in Havasu species list
Western diamondback rattlesnake	<i>Crotalus atrox</i>	No status	Flats and foot hills, prefers brushy areas, riparian habitats.	Carnivore	Yes	Yes	Included in Havasu species list
Amphibians							
Arroyo toad	<i>Bufo microscaphus californicus</i>	Federally Endangered	Desert Riparian	Insectivore	No	No	
Fish							
Bonytail chub	<i>Gila elegans</i>	State and Federally Endangered	Warm, swift, turbid mainstem rivers of the Colorado River basin	Omnivore	No	Yes	
Razorback sucker	<i>Xyrauchen texanus</i>	State and Federally Endangered	Riverine and lacustrine areas. Generally not in fast moving waters and may use backwaters.	Benthic invertebrates	No	Yes	
Colorado pikeminnow	<i>Ptychocheilus lucius</i>	State and Federally Endangered	Colorado River	Carnivore	No	No	This species extirpated from the lower Colorado River basin.

TABLE 3
REPRESENTATIVE RIPARIAN ANIMAL SPECIES
 PACIFIC GAS AND ELECTRIC TOPOCK COMPRESSOR STATION
 NEEDLES, CALIFORNIA

Common Name	Scientific Name	Conservation Status	Habitat	Feeding Guild	Confirmed Present	Potentially Present	Comments
Mammals							
Beaver	<i>Castor canadensis</i>	No status	Riparian	Herbivore	Yes	Yes	
Bobcat	<i>Lynx rufus</i>	No status	Brushy stages of low/mid elevation conifer, oak, riparian, etc.	Carnivore	Yes	Yes	
Cave myotis	<i>Myotis velifer</i>	CSC; no federal status	Desert scrub, desert wash, desert succulent scrub, and desert riparian	Insectivore	Yes	Yes	Included in Havasu species list
Deer mouse	<i>Peromyscus maniculatus</i>	No status	All habitats	Herbivore/ invertivore	Yes	Yes	
Desert shrew	<i>Notiosorex crawfordi</i>	No status	Desert wash, desert scrub, desert riparian, mixed chaparral, and pinyon/juniper habitats	Invertivore	No	Yes	
Raccoon	<i>Procyon lotor</i>	No status	All habitats except alpine and desert w/out water.	Carnivore, Frugivore, Granivore, Invertivore, Piscivore	Yes	Yes	

TABLE 4
REPRESENTATIVE RIPARIAN PLANT SPECIES
 PACIFIC GAS AND ELECTRIC TOPOCK COMPRESSOR STATION
 NEEDLES, CALIFORNIA

Common Name	Scientific Name	Family	Conservation Status	Habitat	Confirmed Present	Potentially Present
Sedge	<i>Carex</i> sp.	Cyperaceae	No status	Wetland	Yes	Yes
Palo verde	<i>Cercidium</i> sp.	Fabaceae	No status	Desert riparian	Yes	Yes
Arrowweed	<i>Pluchea sericea</i>	Asteraceae	No status	Desert scrub, desert wash, desert riparian	Yes	Yes
Common reed	<i>Phragmites communis</i>	Poaceae	No status	Wetland	Yes	Yes
Mesquite	<i>Prosopis</i> sp.	Fabaceae	No status	Desert riparian, desert wash	Yes	Yes
Bulrush	<i>Scirpus</i> sp.	Cyperaceae	No status	Wetland	Yes	Yes
Tamarisk (also known as salt cedar)	<i>Tamarix</i> sp.	Tamaraceae	No status	Desert riparian, desert wash	Yes	Yes
Cattail	<i>Typha</i> sp.	Typhaceae	No status	Wetland	Yes	Yes

TABLE 5
CONSTITUENTS OF POTENTIAL CONCERN
 PACIFIC GAS AND ELECTRIC TOPOCK COMPRESSOR STATION
 NEEDLES, CALIFORNIA

Area of Concern	Constituents of Potential Concern ¹									
	Total Chromium	Hexavalent Chromium	Copper	Lead	Mercury	Molybdenum	Nickel	Zinc	Title 22 Metals	TPH
AOC 1 – Bat Cave Wash	X	X	X	X	X		X	X		
AOC 4	X	X							X	
AOC 9	X	X	X	X		X	X	X		
AOC 10	X	X	X	X		X	X	X		
AOC 11	X	X	X	X			X	X		
AOC 12									X	
AOC 14		X							X	
Former Liquids Tank										X

Notes:

1. Constituents of potential concern were discussed in the Draft RFI/RI Soil Investigation Work Plan Part A (CH2M Hill, 2006c). As discussed in Section 4.2.1 of the Draft RFI/RI Soil Investigation Work Plan Part A, soil samples collected at the lower yard will be analyzed for organic chemicals (i.e., TPH, VOCs, and PAHs) to evaluate the potential for organic chemical contamination outside the compressor station.

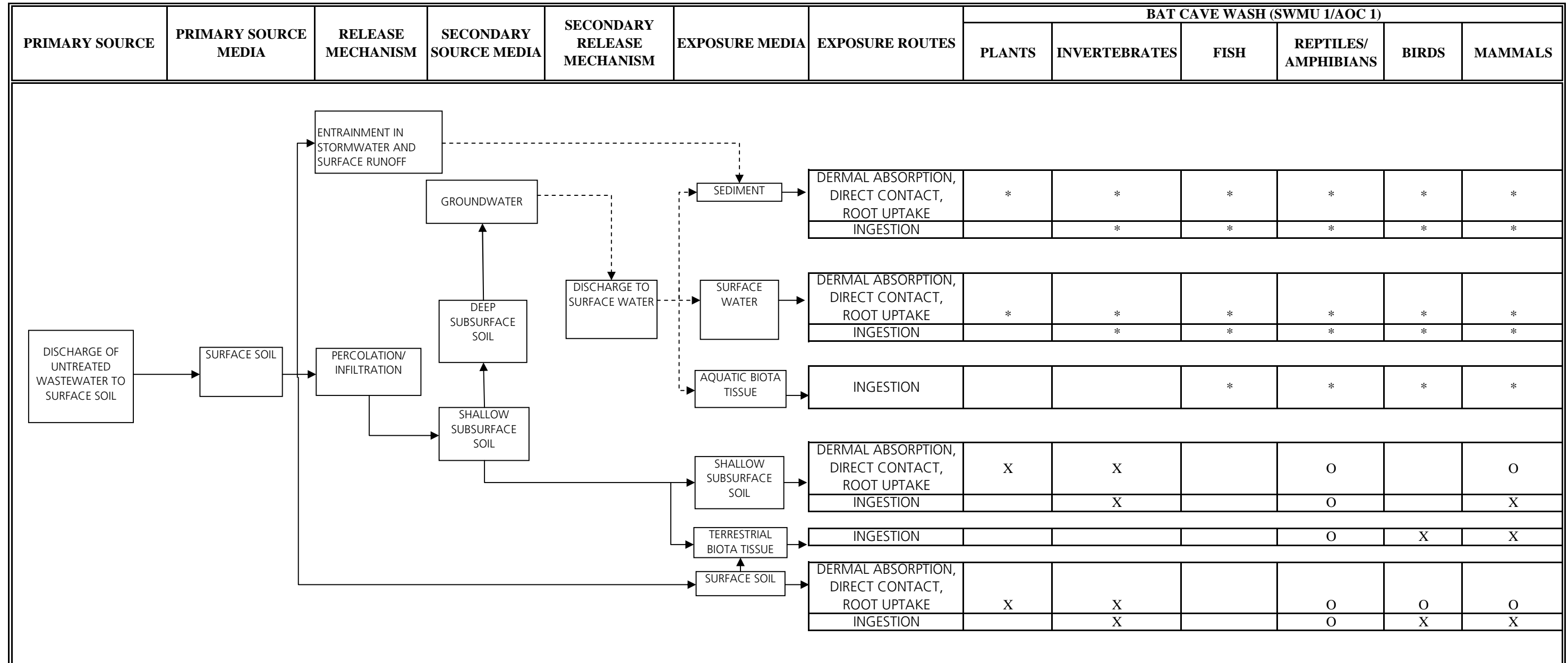
Acronyms:

TPH – total petroleum hydrocarbons

VOCs – volatile organic chemicals

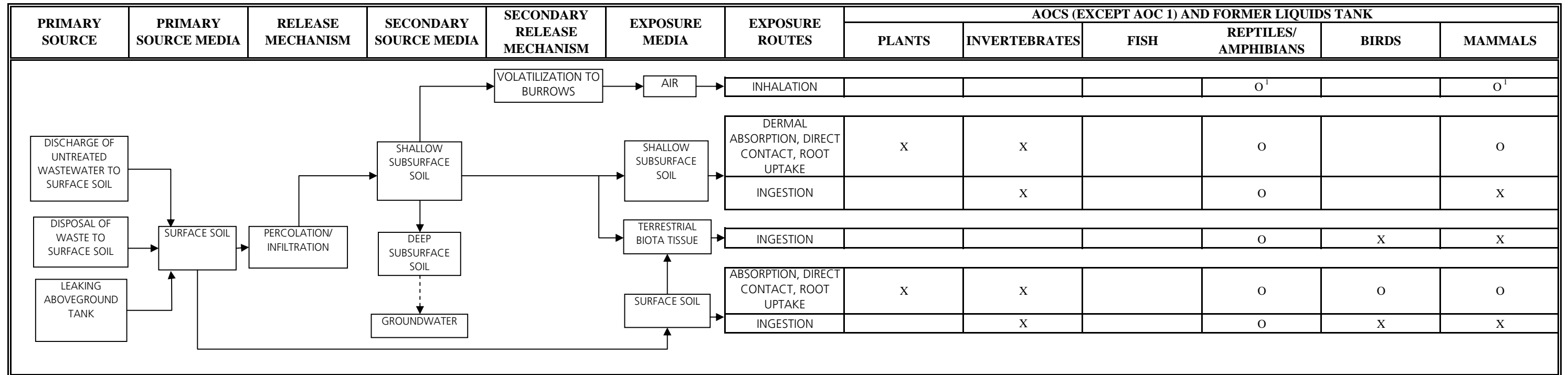
PAHs – polycyclic aromatic hydrocarbons

FIGURE 1
CONCEPTUAL SITE MODEL FOR BAT CAVE WASH
 PACIFIC GAS AND ELECTRIC TOPOCK COMPRESSOR STATION
 NEEDLES, CALIFORNIA



Notes:
 —————> Potentially complete exposure pathway
 - - - - -> Potential pathway under evaluation (separate assessment)
 * Exposure route under evaluation (separate assessment)
 X Potentially complete exposure route
 O Potentially complete exposure route not significant

FIGURE 2
CONCEPTUAL SITE MODEL FOR AREAS OF CONCERN 4, 9, 10, 11, 12, 14, AND FORMER LIQUIDS TANK
 PACIFIC GAS AND ELECTRIC TOPOCK COMPRESSOR STATION
 NEEDLES, CALIFORNIA



NOTES:

- ▶ Potentially complete exposure pathway
- ▶ Potential pathway under evaluation (separate assessment)
- X Potentially complete exposure route
- O Potentially complete exposure route not significant

¹ Potential inhalation exposure in burrows was included for the Former Liquids Tank area only based on the potential presence of total petroleum hydrocarbons (TPH). If a closure report is not located and significant concentrations of TPH are detected, then this pathway will be reconsidered.