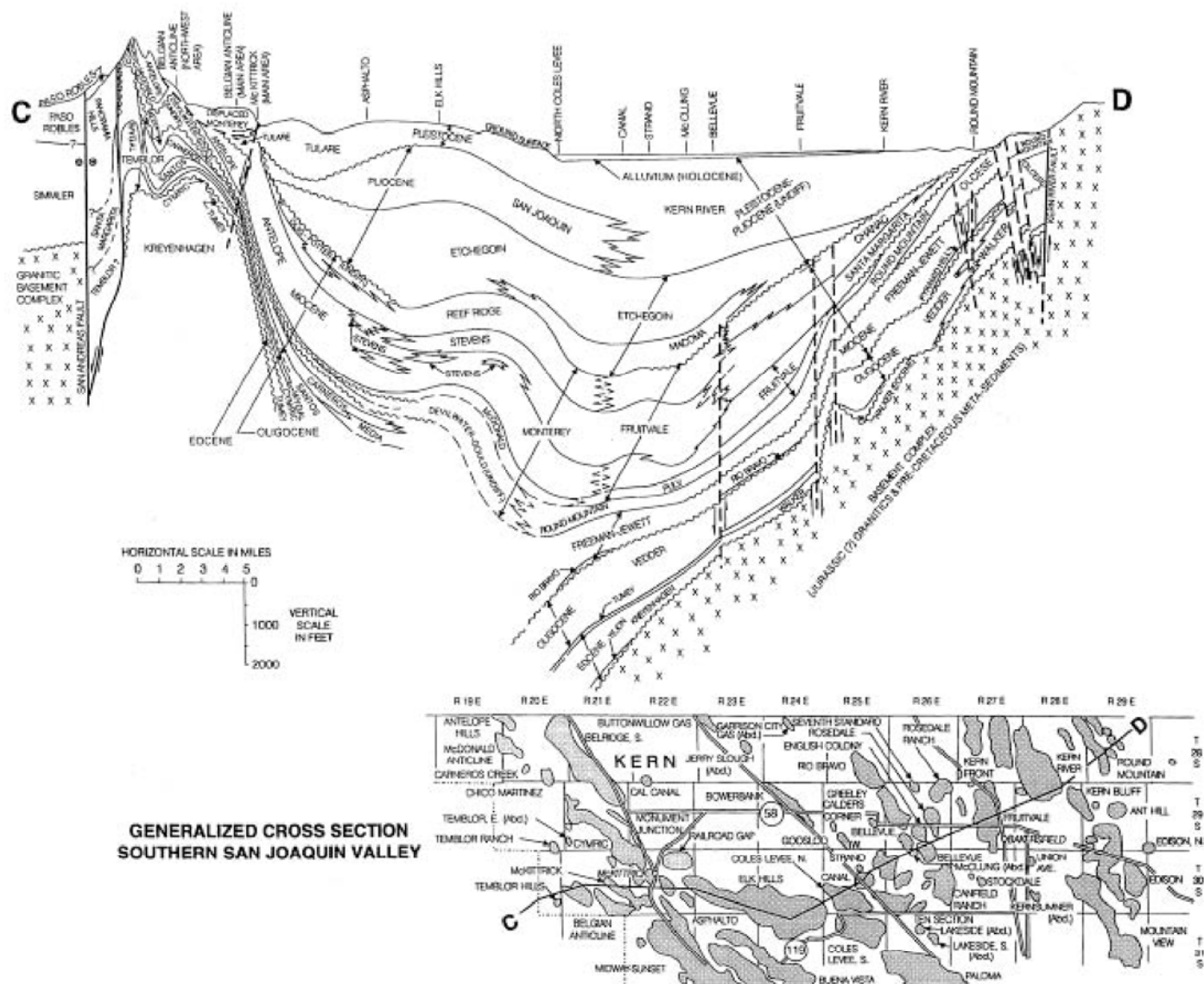


DOCKETED

Docket Number:	08-AFC-08A
Project Title:	Hydrogen Energy Center Application for Certification Amendment
TN #:	233603-6
Document Title:	Continuation of Amended AFC - Volume I and II - HECA 6
Description:	*** These documents supersedes TN 65049 which was just the cover letter due to the fact the Amended AFC was too large to docket at the time. *** - Document was on proceeding webpage and is now moved over to the docket log.
Filer:	Raquel Rodriguez
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	6/22/2020 12:59:32 PM
Docketed Date:	6/22/2020



(Source: DOGGR, 1998)

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Fig. 4.6-3

Generalized Cross Section of the Southern San Joaquin Valley, C-D

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4.6 GEOLOGY AND SOILS

4.6.2.5 Structural Geology

According to ManageTech (2010), “at the surface, the EHOFF presents as a large WNW-ESE trending anticlinal structure, approximately 17 miles long and over 7 miles wide. With increasing depth, the structure subdivides into three distinct anticlines, separated at depth by high angle reverse faults. The anticlines are believed to have formed in a transpressional regime associated with formation of the San Andreas Fault beginning in the Middle Miocene, which began approximately 16 million years ago (Callaway and Rennie, 1991). The anticlines labeled 29R, 31S and Northwest Stevens formed bathymetric highpoints on the deep inland marine surface (seafloor), affecting geometry and lithology of the contemporaneously deposited turbidite sands and muds generated as subaqueous debris flows.”

The 29R structure, oriented in a southeasterly direction, is tightly folded, asymmetrical and faulted. The 31S structure, oriented in an eastward direction, is cut by numerous normal faults, four of which reach the surface in the northeast portion of the structure (DOE, 1997). The other faults in the shallow out-bearing beds do not have topographic expression (Maher et al. 1975). According to DOE (1997), “Woodring et al. (1932) describe smaller ‘earthquake cracks’ along and parallel to the extreme north flank. Their trend is approximately perpendicular to the surface faults. Most noticeable among these cracks or small faults is the Tupman Fault, a fracture cutting post-Tulare fan deposits with strike-slip and vertical displacement in the northeast flank of the EHOFF.”

According to ManageTech (2010), “the shallow Pliocene and Pleistocene section (of the EHOFF) is cut by several shallow listric faults, some of which are sealing; however, these faults do not traverse through the Reef Ridge Shale and do not extend into the deeper Stevens Reservoirs (C&C Reservoirs, 2000).

Surface anticlines such as Elk Hills, Kettleman Hills, and Wheeler Ridge are major surface features rising from the valley floor. This deformation and uplift continues today, and is measured at places such as Buena Vista Hills (URS, 2008).

4.6.2.6 Hydrogeology

Groundwater is at least 50 feet below ground surface in the lower units of the Tulare Formation, which are saturated with both water and oil (DOE, 1997).

4.6.2.7 Seismicity

The State of California considers a fault segment historically active if it has generated earthquakes accompanied by surface rupture during historic time, i.e., approximately the last 200 years. A fault that shows evidence of movement within Holocene time (approximately the last 11,000 years) is defined as active. A fault segment is considered potentially active if there is evidence of displacement during Quaternary time or approximately the last 2 million years.

4.6 GEOLOGY AND SOILS

The U.S. Geological Survey's (USGS) earthquake database lists six recorded earthquakes of magnitude 5.0 or greater recorded since 1900 within about 50 kilometers of the EHO (USGS National Earthquake Information Center, 2010). The largest recorded earthquake in the region occurred in 1952 with an estimated Richter scale magnitude of 7.7 occurred along the San Andreas Fault near Frazier Park. There have been no earthquakes within the 50 kilometer radius of the EHO with a magnitude greater than 5.0 since 1954 (California Geological Survey, 2010).

The Elk Hills is considered to be located in a seismically active region, but no historically active faults have been identified by the State Geologist of the California Division of Mines and Geology (CDMG) for the Elk Hills area (DOE, 1997). Some minor faults have been observed in the EHO, but the most important active fault near the Elk Hills is the San Andreas Fault (located 12 miles west, beyond the Temblor Range). The San Andreas Fault is an important fault in the formation of the southern Coast Ranges and adjacent structures on the west side of the San Joaquin Valley (Maher et al., 1975). The other major fault near the EHO, besides the San Andreas Fault, is the White Wolf Fault (25 miles southeast from the EHO).

San Andreas Fault

The EHO is located approximately 12 miles east of the San Andreas Fault. The San Andreas Fault is part of a complex system of faults, isolated segments of the East Pacific Rise, and scraps of tectonic plates lying east of the East Pacific Rise that collectively separate the North American plate from the Pacific plate (Wallace 1990). Relative movement between the Pacific and the North American tectonic plates dominates the regional seismo-tectonic setting (active transform fault). The boundary between the Pacific and North American tectonic plates extends from the Rivera triple junction, south of Baja California, northwards to the Mendocino triple junction. Atwater (1970) and, more recently, Irwin (1990) describe the evolution of the Pacific-North American plate boundary. For much of the length of the plate boundary, and certainly for the Project Site region, the San Andreas Fault functions as a transform fault (tectonic plate boundary) with strike-slip displacement (Wilson 1965).

White Wolf Fault

The White Wolf Fault traverses the southeast end of the San Joaquin Valley from Wheeler Ridge to northeast of Caliente, a distance of approximately 34 miles. It is a high angle reverse fault with a left lateral component.

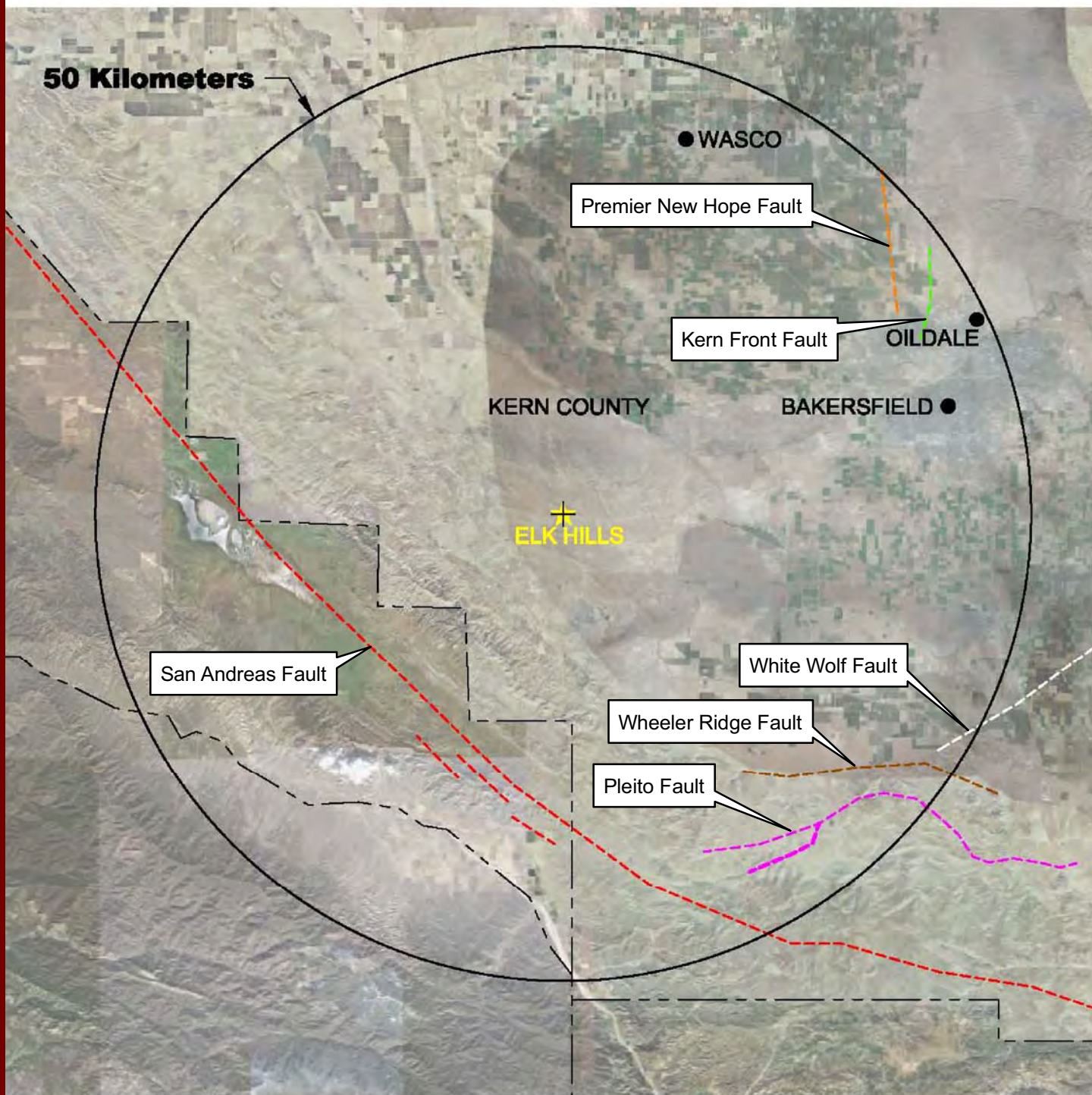
Kern County experienced a major earthquake on the White Wolf Fault in 1952 (magnitude ~7.3). This earthquake was the largest earthquake in "Southern California" since the Owens Valley earthquake of 1872. The earthquake occurred north of the intersection of the Garlock and San Andreas Faults. The area shaken by this earthquake was large; the main shock was felt over most of California and in parts of western Arizona and western Nevada. The main earthquake and associated aftershocks (at least 20 were of magnitude 5.0 or greater) were responsible for damaging hundreds of buildings in the Kern County area.

4.6 GEOLOGY AND SOILS

The 1952 Kern County earthquake came as a surprise to geologists and seismologists as the White Wolf Fault had not previously been considered a major threat. The White Wolf Fault is traceable for only about 34 miles, much less than the fault length typical thought necessary to produce such a major earthquake (compared to the nearly 250 mile San Andreas Fault, which broke in the magnitude 8 during the Fort Tejon earthquake of 1857).

Other Faults of Potential Interest

Four smaller faults of potential significance to the site are the Wheeler Ridge, Pleito, Premier New Hope, and the Kern Front Faults. The Wheeler Ridge and Pleito Faults are located southeast of the EHO and trend east-west. The Premier New Hope and the Kern Front Faults are located northeast of the EHO (north of Bakersfield) and trend north-south (Figure 4.6-4 Faults in the vicinity of EHO).



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Fig. 4.6-4

Faults in the Vicinity of EHO

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4.6 GEOLOGY AND SOILS

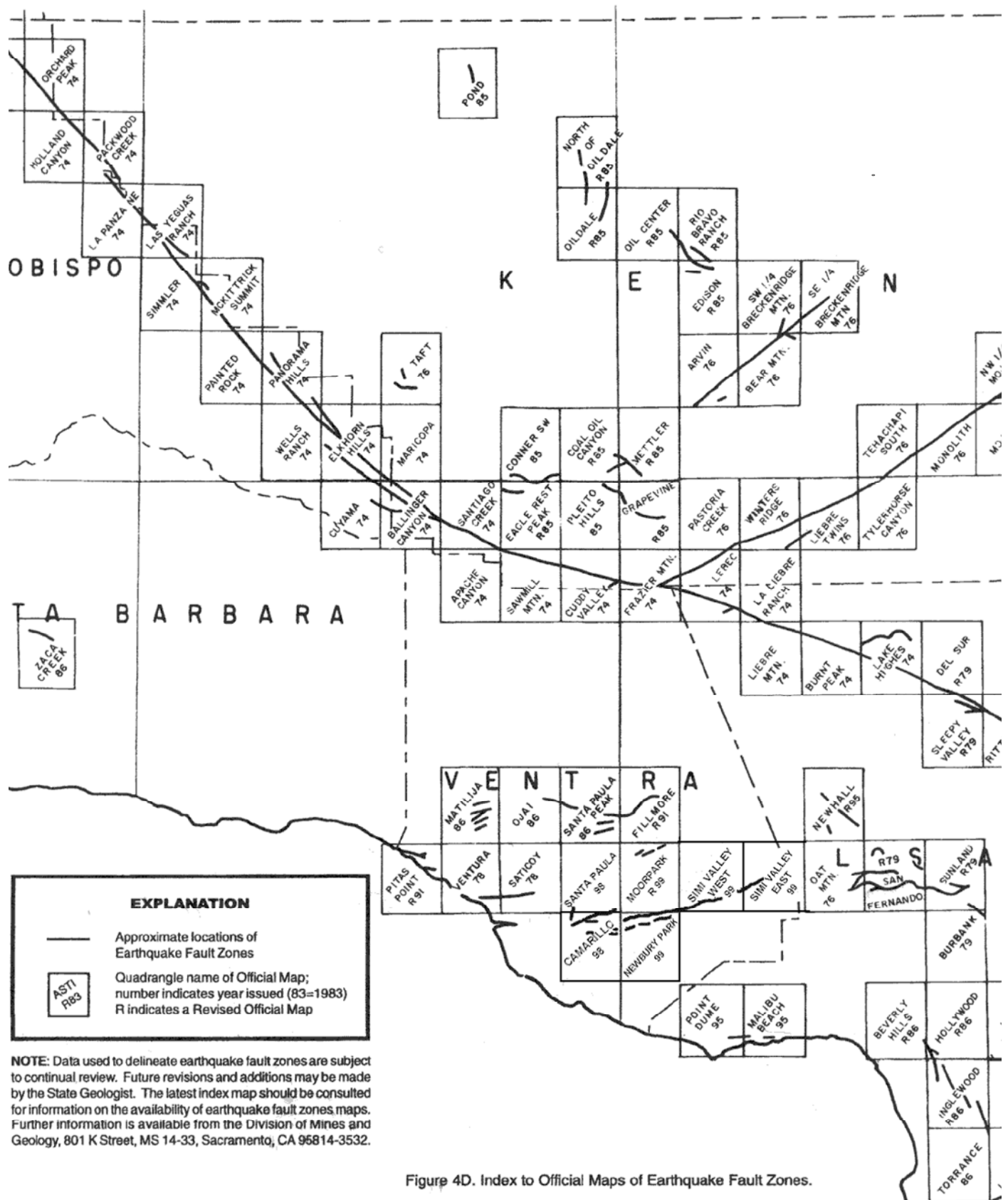
Seismic Hazards

There are several potential hazards associated with an area of seismic activity, including fault rupture, ground shaking, landslides, liquefaction, and tsunamis, as described briefly below. Because of the seismicity in the vicinity of the EHO, it should be expected that an earthquake could cause damage to improperly designed structures.

Fault Rupture

Ground surface displacement, or rupture, caused by an earthquake is a major consideration in the design of construction across active faults. An earthquake can cause significant surface displacement along its surface trace. For example, the 1992 Landers earthquake, located in the Mojave Desert, had offsets of up to 19 feet. It should be noted that, most earthquakes do not result in fault rupture.

The state has mapped known active faults that may cause surface fault rupture in inhabited areas as part of the Alquist-Priolo Earthquake Fault Zoning Act (Figure 4.6-5: Alquist Priolo Special Study Zone and Regional Fault Map). The Project Site is not located in the Alquist-Priolo Special Study zone.



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Alquest Priolo Special Study Zone and Regional Fault Map

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Fig. 4.6-5

4.6 GEOLOGY AND SOILS

Maximum Credible Earthquake (MCE)

The CDMG defines the MCE as the maximum earthquake that appears capable of occurring under the presently known geologic framework. In determining the MCE, little regard is given to probability of occurrence except that the likelihood of occurring is great enough to be of concern.

Identifying faults capable of generating earthquakes that may affect the Project Site is the initial step in developing MCE estimates. To accomplish this, faults that lie within 100 kilometers of the Project Site and considered to have been active in Late Quaternary time (the last 500,000 years) were evaluated based on reviews of publications pertaining to geology and tectonics (Jennings, 1975; Hart, 1988; Clark, 1973; Astiz and Allen, 1984; Buwalda, 1954; Ross, 1986; and Wesnousky, 1986). The 100-kilometer radius was selected based on guidelines developed by the CDMG (1975).

As discussed in the seismic history subsection above numerous significant faults and fault zones are located within a 100-kilometer radius of the Project Site. The San Andreas Fault is the nearest known late Quaternary fault, which is located approximately 12 miles west of the Project Site. The White Wolf Fault is the next nearest significant fault; located approximately 25 miles south east of the EHOF.

A preliminary analysis of other late Quaternary faults within 100-kilometers of the Project Site indicates that earthquakes occurring along them will not affect the Project Site to the extent on the previously identified faults. This is because of the smaller size of earthquakes anticipated on other faults in comparison with the faults previously discussed, the distance of other faults from the Project Site in comparison with the distance from previously identified faults, and observations that earthquake ground motions generally attenuate with distance from the causative fault. Therefore, further discussion of potential earthquake sources will be limited to the San Andreas and White Wolf Faults.

Published studies show that the San Andreas Fault is capable of generating earthquakes similar in magnitude (7.9) to the Fort Tejon Earthquake and the White Wolf Fault is considered capable of generating earthquakes up to a magnitude 7.7. The level of ground motions resulting from earthquakes may be estimated from widely accepted, published relationships that relate various ground motion parameters to earthquake magnitude and distance from the causative fault or earthquake epicenter. Estimated bedrock accelerations at the Project Site and their corresponding MCE's are presented in the Table 4.6-1.

4.6 GEOLOGY AND SOILS

TABLE 4.6-1: SUMMARY OF SIGNIFICANT SEISMIC SOURCES

Fault Name	Estimated Distance from Elk Hills Oil Field (miles)	Maximum Historical Earthquake (Magnitude [M_w]/Date)	Maximum Credible Earthquake (M_w)	Mean Ground Peak Acceleration (g)
San Andreas	12	7.9 / 1857	7.9*	0.24
White Wolf	25	7.3 / 1952	7.7	0.32

Maximum Historical Earthquake Sources:

United States Geological Survey (http://earthquake.usgs.gov/earthquakes/states/historical_state.php)

Southern California Earthquake Data Center (http://www.data.scec.org/chrono_index/quakedex.html)

M_w is the moment magnitude scale used to measure the size of an earthquake in terms of the energy released (<http://earthquake.usgs.gov/learn/faq/?faqID=23>).

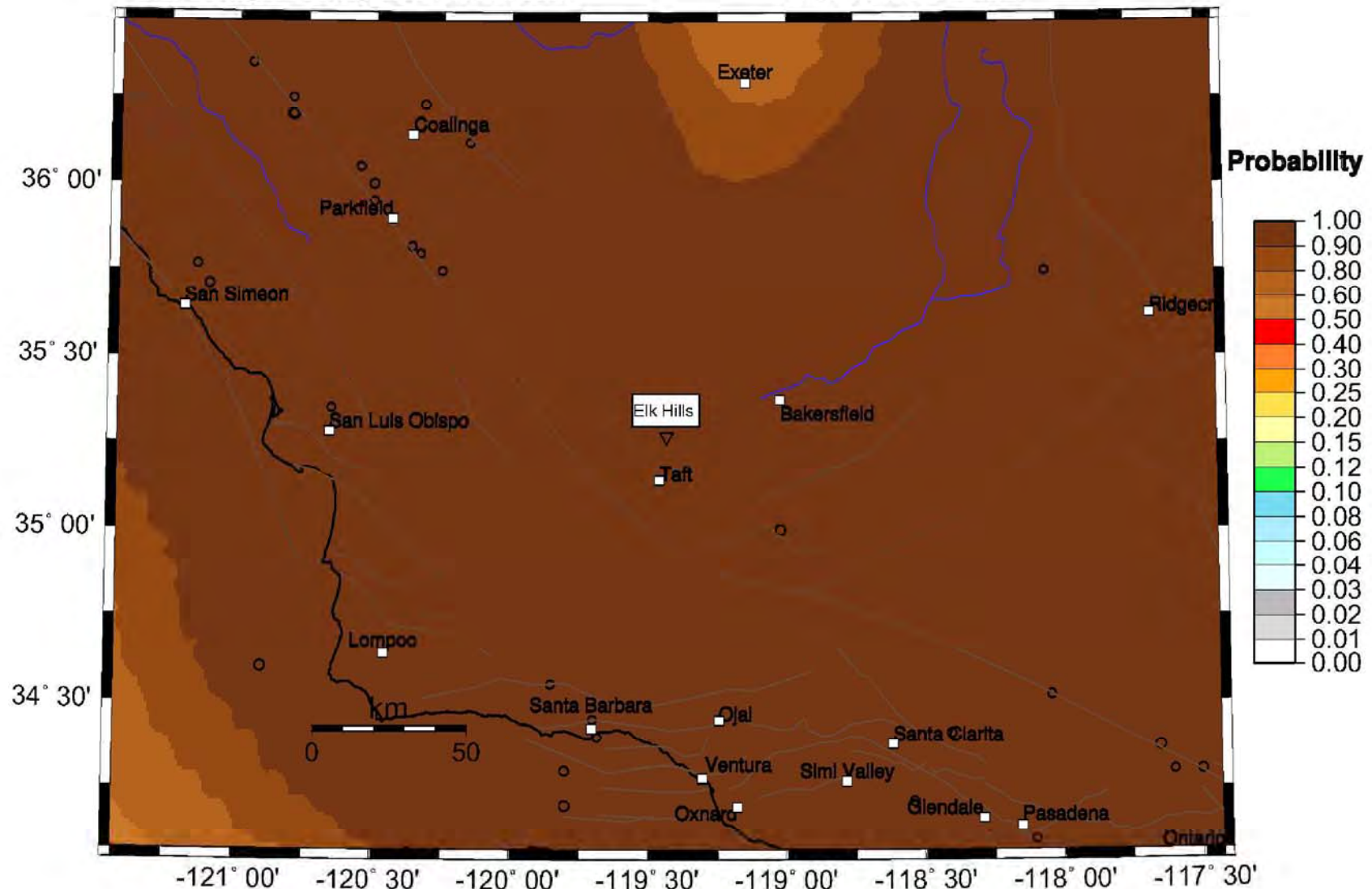
* Reported magnitude is a moment magnitude from Wesnousky (1986)

The anticipated accelerations are 0.24g for the San Andreas Fault and 0.32g for the White Wolf Fault. The MCE on the San Andreas Fault and White Wolf Faults would be 7.9 and 7.7, respectively (Figure 4.6-6: Probability of Earthquake with Magnitude > 5.0 within 150 Years & 50 Kilometers of the Elk Hills).

Earthquake probabilities from USGS OFR 08-1128 PSHA.

U.S. Geological Survey 2009 PSHA Model

Site: -119.43 d E 35.27



Elk Hills: triangle. Fault traces are tan; rivers blue. Epicenters $M \geq 6.0$ circles.

(Source: USGS Earthquake Probability Mapping <https://geohazards.usgs.gov/eqprob/2009/index.php>)

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Probability of Earthquake With Magnitude > 5.0 Within 150 Years & 50 Kilometers of the Elk Hills

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Fig. 4.6-6

4.6 GEOLOGY AND SOILS

Ground Shaking

Ground shaking is the earthquake effect that results in the most damage. Strong shaking from an earthquake can result in landslides and turbidity flows, ground lurching, structural damage, and liquefaction. Strong ground shaking can also set into motion other hazards such as fire, disruption of essential facilities and systems (water, sewer, gas, electricity, transportation, communications, irrigation, and drainage systems), releases of hazardous materials, or floods as a result of dam or water tank failure.

According to the 2007 California Building Code (CBC), the Project Site is located in seismic zone 4 - the region of highest expected ground shaking in the State. In compliance with County engineering requirements for new development, OEHI will be required to address impacts of hazards associated with strong ground shaking by utilizing the 2007 CBC which references the International Building Code Standards of 2006 and the American Society of Civil Engineers (ASCE) Standard 7.05 "Minimum Design Loads for Buildings and other Structures."

Slope Stability

The Project Site has several areas of moderate to relatively steep slopes. By disturbing the land and removing vegetation, construction activities can destabilize soils and slopes and increase the potential for landslides. In addition, roads can concentrate water in the adjacent land, thereby decreasing the stability of soils in these areas.

A landslide is the slipping down or flowing of a mass of land (rock, soil, and debris) from a mountain or hill. Landslide potential is highest in steeply sloped areas with alluvial soils but can also happen on gentle slopes. As would be expected, the potential for landslides is greatest in areas underlain by or adjacent to previous landslides. Landslides could result in danger to Project personnel and Project facilities.

The Project Site is not located within a State of California Seismic Hazard Zone for landslides, which would require an evaluation of the potential for seismically induced landslides. The dense, relatively hard soils in the portion of the Project Site where operating equipment and pipelines will be placed generally supports a very low potential for land sliding or other forms of natural slope instability.

4.6 GEOLOGY AND SOILS

Groundwater and Liquefaction

Liquefaction is the transformation of surface materials from a solid to near-liquid state when moderate to severe ground shaking causes pore-water pressure to increase, particularly in materials with high porosity, such as sand and silty sand. Liquefaction takes place during some earthquakes when clay free soil deposits behave as viscous fluids. Poorly consolidated, water-saturated fine sands and silts located within 50 feet of the surface are typically considered the most susceptible to liquefaction. Soils and sediments that are not water-saturated and that consist of coarser or finer materials are generally less susceptible to liquefaction (CMDG, 1997). Liquefaction is not a significant concern within the Project Site as granitic bedrock, boulders, cobbles, gravels and coarse sands make up the majority of the underlying deposits at groundwater depths. Liquefaction is also not considered problematic where the depth to groundwater is greater than 50 feet. The groundwater depth in the vicinity of the Project Site exceeds 50 feet. The geology, soil types, and the average groundwater level present in the Project Site indicate that the potential for liquefaction is very low. Further phases of geotechnical analysis and evaluation as discussed below under "Impacts and Mitigation Measures" would further reduce damage from liquefaction hazards.

Two potential ground failure types associated with liquefaction are lateral spreading and differential settlement. Lateral spreading involves a layer of ground at the surface being carried on an underlying layer of liquefied material over a nearly level surface toward a river channel or other open face. Lateral spreading is not a significant concern within the Project Site.

Another common hazard is differential settlement, as soil compacts and consolidates to varying degrees after ground shaking ceases. Differential settlement occurs when layers that liquefy are not of uniform thickness, a common problem when the liquefaction occurs in artificial fills.

Tsunami / Seiche

A tsunami can be caused by an offshore earthquake, volcanic activity, or landslide. Tsunamis can inundate low-lying areas and cause extensive erosion and the deposition of sediment. Seiches are wave oscillations that can form on enclosed bodies of water, such as a lake, that may be caused by an earthquake. The nearest enclosed body of water is Lake Webb within the Buena Vista Aquatic Recreational Area approximately 5 miles southeast of the Project Site. In addition, the Project Site is not located in a low-lying area and is also 90 miles from the edge of the Pacific Ocean. Therefore, the risks of a tsunami or seiche are minimal.

4.6.2.8 Soils Types and Characteristics

There are eleven soil complexes in the Project Site. A soil complex is a map unit made up of two or more kinds of soil in such an intricate pattern or in so small an area that it is not practical to map them separately. Soil survey information for the Project Site is divided between the northwest and southwest parts of the Soil Surveys of Kern County California. Soil Surveys prepared (for both parts in 1982 and 2009 respectively) by the U.S. Department of Agriculture's Soil Conservation Service

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(now the Natural Resources Conservation Service [NRCS]), indicate the presence of the following eleven surface soils on-site: Granoso, Cajon, Elkhills, Torriorthents, Excelsior, Kettleman, Kimberlina, Lokern, Guijarral, Riverwash, and Sodic Haplocambids. Seven of these eleven soils are established by the NRCS as an official soil series and include the following: the Cajon, Elkhills, Excelsior, Guijarral, Kettleman, Kimberlina, and Lokern Series. Cajon soils are extensive, found on recent alluvial fans, fan skirts, fan aprons, inset fans and river terraces throughout south-eastern California (the lower elevations commonly occur in the San Joaquin Valley), southern Nevada, and Arizona. Elkhills soils are of small extent, found mainly on uplifted fan terraces along the south-western edge of the San Joaquin Valley. Excelsior soils are of moderate extent, limited only to alluvial fans and bars or channels on flood plains of the San Joaquin Valley. Guijarral soils are not extensive, limited only to fan remnants on the western edge of the San Joaquin Valley. Kettleman soils are of large extent, found on hills and uplands of the Kettleman Hills, Kreyenhagen Hills, Anticline Ridge, Big Blue Hills, and Pyramid Hills in California. Kimberlina soils are of large extent, found mainly on flood plains and recent alluvial fans in the southern part of the San Joaquin Valley. The Lokern soils are moderately extensive, found mainly on basins in the southern part of the San Joaquin Valley. Figure 4.6-8, Project Soils, illustrates a general map from the Soil Survey of Kern County, California, Southwest Part, of the soil-types located at the Project Site (a general map from the Soil Survey of Kern County, California, Northwestern Part, was not available). A comprehensive discussion of the seven established on-site soils is provided below:

Cajon Loamy Sand, 0 to 2% Slopes; Cajon Sandy Loam 2 to 5% Slopes; Cajon Sandy Loam, Overblown, 0 to 2%. The Cajon series consists of very deep, somewhat excessively drained soils, which demonstrate very slow runoff, rapid permeability, and low shrink-swell potential. Cajon soils form in sandy alluvium from dominantly granitic rocks. Cajon soils are on alluvial fans, fan aprons, fan skirts, inset fans and river terraces. The Cajon Series have slopes of 0 to 15 percent. The hazard of water erosion is slight and the hazard of soil blowing is high. Surface soils are comprised of light gray, light yellowish brown, or pale brown loamy sand. Beneath the surface soils are light gray sand and light grayish brown sandy loam. This soil does not meet hydric criteria.

Elkhills Sandy Loam, 5 to 15%, 15 to 30%, 9 to 50%, and 30 to 60% Slopes; Elkhills Gravelly Sandy Loam, 9 to 15% and 15 to 50% Slopes; Elkhills-Bitterwater-Kettlmen Association, 9 to 15%; Elkhills-Torriorthents, Stratified, Complex, 9 to 15% Slopes; Elkhills-Torriorthents, Stratified, Eroded, Complex, 15 to 50%; and Elkhills-Haplocambids, Thick, Complex, 15 to 30%. The Elkhills series consists of deep, well drained soils, which demonstrate medium or rapid runoff, moderately rapid permeability, and low shrink-swell potential. Elkhills soils form in mixed stratified alluvium from sedimentary and granitic rocks on uplands. The Elkhills Series have slopes of 9 to 50 percent. This soil is susceptible to soil blowing and water erosion. Surface soils are comprised of very pale, pale brown and light yellowish brown sandy loam. Beneath the surface soils are light gray stratified gravelly coarse sand, sand, gravelly sandy loam, loamy sand, loam, and clay loam. Included in these units are small areas of

4.6 GEOLOGY AND SOILS

Torriorthents sand, Kimberlina gravelly sandy loam, Panoche clay loam, Bitterwater sandy loam, and Kettleman loam. This soil does not meet hydric criteria.

Excelsior Fine Sandy loam, Saline Sodic, 0 to 1% Slopes; Excelsior Sandy Loam, 0 to 2% Slopes; and Excelsior Variant Silt Loam, 0 to 2% Slopes. The Excelsior series consists of deep, well drained soils, which demonstrate negligible to medium runoff, moderate to slow permeability, and low shrink-swell potential. Excelsior soils form in mixed alluvium dominantly from igneous and calcareous sedimentary rocks on old alluvial fans and terraces. The Excelsior series have slopes of 0 to 2 percent. The hazard of water erosion is slight. Surface soils are comprised of light gray and light brownish gray and light gray gravelly sandy loam and gravelly loamy sand. Beneath the surface soils are light brownish gray loamy sand, and light gray sandy loam and silt loam. This soil does not meet hydric criteria.

Guijaral Sandy Loam, 0 to 2% and 2 to 9% Slopes; and Guijaral Gravelly Sandy Loam 2 to 5% Slopes. The Guijaral series consists of deep, well drained soils, which demonstrate very low or low runoff, moderately rapid permeability, and low shrink-swell potential. Guijaral soils form in alluvium derived dominantly from calcareous sedimentary rock on fan remnants. The Guijaral series have slopes of 2 to 15 percent. The hazard of water erosion is slight. Surface soils are comprised of grayish brown sandy loam and light brownish gray silt loam. Beneath the surface soils are light brownish gray loamy sand, and light gray sandy loam and silt loam. This soil does not meet hydric criteria.

Kettleman Loam, 9 to 15% and 15 to 50% Slopes; and Kettleman Gravelly Loam, 15 to 50% Slopes. The Kettleman series consists of moderately deep, well drained soils, which demonstrate medium to high runoff, moderate permeability, and low shrink-swell potential. Kettleman soils form in material weathered from sandstone and shale on hills and uplands. The Kettleman series have slopes of 5 to 50 percent. The hazard of water erosion is moderate to high. Surface soils are comprised of pale brown loam and light brownish gray gravelly loam. Beneath the surface soils are light yellowish brown loam and pale brown gravelly loam. This soil does not meet hydric criteria.

Kimberlina Sandy Loam, 2 to 5% and 5 to 9% Slopes; Kimberlina Sandy Gravelly Loam, 2 to 5% and 5 to 9% Slopes; Kimberlina Fine Sandy Loam, 0 to 2% and 2 to 5% Slopes; Kimberlina Fine Sandy Loam, Saline-Sodic, 0 to 2%; Kimberlina Gravelly Sandy Loam, 0 to 2% and 5 to 9% Slopes; Kimberlina-Granoso Complex, 0 to 5% Slopes, Occasionally Flooded; and Kimberlina-Urban Land Complex, 0 to 5% Slopes. The Kimberlina series consists of deep, well drained soils, which demonstrate negligible to medium runoff, moderately rapid to moderate permeability (saline-sodic phases and soils with sandy clay loam substratums have moderately slow permeability), and low shrink-swell potential. Kimberlina soils form in mixed alluvium derived dominantly from igneous and/or sedimentary rock sources. The Kimberlina Series have slopes of 0 to 9 percent. The hazard of water erosion is negligible to slight. Surface soils are comprised of pale brown and brown fine sandy loam, sandy loam, sandy clay loam, and light gray gravelly sandy loam. Beneath the surface soils are pale brown fine sandy loam,

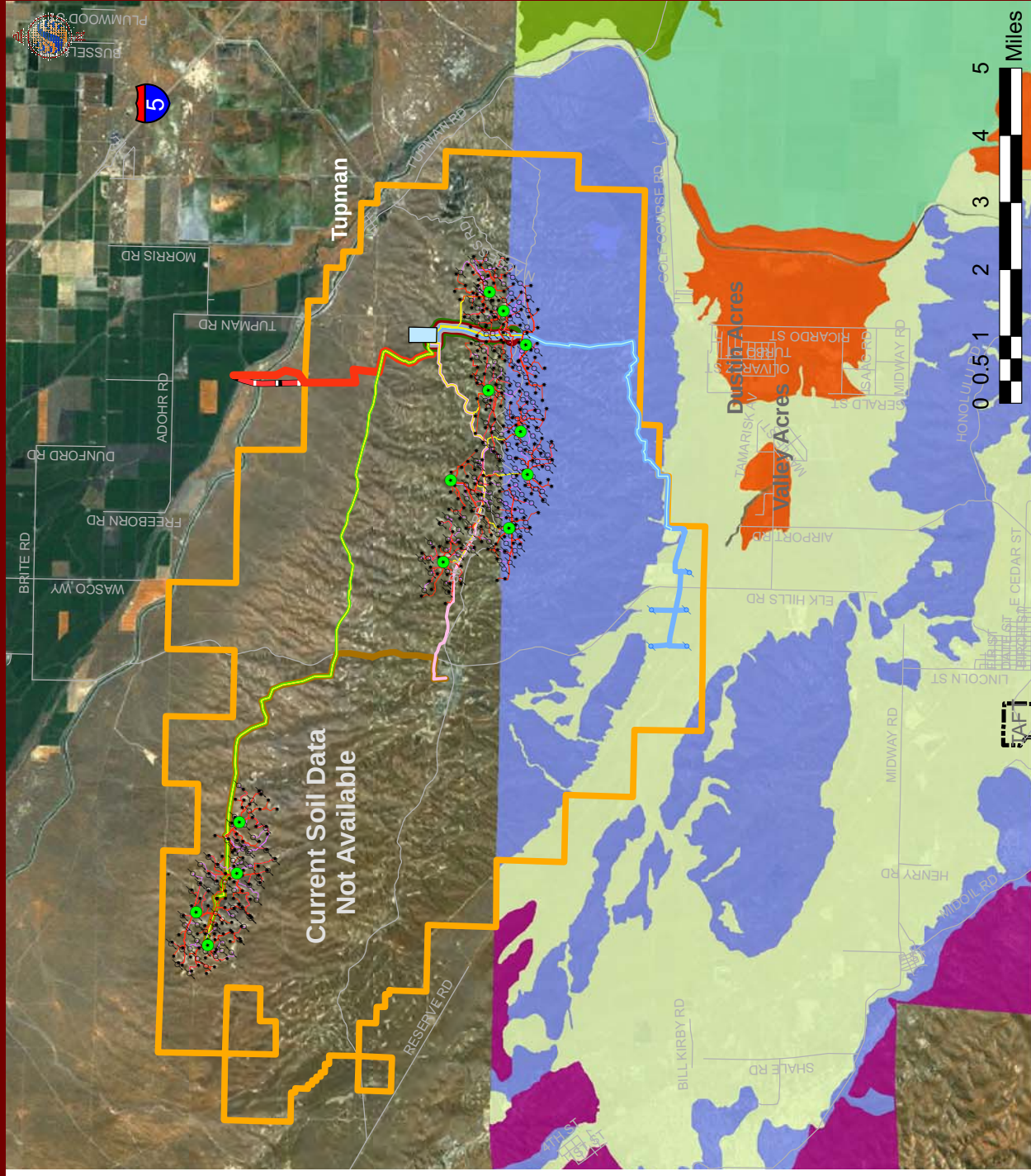
4.6 GEOLOGY AND SOILS

loamy sand, silt loam, coarse sandy loam, gravelly sandy loam, and light gray gravelly sandy loam. Included in these units are small areas of Wasco sandy loam, Milham sandy loam, Cajon loamy sand, Panoche clay loam, Kettleman loam, and Excelsior sandy loam. This soil does not meet hydric criteria.

Lokern Clay, Drained, 0 to 2% Slope. The Lokern series consists of deep, somewhat poorly drained soils, which demonstrate slow to very slow runoff, slow permeability, and high shrink-swell potential. Lokern soils form in mixed but predominantly granitic alluvium. The Lokern Series have slopes of 0 to 2 percent. The hazard of water erosion is slight. Surface soils are comprised of dark gray clay and silty clay. Beneath the surface soils are gray and dark gray clay, and light brownish gray fine sandy loam. This soil does not meet hydric criteria.

LEGEND

- Elk Hills Oil Field
 - EOR Processing Facility
 - Satellite Facility
 - ⚡ Water Wells
 - ⚡ Injection Wells
 - Producing Wells
 - Producing Lines
 - Injection Lines
 - Gathering Lines
 - CO2 Trunk Line
 - Oil Line
 - NGL Line
 - Water Line
 - Fuel Gas Line
 - Residue Gas Line
 - Nitrogen Line
 - Propane Line
 - Prop. HECA CO2 Supply Line
 - Alt. HECA CO2 Supply Line
 - Roadways
 - City Limits
-
- ### Soils
- Copus-Lokern
 - Garces-Millox
 - Bakersfield-Oldriver
 - Gujjaral-Cerini-Excelsior
 - Calflax-Excelsior-Fages
 - Elkhills-Sodic Haplocambids, thick
 - Little Signal



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2550 Venture Oaks Way, Sacramento, CA 95833
 Phone 916.599.2500 Fax 916.921.9274 www.stantec.com
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Fig. 4.6-8

Project Site Soils

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The following table, Table 4.6-2 Project Site Soils Properties, summarizes the characteristics of the soil components identified within the Project Site:

TABLE 4.6-2 PROJECT SITE SOILS PROPERTIES							
Soil Type	Soil Survey / Map Unit	Drainage Class	Permeability	Shrink-Swell Potential	Runoff	Land Capability Class	Land Capability Subclass
Granoso Loamy Sand, 2-5% Slopes	southwest part / 121	Somewhat Excessively Drained	Moderately Slow (hydrologic soil group B)	Low	Very Low	3-4 (irrigated) 7 (nonirrigated)	e
Granoso Loamy Sand, Loamy Substratum, 0-2% Slopes	southwest part / 122	Somewhat Excessively Drained	Moderately Slow (hydrologic soil group B)	Low	Very Low	3-4 (irrigated) 7 (nonirrigated)	e
Granoso Sandy Loam, 0-2% Slopes, Overwash	southwest part / 123	Somewhat Excessively Drained	Moderately Slow (hydrologic soil group B)	Low	Slow or Very Slow	3-4 (irrigated) 7 (nonirrigated)	s
Granoso Gravelly Loamy Sand, 0-2% Slopes	southwest part / 124	Somewhat Excessively Drained	Moderately Slow (hydrologic soil group B)	Low	Slow or Very Slow	4 (irrigated) 7 (nonirrigated)	e s
Cajon Loamy Sand, 0-2% Slopes	northwest part / 125	Somewhat Excessively Drained	Rapid (hydrologic soil group B)	Low	Negligible to low runoff	3 (irrigated) 7 (nonirrigated)	s
Cajon Loamy Sand, 2-5% Slopes	northwest part / 126	Somewhat Excessively Drained	Rapid	Low	Negligible to low runoff	2 (irrigated) 7 (nonirrigated)	e
Cajon Sandy Loam, Overblown, 0-2% Slopes	northwest part / 127	Somewhat Excessively Drained	Rapid	Low	Negligible to low runoff	2 (irrigated) 7 (nonirrigated)	w
Elkhills Sandy Loam, 9-50% Slopes, Eroded	northwest part / 146	Well-Drained	Moderately Rapid	Low	Medium	7 (nonirrigated)	e
Elkhills Gravelly Sandy Loam, 9-15% Slopes	northwest part / 147	Well-Drained	Moderately Rapid	Low	Medium	7 (nonirrigated)	e
Elkhills Gravelly Sandy Loam, 15-50% Slopes	northwest part / 148	Well-Drained	Moderately Rapid	Low	Medium to Rapid	7 (nonirrigated)	e
Elkhills-Bitterwater-Kettleman Association, 9-50% Slopes	northwest part / 149	Well-Drained	Moderately Rapid	Low	Medium to Rapid	7 (nonirrigated)	e
Elkhills-Torriorthents, Stratified, Complex, 9-15% Slopes	northwest part / 150	Well-Drained	Moderately Rapid	Low	Medium	7 (nonirrigated)	e

4.6 GEOLOGY AND SOILS

TABLE 4.6-2 PROJECT SITE SOILS PROPERTIES

Soil Type	Soil Survey / Map Unit	Drainage Class	Permeability	Shrink-Swell Potential	Runoff	Land Capability Class	Land Capability Subclass
Excelsior Fine Sandy Loam, Saline-Sodic, 0-1% Slopes	southwest part / 151	Well Drained	Slow (hydrologic soil group B)	Low	Negligible to Medium	2 (irrigated) 7 (nonirrigated)	s e
Excelsior Sandy Loam, 0-2% Slopes	southwest part / 152	Well Drained	Slow (hydrologic soil group B)	Low	Negligible to Medium	2 (irrigated) 7 (nonirrigated)	s e
Excelsior Variant Silt Loam, 0-2% Slopes	northwest part / 153	Moderately Well Drained	Moderately Rapid	Low	Slow	2-4 (irrigated) 7 (nonirrigated)	s
Kettleman Loam, 9-15% Slopes	northwest part / 168	Well Drained	Moderate	Low to Moderate	Medium	7 (nonirrigated)	e
Kettleman Loam, 15-50% Slopes	northwest part / 169	Well Drained	Moderate	Low to Moderate	Medium	7 (nonirrigated)	e
Kettleman Gravelly Loam, 15-50% Slopes	north west / 170	Well Drained	Moderate	Low to Moderate	Rapid	7 (nonirrigated)	e
Kimberlina Sandy Loam, 2-5% Slopes	northwest part / 175	Well Drained	Moderate	Low	Slow	1-2 (irrigated) 7 (nonirrigated)	e
Kimberlina Sandy Loam, 5-9% Slopes	north west / 176	Well Drained	Moderate	Low	Medium	1-3 (irrigated) 7 (nonirrigated)	e
Kimberlina Gravelly Sandy Loam, 2-5% Slopes	northwest part / 177	Well Drained	Moderate	Low	Slow	7 (nonirrigated)	e
Kimberlina Sandy Gravelly Loam, 5-9% Slopes	northwest part / 178	Well Drained	Moderate	Low	Medium	7 (nonirrigated)	e
Lokern Clay, Drained, 0-2% Slope	northwest part / 187	Poorly Drained	Slow	High	Slow	2-5 (irrigated) 7 (nonirrigated)	s
Guijarral Sandy Loam, 0-2% Slopes	southwest part / 190	Well Drained	Moderately Rapid (hydrologic soil group B)	Low	Low	2-4 (irrigated) 7 (nonirrigated)	e
Guijarral Sandy Loam, 2-9% Slopes	southwest part / 191	Well Drained	Moderately Rapid (hydrologic soil group B)	Low	Low	3-4 (irrigated) 7 (nonirrigated)	e

4.6 GEOLOGY AND SOILS

TABLE 4.6-2 PROJECT SITE SOILS PROPERTIES

Soil Type	Soil Survey / Map Unit	Drainage Class	Permeability	Shrink-Swell Potential	Runoff	Land Capability Class	Land Capability Subclass
Guijarral Gravelly Sandy Loam, 2-5% Slopes	southwest part / 193	Well Drained	Moderately Rapid (hydrologic soil group B)	Low	Low	3-4 (irrigated) 7 (nonirrigated)	e
Kimberlina Fine Sandy Loam, 0-2% Slopes	southwest part / 210	Well Drained	Moderate and Moderately Rapid (hydrologic soil group B)	Low	Very Low	1 (irrigated) 7 (nonirrigated)	e
Kimberlina Fine Sandy Loam, 2-5% Slopes	southwest part / 211	Well Drained	Moderate and Moderately Rapid (hydrologic soil group B)	Low	Low	1-2 (irrigated) 7 (nonirrigated)	e
Kimberlina Fine Sandy Loam, Saline-Sodic, 0-2% Slopes	southwest part / 212	Well Drained	Moderate and Moderately Rapid (hydrologic soil group C)	Low	Low	2-6 (irrigated) 7 (nonirrigated)	s
Kimberlina Gravelly Sandy Loam, 0-2% Slopes	southwest part / 214	Well Drained	Moderate and Moderately Rapid (hydrologic soil group B)	Low	Very Low	1-2 (irrigated) 7 (nonirrigated)	e
Kimberlina Gravelly Sandy Loam, 5-9% Slopes	southwest part / 215	Well Drained	Moderate and Moderately Rapid (hydrologic soil group B)	Low	Low	2-4 (irrigated) 7 (nonirrigated)	e
Kimberlina-Granoso Complex, 0-5% Slopes, Occasionally Flooded	southwest part / 216	Well Drained	Moderate and Moderately Rapid (hydrologic soil group B)	Low	Low	1-2 (irrigated) 7 (nonirrigated)	e
Kimberlina-Urban Land Complex, 0-5% Slopes	southwest part / 217	Well Drained	Moderate and Moderately Rapid (hydrologic soil group B)	Low	Low	1-2 (irrigated) 7 (nonirrigated)	e
Torriorthents, Stratified, Eroded-Elkhills Complex, 9-50% Slopes	northwest part / 232	Well Drained	Moderate to Slow	Low	Rapid	7 (nonirrigated)	e

4.6 GEOLOGY AND SOILS

TABLE 4.6-2 PROJECT SITE SOILS PROPERTIES

Soil Type	Soil Survey / Map Unit	Drainage Class	Permeability	Shrink-Swell Potential	Runoff	Land Capability Class	Land Capability Subclass
Riverwash	southwest part / 290	None Noted	None Noted	Low	Low	8 (nonirrigated)	Not Assigned
Sodic Haplocambids, Thick, 9-30% Slopes	southwest part / 441	Well Drained	None Noted (hydrologic soil group C)	Low to Moderate	Very High	7 (nonirrigated)	e
Elkhills Sandy Loam, 5-15% Slopes	southwest part / 442	Well Drained	Moderately Rapid (hydrologic soil group B)	Low	Low	7 (nonirrigated)	e
Elkhills Sandy Loam, 15-30% Slopes	southwest part / 444	Well Drained	Moderately Rapid (hydrologic soil group B)	Low	Medium	7 (nonirrigated)	e
Sodic Haplocambids, thick-Elkhills Complex, 30-50% Slopes	southwest part / 445	Well Drained	None Noted (hydrologic soil group C)	Low to Moderate	Very High	7 (nonirrigated)	e
Elkhills Sandy Loam, 30-60% Slopes	southwest part / 724	Well Drained	Moderately Rapid (hydrologic soil group B)	Low	Medium	7 (nonirrigated)	e
Sodic Haplocambids, thick, 9-15% Slopes	southwest part / 725	Well Drained	None Noted (hydrologic soil group C)	Low to Moderate	Very High	7 (nonirrigated)	e
Sodic Haplocambids, thick, 15-30% Slopes	southwest part / 726	Well Drained	None Noted (hydrologic soil group C)	Low to Moderate	Very High	7 (nonirrigated)	e
Sodic Haplocambids, thick, 30-50% Slopes	southwest part / 727	Well Drained	None Noted (hydrologic soil group C)	Low to Moderate	Very High	7 (nonirrigated)	e
Torriorthents, Very Thin, 30-50% Slopes	southwest part / 728	Well Drained	None Noted (hydrologic soil group C)	Low to Moderate	Very High	7 (nonirrigated)	e
Sodic Haplocambids, Thick-Torriorthents, Thin-Torriorthents, Very Thin, Eroded, Complex, 30-60% Slopes	southwest part / 729	Well Drained	None Noted (hydrologic soil group B and C)	Low to Moderate	Very High	7 (nonirrigated)	e

4.6 GEOLOGY AND SOILS

TABLE 4.6-2 PROJECT SITE SOILS PROPERTIES

Soil Type	Soil Survey / Map Unit	Drainage Class	Permeability	Shrink-Swell Potential	Runoff	Land Capability Class	Land Capability Subclass
Haplocambids, Thick-Elkhills Complex, 9-15% Slopes	southwest part / 730	Well Drained	None Noted (hydrologic soil group B)	Low	Medium	7 (nonirrigated)	e
Haplocambids, thick-Elkhills Complex, 15-30% Slopes	southwest part / 731	Well Drained	None Noted (hydrologic soil group B)	Low	Medium to High	7 (nonirrigated)	e
Elkhills-Haplocambids, Thick, Complex, 30-50% Slopes	southwest part / 732	Well Drained	None Noted (hydrologic soil group B)	Low	Medium to High	7 (nonirrigated)	e
Sodic Haplocambids, Thick-Torriorthents, Thin, Complex, 15-30% Slopes	southwest part / 733	Well Drained	None Noted (hydrologic soil group B and C)	Low to Moderate	Very High	7 (nonirrigated)	e
Sodic Haplocambids, Thick Torriorthents, Very Thin, Eroded-Elkhills Complex, 15-50% Slopes	southwest part / 734	Well Drained	None Noted (hydrologic soil group B and C)	Low to Moderate	Very High	7 (nonirrigated)	e
Sodic Haplocambids, Thick-Elkhills-Torriorthents, Thin, Complex, 30-60% Slopes	southwest part / 735	Well Drained	None Noted (hydrologic soil group B and C)	Low to Moderate	Very High	7 (nonirrigated)	E

4.6 GEOLOGY AND SOILS

TABLE 4.6-2 PROJECT SITE SOILS PROPERTIES

Soil Type	Soil Survey / Map Unit	Drainage Class	Permeability	Shrink-Swell Potential	Runoff	Land Capability Class	Land Capability Subclass
Land Capability Classes and Subclasses: Capability class is the broadest category in the land capability classification system. Class codes 1, 2, 3, 4, 5, 6, 7, and 8 are used to represent both irrigated and nonirrigated land capability classes. Class 1 soils have slight limitations that restrict their use. Class 2 soils have moderate limitations that reduce the choice of plants or require moderate conservation practices. Class 3 soils have severe limitations that reduce the choice of plants or require special conservation practices, or both. Class 4 soils have very severe limitations that restrict the choice of plants or require very careful management, or both. Class 5 soils have little or no hazard of erosion but have other limitations, impractical to remove, that limit their use mainly to pasture, range, forestland, or wildlife food and cover. Class 6 soils have severe limitations that make them generally unsuited to cultivation and that limit their use mainly to pasture, range, forestland, or wildlife food and cover. Class 7 soils have very severe limitations that make them unsuited to cultivation and that restrict their use mainly to grazing, forestland, or wildlife. Class 8 soils and miscellaneous areas have limitations that preclude their use for commercial plant production and limit their use to recreation, wildlife, or water supply or for esthetic purposes. Capability subclass is the second category in the land capability classification system. Class codes e, w, s, and c are used for land capability subclasses. Subclass e is made up of soils for which the susceptibility to erosion is the dominant problem or hazard affecting their use. Erosion susceptibility and past erosion damage are the major soil factors that affect soils in this subclass. Subclass w is made up of soils for which excess water is the dominant hazard or limitation affecting their use. Poor soil drainage, wetness, a high water table, and overflow are the factors that affect soils in this subclass. Subclass s is made up of soils that have soil limitations within the rooting zone, such as shallowness of the rooting zone, stones, low moisture-holding capacity, low fertility that is difficult to correct, and salinity or sodium content. Subclass c is made up of soils for which the climate (the temperature or lack of moisture) is the major hazard or limitation affecting their use. The subclass represents the dominant limitation that determines the capability class. Within a capability class, where the kinds of limitations are essentially equal, the subclasses have the following priority: e, w, s, and c. Subclasses are not assigned to soils or miscellaneous areas in capability classes 1 and 8.							
Sources: United States Department of Agriculture, Natural Resources Conservation Service (NRCS). 2009. <i>Soil Survey of Kern County, California, southwest part (southwest)</i>. Accessible online at http://soils.usda.gov/survey/printed_surveys/ United States Department of Agriculture, Natural Resources Conservation Service (NRCS). 1982. <i>Soil Survey of Kern County, California, northwest part (northwest)</i>. Accessible online at http://soils.usda.gov/survey/printed_surveys/ http://www.nrcs.usda.gov/technical/NRI/maps/meta/m6175.html https://soilseries.sc.egov.usda.gov/osdname.asp							

4.6 GEOLOGY AND SOILS

Overall, (with the exception of Lokern Clay which occurs primarily north of Tupman Road and the California Aqueduct) the soils in the Project Site are coarser grained and well drained. These types of soils do not exhibit shrink-swell patterns (i.e., are not considered expansive soils).

4.6.2.9 Soil Erosion

Erosion is the process by which rocks, soil, and other land materials are abraded or worn away from the earth's surface. The erosive potential of soil is determined by a number of soil characteristics, including soil texture and content, surface roughness, vegetation cover, and slope grade and length. Ground-disturbing activities can increase erosion potential by altering natural soil characteristics, removing vegetation, and generally destabilizing an area.

Erosion from water mainly occurs in loose soils on moderate to steep slopes, particularly during high-intensity storm events. To estimate erosion potential of soils unprotected by vegetation during precipitation events, the Natural Resource Conservation Service has considered soil characteristics such as available water capacity, permeability, and associated water table and bedrock depth and categorized soils into four hydrological soil groups (HSGs), Groups A through D. Soils are classified according to the intake of water when they are thoroughly wet and receive precipitation from long-duration storms and they have had a chance to swell (U.S. Department of Agriculture 1977). Group A soils have a high infiltration rate when thoroughly wet, consist mainly of deep and well-drained to excessively drained sands or gravelly sands, and, therefore, have a low runoff potential (less erosive). Group D soils have a very slow infiltration rate and consist chiefly of clays that have high shrink-swell potentials, soils with a permanent high water table, and soils having a clay pan or clay layer at or near the surface and, therefore, have a high runoff potential (more erosive). The soil types found in the Project Site (see table 4.6-2 for the Permeability) include group B and C Soils which has slow to moderately rapid permeability respectively (U.S. Department of Agriculture, Natural Resources Conservation Service 2007).

Erosion may also occur as a result of wind. Wind erosion may be anticipated when dry, fine-grained, non-cohesive soils are exposed to high velocity wind. To estimate the erosion potential of soils by wind, the Natural Resource Conservation Service has considered soil characteristics such as soil texture, organic matter content, rock content, and mineralogy, and has categorized soils into wind erodibility groups (WEGs), Groups 1 to 8. Group 1 soils are dominated by sands (coarse, fine, and very fine) and are extremely erodible, while Group 8 soils are typically stony or gravelly soils and are not as susceptible to wind erosion. The soils types in the Project Site (see Figure 4.6-9: Project Soils Wind Erodibility Group) range from WEG 3 to 5, which are moderately susceptible to wind erosion (U.S. Department of Agriculture, Natural Resources Conservation Service 2007).

Wind Erodibility Groups (WEG) and Index (Exhibit 618-16)

WEG 1,3,4,5,7	Properties of Soil Surface Layer	Dry Soil Aggregates More Than 0.84 mm (wt.%)	Wind Erodibility Index (I) (tons/ac/yr)
1	Very fine sand, fine sand, sand or coarse sand ²	1	310
		2	250
		3	220
		5	180
		7	160
2	Loamy very fine sand, loamy fine sand, loamy sand, and loamy coarse sand; very fine sandy loam and silt loam with 5 or less percent clay and 25 or less percent very fine sand; and sapric soil materials (as defined in <i>Soil Taxonomy</i>); except Folists.	10	134
3	Very fine sandy loam (but does not meet WEG criterion 2), fine sandy loam, sandy loam, and coarse sandy loam; noncalcareous silt loam that has greater than or equal to 20 to less than 50 percent very fine sand and greater than or equal to 5 to less than 12 percent clay.	25	86
4	Clay, silty clay, noncalcareous clay loam that has more than 35 percent clay and noncalcareous silty clay loam that has more than 35 percent clay; all of these do not have sesquic, parasesquic, ferritic, ferruginous, or kaolinitic mineralogy (high iron oxide content).	25	86
4L	Calcareous ⁴ loam, calcareous silt loam, calcareous silt, calcareous sandy clay, calcareous sandy clay loam, calcareous clay loam, and calcareous silty clay loam.	25	86
5	Noncalcareous loam that has less than 20 percent clay; noncalcareous silt loam with greater than or equal to 5 to less than 20 percent clay (but does not meet WEG criterion 3); noncalcareous sandy clay loam; noncalcareous sandy clay; and hemic soil materials (as defined in <i>Soil Taxonomy</i>).	40	56
6	Noncalcareous loam and silt loam that have greater than or equal to 20 percent clay; noncalcareous clay loam and noncalcareous silty clay loam that have less than or equal to 35 percent clay; silt loam that has parasesquic, ferritic, or kaolinitic mineralogy (high iron oxide content).	45	48
7	Noncalcareous silt; noncalcareous silty clay, noncalcareous silty clay loam, and noncalcareous clay that have sesquic, parasesquic, ferritic, ferruginous, or kaolinitic mineralogy (high content of iron oxide) and are Oxisols or Ultisols; and fibric soil materials (as defined in <i>Soil Taxonomy</i>).	50	38
8	Soils not susceptible to wind erosion due to rock and pararock fragments at the surface and/or wetness; and Folists.	--	0

The following footnotes are applied in the order listed:

¹ For all WEGs except 1 and 2 (sands and loamy sand textures), if percent rock and pararock fragments (>2mm) by volume is 15-35, reduce "I" value by one group with more favorable rating. If percent rock and pararock fragments by volume is 35-60, reduce "I" value by two favorable groups except for sands and loamy sand textures which are reduced by one group with more favorable rating. If percent rock and pararock fragments is greater than 60, use "I" value of 0 for all textures except sands and loamy sand textures which are reduced by three groups with more favorable ratings. An example of more favorable "I" rating is next lower number: "I" factor of 160 to "I" factor of 134 or "I" factor of 86 to "I" factor of 56. The index values should correspond exactly to their wind erodibility group (e.g., "I" factor of 56 = WEG 5).

² The "I" values for WEG 1 vary from 160 for coarse sands to 310 for very fine sands. Use an "I" of 220 as an average figure.

³ All material that meets criterion 3 in the required characteristics for andic soil properties as defined in the *Keys to Soil Taxonomy*, 11th edition. Such material is placed in WEG 2 regardless of the texture class of the fine-earth fraction.

⁴ All material that meets criterion 2, but not criterion 3, in the required characteristics for andic soil properties as defined in the *Keys to Soil Taxonomy*, 11th edition. Such material is placed in WEG 6, regardless of the texture class of the fine-earth fraction. The only exception to this is for Cryic Spodosols which have a medial substitute class and a MAAT < 4 degrees C.; these soils are placed in WEG 2.

⁵ For surface layers or horizons that do not meet the required characteristics for andic soil properties but do meet Vitrandic, Vitritrandic, Vitrixerandic, and Ustivitrandic subgroup criteria (thickness criterion excluded) move one wind erodibility group (WEG) with a less favorable rating.

⁶ Calcareous is a strongly or violently effervescent reaction (class) of the fine-earth fraction to cold dilute (1N) HCL; a paper "Computing the Wind Erodible Fraction of Soils" by D. W. Fryrear et.al (1994) in the *Journal of Soil and Water Conservation* 49 (2) 183-188 raises a yet unresolved question regarding the effect of carbonates on wind erosion.

⁷ For mineral soils with thin "O" horizons, the WEG is based on the first mineral horizon.

(Source: <http://soils.usda.gov/technical/handbook/contents/part618ex.html#ex16>)



Stantec does not certify the accuracy of the data. This map is for reference only and should not be used for construction.

2590 Venture Oaks Way, Sacramento, CA 95833
Phone 916.569.2500 Fax 916.921.9274 www.stantec.com
Project # 185802314

Stantec

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Fig. 4.6-9

Project Soils Wind Erodibility Group

OEHI C02 EOR Project - Supplemental Environmental Information

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4.6.2.10 *Expansive Soils*

Expansive soils are those whose volume expands and contracts in a “shrink-swell” pattern. Shrink-swell potential is generally related to the presence of highly plastic clayey soils found near the ground surface. Fine-grain clay sediments expand and contract as the result of changing moisture levels. As the density of soils changes, overlying materials can shift, causing structural damage to foundations and other above ground facilities.

Because the Project Site is predominantly composed of sandy loam with very little to no fine-grained soil, there is a low probability of impact due to shrink-swell soil behavior (see Table 4.6-2).

4.6.2.11 *Settlement*

Settlement, or the sinking, depression, or descending of soils, can result from the placement of a heavy load, such as building, foundation, or fill material, on the underlying sediments. Settlement can disrupt the stability of aboveground structures and destabilize slopes.

Seismically induced settlement potential for this site is considered to be low to moderate. The site materials that might have the most likely potential for seismically induced settlement potential are the alluvial materials located within the major site drainages.

4.6.2.12 *Soil Radon Hazards*

Kern County is located in an EPA Radon Zone 2, having a moderate potential for elevated indoor radon levels. Radon is a radioactive gas resulting from the natural decay of uranium that is found in nearly all soils. It typically moves up through the ground via soil gases or water. Once airborne, radon has the potential to accumulate inside homes, posing a significant health risk to occupants.

Sections 307 and 309 of the Indoor Radon Abatement Act of 1988 (IRAA) directed the U.S. Environmental Protection Agency (EPA) to list and identify areas of the U.S. with the potential for elevated indoor radon levels. The EPA’s Map of Radon Zones assigns each county in the U.S. to one of three zones based on radon potential. For a more detailed analysis of the risks associated with Radon, see Hazards and Hazardous Materials Section 4.7.

4.6.3 Regulatory Setting

4.6.3.1 *Local*

Kern County General Plan

The policies, goals, and implementation measures in the Kern County General Plan for geology and soils applicable to the proposed Project are provided below. The Kern County General Plan contains additional policies, goals, and implementation measures that are more general in nature and are not specific to development such as the Project. These measures are not listed below, but, as stated in

4.6 GEOLOGY AND SOILS

Chapter 2, "Introduction," all policies, goals, and implementation measures in the Kern County General Plan are incorporated by reference.

1.3 Physical and Environmental Constraints

Policies

Policy 1. Kern County will ensure that new developments will not be sited on land that is physically or environmentally constrained (Map Code 2.1 [Seismic Hazard], Map Code 2.2 [Landslide], Map Code 2.3 [Shallow Groundwater], Map Code 2.5 [Flood Hazard], Map Codes from 2.6 – 2.9, Map Code 2.10 [Nearby Waste Facility], and Map Code 2.11 [Burn Dump Hazard]) to support such development unless appropriate studies establish that such development will not result in unmitigated significant impact.

Policy 6. Regardless of percentage of slope, development on hillsides will be sited in the least obtrusive fashion, thereby, minimizing the extent of topographic alteration required and reducing soil erosion while maintaining soil stability.

Policy 7. Ensure effective slope stability, wastewater drainage, and sewage treatments in areas with steep slopes are adequate for development.

1.9 Resource (Land Use, Open Space, and Conservation Element)

Policies

Policy 20. Areas along rivers and streams will be conserved where feasible to enhance drainage, flood control, recreational, and other beneficial uses while acknowledging existing land use patterns.

4.3 Seismically Induced Surface Rupture, Ground Shaking, and Ground Failure (Safety Element)

Policies

Policy 1. The County shall require development for human occupancy to be placed in a location away from an active earthquake fault in order to minimize safety concerns.

4.5 Landslides, Subsidence, Seiche, and Liquefaction (Safety Element)

Policies

Policy 1. Determine the liquefaction potential at sites in areas of shallow groundwater (Map Code 2.3) prior to discretionary development and determine specific mitigation to be incorporated into the foundation design, as necessary, to prevent or reduce damage from liquefaction in an earthquake.

Policy 2. Route major lifeline installations around potential areas of liquefaction or otherwise protect them against significant damage from liquefaction in an earthquake.

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Policy 3. Reduce potential for exposure of residential, commercial, and industrial development to hazards of landslide, land subsidence, liquefaction, and erosion.

Kern County Building Code

All construction in Kern County is required to conform to the Kern County Building Code (Chapter 17.08, Building Code, of the Kern County Code of Regulations). The Kern County Building Code adopts the 2007 California Building Standards Code that imposes substantially the same requirements as are contained in the International Building Code of 2006, with particular minor modifications and amendments for conditions specific to Kern County. The requirements for seismic protection are the same as those of the California Building Standards.

Kern County Grading Ordinance

The purpose of the Kern County Grading Ordinance is to safeguard life, limb, property and the public welfare by regulating grading on private property. Although the proposed Project will involve grading, the Kern County Grading Ordinance exempts the requirement to obtain a grading permit for accepted oil field activities related to oil field drilling, such as oil field roads, drilling pads, and sumps used for drilling mud and grading required for the setting of production equipment. Access roads with cut and fill slopes less than two feet in height are also exempt.

Permits Required and Schedule

Permits potentially required for matters dealing with geologic resources and hazards for the proposed Project and the schedule to obtain each of these permits are provided in Table 4.6-3: Permits required and permit schedule. Information required to obtain each permit is also included.

TABLE 4.6-3: PERMITS REQUIRED AND PERMIT SCHEDULE	
Permit/Required Information	Schedule
• Building Permit including Seismic Design Criteria: • 30 day review and approval process • Requires structural, civil, electrical and mechanical plans • Geotechnical/Geologic report • Identify geologic hazards and potentially conduct a seismic risk analysis • Architectural plans	• Submit application 30 days prior to start of construction.
• Grading/Drainage/Erosion Control Permit: • Engineered Grading Plan • Topographic Plan • Drainage controls • Surface Hydrology Report • Geotechnical/Geological Hazard Evaluation • Identify material source or disposal location and haul route • Erosion and Dust Control Plan • Traffic Control Plan	• Submit application 30 days prior to start of construction activities.

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4.6.3.2 State

California Building Code (CBC)

The CBC contains requirements related to excavation, grading, and construction. According to the CBC, a grading permit is required if more than 50 cubic yards of soil is moved. The CBC specifies the acceptable design criteria for construction of facilities with respect to seismic design and load-bearing capacity.

Applicable codes and industry standards related to various geologic and soil features are identified in the ASCE Standard 7.05 Minimum Design Loads for Buildings and other Structures. The Project Site is not located within a State of California Seismic Hazard Zone for landslides.

Alquist-Priolo Earthquake Fault Zoning Act of 1972

In response to the 1971 San Fernando Earthquake, which damaged numerous homes, commercial buildings, and other structures, California passed the Alquist-Priolo Earthquake Fault Zoning Act. The goal of the act is to avoid or reduce damage to structures like that caused by the San Fernando Earthquake by preventing the construction of buildings on active faults.

In accordance with the law, the California Geological Survey maps active faults and the surrounding earthquake fault zones for all affected areas. Any project that involves the construction of buildings or structures for human occupancy, such as residential housing, is subject to review under this law. Structures for human occupancy must be constructed at least 50 feet from any active fault. As described above, the Project is not located in an Alquist-Priolo Special Study zone and it will not involve the construction of buildings or structures for human occupancy within 1.5 miles of an active fault.

Seismic Hazards Mapping Act of 1990

The California Seismic Hazards Mapping Act is designed to protect the public from the effects of strong ground shaking, liquefaction, landslides, other ground failures, or other hazards caused by earthquakes. The Act requires site-specific geotechnical investigations to identify the hazard and formulation of mitigation measures before the permitting of most developments designed for human occupancy.

Special Publication 117, Guidelines for Evaluating and Mitigating Seismic Hazards in California, (California Geological Survey 1997) constitutes the guidelines for evaluating seismic hazards other than surface fault rupture, and for recommending mitigation measures as required by Public Resources Code Section 2695(a).

4.6 GEOLOGY AND SOILS

4.6.4 Impacts and Mitigation Measures

4.6.4.1 Methodology

Potential impacts on the environment, human life, property and geologic resources were evaluated on the basis of the existing conditions of the Project Site and the Project's potential to result in soil erosion and to be subject to geologic hazards.

4.6.4.2 Thresholds of Significance

Appendix G of the CEQA Guidelines and the Kern County CEQA Implementation Document state that a project would have a significant impact on agricultural resources if it would:

Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, involving;

Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault;

Strong seismic ground shaking; or

Seismic-related ground failure, including liquefaction.

Landslides;

Result in substantial soil erosion or loss of topsoil;

Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the Project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse;

Be located on expansive soils, as defined in section 1802.3.2 of the International Building Code (IBC) (2006) creating substantial risk to life or property; or

Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems, where sewers are not available for the disposal of wastewater.

4.6 GEOLOGY AND SOILS

4.6.4.3 *Project Impacts*

IMPACT GEO-1 Expose People or Structures to Substantial Adverse Effects Involving the Rupture of a Known Earthquake Fault

The Project Site is located in an area classified as a low seismic activity zone under the Alquist-Priolo Act. The proposed Project is not in the Alquist-Priolo Earthquake Special Study zone. The Project Site is located in a designated Seismic Hazard Zone. However, the Project Site's proximity to active faults in the region that could generate significant earthquakes could subject the Project Site to a potential ground shaking hazard.

Additionally, the Project Site is located within Seismic Zone 4, as set forth in the adopted IBC/CBC. All structures associated with the proposed Project would be required to meet the seismic design standards for Seismic Zone 4. As part of compliance with the locally adopted sections of the IBC/CBC, proposed Project development would be designed to withstand expected seismic forces that could sustain both horizontal and vertical oscillations and net displacement of earth material along faults. The IBC/CBC may require certain engineering methods and flexible utility connections to accommodate warping and distributive deformation associated with faulting, or other methods as deemed appropriate. Compliance with IBC/CBC standards would ensure that impacts associated with ground shaking would be less than significant.

There is a potential for strong seismic ground shaking to affect the Project Site in the event of a large magnitude earthquake occurring on fault segments associated with the San Andreas or White Wolf Fault zones. Seismic hazards and potential adverse foundation conditions will be minimized by conformance with the recommended seismic design criteria of the IBC/CBC Seismic Zone 4 requirements. Furthermore, the Project Site will not be located within the projected trace of any active or potentially active faults. As such, potential impacts as a result of ground shaking are expected to be less than significant.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.6 GEOLOGY AND SOILS

IMPACT GEO-2 Expose People or Structures to Substantial Adverse Effects Involving Strong Seismic Ground Shaking

Strong seismic ground shaking could occur at the site resulting in damage to structures and, potentially, to individuals in or near proposed Project infrastructure during an earthquake. As described above, the Project Site is located in a seismically active area, including two active faults adjacent to the Project Site. OEHI shall design all associated infrastructure to meet applicable design requirements which will minimize potential impacts as a result of strong ground shaking. All proposed Project facilities shall be designed to be in accordance with applicable CBC seismic design standards, Kern County Building Code, Chapter 17, and as recommended by a California registered professional engineer in the site-specific geotechnical review. As such, potential impacts as a result of ground shaking are expected to be less than significant.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT GEO-3 Expose People or Structures to Substantial Adverse Effects Involving Seismic-Related Ground Failure, Including Liquefaction

The alluvial deposits within the majority of the site are relatively dense and coarse-grained, and groundwater in the Project Site is relatively deep (over 50 feet deep); therefore, the potential for liquefaction is limited. Therefore, this impact is less than significant.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT GEO-4 Expose People or Structures to Substantial Adverse Effects Involving Landslides

There is a risk of landslides on steep slopes due to seismic events, particularly after slopes have been disturbed by construction activities. While it is unlikely that a large landslide would occur, there is potential for local landslides, debris flows, or rock fall that could affect individuals on the Project Site. This is considered a potentially significant impact and mitigation would be required.

4.6 GEOLOGY AND SOILS

Mitigation Measures

Mitigation Measure GEO-1 The applicant shall design cut/fill slopes for an adequate factor of safety, considering material type and compaction, identified during the site-specific geotechnical study. The slope of cut surfaces shall be no steeper than 2:1 (horizontal to vertical units), unless the applicant furnishes a soils engineering or an engineering geology report, or both, stating that the site has been investigated and giving an opinion that a cut at a steeper slope will be stable and will not create a hazard to public or private property.

Mitigation Measure GEO-2 The applicant shall cut slopes with a slope ratio compatible with the known geologic conditions and/or shall stabilize the slope by using stabilizing methods such as a buttressed fill.

Mitigation Measure GEO-3 Project facilities where slopes exceed 4:1 shall require specific consultation and approval by the Kern County Engineering and Survey Services Department.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT GEO-5 Result in Substantial Soil Erosion or Loss of Topsoil

Preparation of the ground surface at the Project Site will involve grading, leveling, and filling. Potential soil erosion impacts will be reduced by conducting such operations in accordance with the Kern County Grading Ordinance. To further minimize potential soil erosion, slopes will be provided with temporary drainage and erosion control measures during construction until permanent measures are installed.

Soils in the Project Site are categorized as HSG B and C, have a moderate infiltration rate when thoroughly wet, consist mainly of deep and well-drained to excessively drained sands or gravelly sands and, therefore, have a relatively slow to moderate runoff potential. Soils in the Project Site also are categorized as WEG 3 to 5, which are moderately susceptible to wind erosion. Wind may erode soils from graded surfaces and soils stockpiled for use during restoration.

The proposed Project area topsoil is poor to fair, which is reflected by the use of the Project Site and surrounding area as rangeland, natural habitat, and other non-irrigated agricultural uses. Nevertheless, the topsoil layer contains native seed and organic materials that will facilitate restoration of areas of temporary disturbance and should be salvaged to the extent feasible.

This impact is considered potentially significant, and mitigation would be required.

Mitigation Measures

Mitigation Measure GEO-4 OEHI shall limit grading to the minimum area necessary for construction.

4.6 GEOLOGY AND SOILS

Mitigation Measure GEO-5 As required by Kern County, OEHI shall prepare an Erosion Control Plan to mitigate potential loss of soil and erosion. The plan will be submitted for review and approval by the Kern County Engineering and Survey Services Department. The plan will include the following:

Best management practices (BMPs) will be implemented to minimize soil erosion.

Provisions to maintain flow in washes, should it occur, throughout construction.

Sediment collection facilities as may be required by the Kern County Engineering and Survey Services Department.

Mitigation Measure GEO-6 OEHI shall water disturbed areas during construction to reduce dust and minimize loss of soils from wind (see Section 4.3, "Air Quality," for additional discussion).

Mitigation Measure GEO-7 In all areas disturbed by the Project, OEHI shall salvage topsoil and reuse during restoration.

Mitigation Measure GEO-8 OEHI shall use existing roads to the greatest extent feasible to minimize increased erosion.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT GEO-6 Located on Soil that is Unstable

The initial geological evaluation did not identify significant geological hazards, with the exception of impacts from fault rupture or ground shaking. As discussed above, the proposed Project is located on soils that are not likely to become unstable. However, construction activities on steep slopes (greater than 30 percent) have the potential to cause soil to become unstable. This is a potentially significant impact. Implementation of mitigation measure GEO-1 through GEO-3 will reduce the impact to less than significant.

Mitigation Measures

Implement Mitigation Measures GEO-1 through GEO-3.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT GEO-7 Located on Expansive Soils

As described in the "Soils" sub section, the soil complexes found in the Project Site have only a low to moderate shrink-swell potential and do not include expansive soils. As such, this impact is considered less than significant.

4.6 GEOLOGY AND SOILS

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.6.5 Cumulative Impacts

The proposed Project will be constructed to the requirements of the CBC Seismic Zone 4. Site-specific geotechnical investigations will be performed prior to final design and construction. Since construction and operation of the proposed Project will not cause significant impacts to geological resources, it will not cause cumulative impacts to geological resources.

Geologic hazards such as seismicity, landslides, and erosion and other geologic and soil hazards at the proposed Project Site would be mitigated by implementing standard design measures, which would reduce impacts to less than significant levels.

Mitigation Measures

Implement Mitigation Measures GEO-1 through GEO-8.

Level of Significance after Construction

The proposed Project would have less than significant cumulative impacts.

4.7 HAZARDS AND HAZARDOUS MATERIALS

4.7 Hazards and Hazardous Materials

4.7.1 Introduction

The CO2 EOR Project (Project) includes activities that will involve procedures, chemicals, and materials which pose some risk of fires, spills, gaseous releases, or other health and environmental hazards within the EHOE. These risks are primarily generated during production, transportation, storage, treatment, handling or disposal of potentially toxic hazardous materials associated with construction, operation, and maintenance of the Project.

This section describes the potential hazards, other than geologic hazards, associated with the Project. The potential safety issues associated with airports and flight paths, naturally occurring radioactive materials (NORM), CO2 releases, hydrogen sulfide (H2S), radon gas, proximity to navigable waterways, and hazardous materials, are analyzed in this section.

4.7.2 Environmental Setting

Wildfires

Kern County categorizes the areas of the County into three fire hazard levels: moderate, high, and very high. Based on the map of Hazardous Fire Areas in the Kern County General Plan Safety Element, the fire hazard rating for the proposed Project area ranges from high to very high (Kern County 2004a). The Kern County Fire Department (KCFD) would be the first responder to a wildfire within the Project Site, including helicopter support when needed. As described in Section 4.13, "Public Services," within the KCFD network, the Taft Station would likely be the first responder. The proposed Project does not fall within the mutual aid areas of the U.S. Forest Services (USFS) or their jurisdiction within Los Angeles or Ventura Counties; however, these agencies would likely provide air support from the USFS.

The proposed Project will not be placing residential dwellings adjacent to wildlands and will not increase the size of the wildland-urban interface (WUI), defined as the area where structures and other human development meet or intermingle with undeveloped wildland or natural open space. The Project Site is a currently operating oil field and the amount WUI is minimal.

Hazardous Materials and Waste

Hazardous material can be defined as any material that, because of its quantity, concentration, or physical or chemical characteristics, may pose a hazard to human health or the environment. Hazardous materials can be categorized as flammable and combustible material, toxic material, corrosive material, oxidizers, aerosols, and compressed gases. They can be highly reactive and cause irritation to skin and eyes. The term "hazardous substances" encompasses chemicals regulated by both the U.S. Department of Transportation (DOT) hazardous materials regulations and the U.S. Environmental Protection Agency (EPA) hazardous waste regulations. Inert gases including

4.7 HAZARDS AND HAZARDOUS MATERIALS

refrigerated liquids, such as CO₂, are also regulated by the DOT. Hazardous wastes require special handling and disposal because of their potential to damage public health and the environment.

Past and current uses of the Project Site are primarily oil production. Agricultural and grazing occurs to the north and down-slope of the Project Site and have minimal impacts on the Project Site. On occasion, herbicides are laid down adjacent to structures on EHOE to reduce the amount of weeds. It is anticipated that herbicides will be applied to control weeds near the CO₂ EOR Processing Facility located in Section 27S.

Airports in Proximity

The proposed Project is not located in any area regulated by the Kern County Airport Land Use Compatibility Plan. The Elk Hills – Buttonwillow Airport is located approximately four miles north of the Project Site. To evaluate private airport obstructions for this Project, regulatory thresholds of significance were chosen from the *CFR, Title 14, Chapter 1, Part 77, Subpart C*, which sets standards for determining obstructions. These standards apply to existing and proposed manmade objects, objects of natural growth, and terrain.

Naturally Occurring Radioactive Materials (NORM)

NORMs are comprised of radioactive elements found in the environment, such as uranium, thorium and potassium and any of their decay products, such as radium and radon (see below). They are present in very low concentrations in the Earth's crust and are brought to the surface through activities such as oil and gas exploration.

The hazards associated with NORM are inhalation and ingestion routes of entry as well as external exposure where there has been a significant accumulation of scales. Respirators may be necessary in dry processes, where NORM scales and dust become air borne and have a significant chance to enter the body.

The radioactive isotopes found in NORM are radium-226, radium-228 and radon-222, and also daughter products from these radionuclides. If present inside the body, these elements can migrate to the bone tissue and concentrate. The exposure can cause bone cancers and other bone abnormalities. Concentrations of radium, radon, and other daughter products can build over time if there are several years of excessive exposure.

Radium radionuclide's emit alpha and beta particles as well as gamma rays. The radiation emitted from a radium-226 atom is 96 percent alpha particles and 4 percent gamma rays. The alpha particle is the most dangerous particle associated with NORM. Alpha particles are helium nuclei. Alpha particles can travel short distances in air, approximately 2 to 3 centimeters, but cannot penetrate through a dead layer of skin on the human body. If radium atoms are not expelled from the body, they concentrate in areas where chloride ions are prevalent, such as bone tissue. The half-

4.7 HAZARDS AND HAZARDOUS MATERIALS

life for radium 226 is approximately 1,601 years, and will remain in the body for the lifetime of the human.

Beta particles are high energy electrons or positrons. They are in the middle of the scale in terms of ionizing potential and penetration power, being stopped by a few millimeters of aluminum foil. The radiation is a small portion of the total emitted during radium-226 decay. Radium-228 emits 100 percent beta particles, which are also a concern for human health through inhalation and ingestion. Beta particles are electrons or positrons and can travel farther than alpha particles in air. The half-life of radium-228 is approximately 5.75 years.

The gamma rays emitted from radium-226, accounting for 4 percent of the radiation, are harmful to humans with sufficient exposure. Gammas rays are highly penetrating and some can pass through metals, so Geiger-Müller (Geiger) counters with a scintillation probe are used to measure gamma ray exposures when monitoring for NORM.

NORM is not federally regulated in the United States. The U.S. Nuclear Regulatory Commission (NRC) has jurisdiction over a relatively narrow spectrum of radioactive material, and the Federal EPA has jurisdiction over NORM and has not developed NORM regulations to date. Therefore, the responsibility falls upon the State of California and OEHI has implemented a NORM monitoring program to provide guidelines for protecting members of the public, company and contractor employees from possible effects of NORM.

OEHI currently has a NORM Guideline in place at EHOFF. Radiation survey instruments are used to monitor oil and produced water tanks, tank battery process equipment, equipment at water hauling facilities, pig traps, pits and ponds, tubular goods, ground surfaces in immediate vicinity of present or past scale/sludge removal, and scrape yard materials, warehouses and pipeyards. The action level for sale or disposal of equipment and/or management of miscellaneous materials is 50 micro-rem **per hour (µr/hr) including background.**

Radon Gas Hazards

Radon (Rn) is a naturally occurring inert, colorless, odorless, tasteless, radioactive noble gas derived from the decay of radium. Radium occurs in geologic units including granite, shale, phosphate, or pitchblende that contain minor amounts of uranium and was commercially used in luminescent products. Radium decays into reactive, radioactive daughter particles that attach themselves to other particles such as dust and are a lung cancer risk. Radon can move through permeable rocks and soils and can eventually seep into buildings. The movement of radon into buildings is controlled largely by the soil permeability under a foundation and preventing access to the interior of buildings through openings in the foundation.

According to the USEPA, Kern County is located in Radon Zone 2. Zone 2 counties have a predicted average indoor radon screening between 2 and 4 picocuries per liter (pCi/L). This indicates that

4.7 HAZARDS AND HAZARDOUS MATERIALS

there is a moderate potential for elevated indoor radon levels (USEPA 2007) if these structures are to be built for the proposed Project.

Carbon Dioxide (CO₂)

Some CO₂ used as part of the proposed Project will be handled close to or above its critical pressure (73.82 bar) where many of its properties are similar to that of a liquid. In this state it is often referred to as a dense phase fluid. If CO₂ is above both its critical temperature (31.04°C) and critical pressure it is referred to as supercritical. Most of the additional hazards associated with the handling of dense phase or supercritical CO₂ arise when pressure suddenly falls or is lost completely.

In the event of a major pressure loss, e.g. a pipe rupture or containment failure, the depressurization will result in an increase in the volume occupied by the CO₂ of several hundred fold as the escaping fluid undergoes a rapid expansion (and phase change) as a portion essentially “boils” and becomes a gas while the remainder forms solid particles. This rapid, violent expansion causes the temperature of escaping CO₂ to fall very rapidly, frequently below -80°C; and particles of solid CO₂ formed (dry ice) can be expelled at high velocities. Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.

Carbon dioxide is classified as an asphyxiant that inhibits cellular respiration and uptake of oxygen, causing biochemical suffocation. Table 4.7-1 lists the permissible exposure limit (PEL) concentrations of CO₂ as established by the US Occupational Safety and Health Administration (OSHA). These concentrations are stated in terms of Time Weighted Average (TWA) and Short-Term Exposure Limit (STEL). A TWA is the average exposure over a specified period of time, usually eight hours; while the STEL represents the average concentration to which workers can be exposed continuously for a 15 minute period of time without suffering from irritation, chronic or irreversible tissue damage, or narcosis of sufficient degree to increase the likelihood of accidental injury, impaired judgment, or materially reduction in work efficiency.

TABLE 4.7-1: CO₂ EXPOSURE LIMITS

Exposure Limit for Carbon Dioxide	Concentration	Exposure Period
OSHA TWA	5,000 ppm	Maximum concentration to which a healthy individual can be exposed over an eight-hour work period and expressed in parts per million.
OSHA STEL	30,000 ppm	The maximum level to which a healthy individual can be exposed to a chemical for 15 minutes and escape without suffering irreversible health effects or impairing symptoms and expressed in parts per million.

4.7 HAZARDS AND HAZARDOUS MATERIALS

Hydrogen Sulfide (H₂S)

Hydrogen sulfide (H₂S, CAS # 7783-06-4) is an extremely hazardous, toxic compound. It is a colorless, flammable gas that can be identified in relatively low concentrations by a characteristic rotten egg odor. The gas occurs naturally in oil and gas production fields, and results from the bacterial breakdown of organic matter in the absence of oxygen.

H₂S has a very low odor threshold, with its smell being easily perceptible at concentrations well below one (1) part per million (ppm) in air. The odor increases as the gas becomes more concentrated, with the strong rotten egg smell recognizable up to 30 ppm. Above this level, the gas is reported to have a sickeningly sweet odor up to around 100 ppm. However, at concentrations above 100 ppm, a person's ability to detect the gas is affected by rapid temporary paralysis of the olfactory nerves in the nose, leading to a loss of the sense of smell. This means that the gas can be present at dangerously high concentrations, with no perceivable odor. Prolonged exposure to lower concentrations can also result in similar effects of olfactory fatigue.

H₂S is classified as a chemical asphyxiant, similar to CO₂; however, H₂S is also toxic and flammable. Typical exposure symptoms include:

- Low (0 – 10 ppm) irritation of the eyes, nose and throat;
- Moderate (10 – 50 ppm) headache, dizziness, nausea and vomiting, coughing and breathing difficulty; and
- High (50-200 ppm) severe respiratory tract irritation, eye irritation including acute conjunctivitis, shock, convulsions, coma, and death in severe cases.

Prolonged exposures at lower levels can lead to bronchitis, pneumonia, migraine headaches, pulmonary edema, and loss of motor coordination. While the distinctive odor of H₂S is easily detected, its olfactory fatigue effects mean that one cannot rely on the nose as a warning device. The only reliable way to evaluate exposure levels is to measure the amount in the air using continuous monitoring systems such as personal H₂S monitoring alarms set at 10 ppm or less.

With a vapor density of 1.19, H₂S is approximately 20 percent heavier than air, so this invisible gas will collect in depressions and in confined spaces. Cal-OSHA requires the use of direct reading gas detection instrumentation before entering any areas where H₂S is suspected.

H₂S may be found at EHOFF near production tanks and separators, produces water tanks/filters, compressor stations, casing vent systems, valve boxes/drains, well cellars, mud shakers, electrical vaults, and low lying areas near production and gas operations facilities. Typically, H₂S meters are installed at their larger oil related facilities and at least one person per work crew, including contractors, subcontractors, and visitors, are required to have a calibrated portable H₂S monitor. Monitors sound an audible alarm when 10 ppm of H₂S is detected.

4.7 HAZARDS AND HAZARDOUS MATERIALS

OEHI has specific recommendation to follow if the H2S alarm is sounded at the EHOFF. All contractors and subcontractors are required to take a mandatory safety OEHI orientation that outlines working safely in conditions where H2S may accumulate. If an alarm is sounded, workers are to stop what they are doing and immediately check the direction the wind is blowing, followed by evacuation crosswind then upwind of the suspected release. Re-entry to the work site is only allowed after it is verified that the H2S levels are below 10 ppm, a new Job Safety Analysis (JSA) Permit is completed, and continuous monitoring is conducted.

The OSHA PEL-TWA and PEL-Ceiling for H2S is listed below in Table 4.7-2. Because H2S is a highly toxic substance, a ceiling value is reported instead which corresponds to a concentration that may not be exceeded for any period of time.

TABLE 4.7-2: H2S EXPOSURE LIMITS		
Exposure Limit for Hydrogen Sulfide	Concentration	Exposure Period
OSHA TWA	10 ppm	Maximum concentration to which a healthy individual can be exposed over an eight-hour work period and expressed in parts per million.
OSHA Ceiling Limit	20 ppm	A ceiling limit is one that may not be exceeded for any period of time, and is applied to irritants and other materials that have immediate effects.

4.7.3 Regulatory Setting

The use of hazardous materials and disposal of hazardous waste are subject to numerous laws and regulations at all levels of government. Table 4.7-3 provides a brief overview of federal and state laws and regulations.

4.7 HAZARDS AND HAZARDOUS MATERIALS

TABLE 4.7-3: APPLICABLE HAZARDOUS MATERIALS LAWS AND REGULATIONS	
Law/Regulation	Context
The Hazard Communication Standard (HCS)	The Occupational Safety and Health Act of 1970 established the OSHA within the US Department of Labor. The original Act included language to the effect that employees should be apprised of all hazards to which they are exposed to on the job. In the early 1980's, OSHA implemented this instruction by enacting the Hazard Communication Standard (HCS) as 29 CFR 1910.1200. The HCS became effective in 1986. A fundamental premise of the HCS is that employees who may be exposed to hazardous chemicals in the workplace have a right to know about the hazards and how to protect themselves. For this reason, the HCS is sometimes referred to as the Worker Right-to-Know Legislation. The HCS sets forth guidelines and requirements in six areas: Chemical labeling, Material Safety Data Sheets (MSDS), Hazard Determination, Written Implementation Program, Employee Training, and Trade Secrets.
Hazardous Materials Management	State and federal laws require detailed planning to ensure that hazardous materials are properly handled, used, stored, and dispose of, and in the event that such materials are accidentally released, to prevent or to mitigate injury to health or the environment. These laws require hazardous materials users to prepare written plans, such as HCS, Hazardous Materials Business Plans, and Chemical Hygiene Plans. Laws and regulations require hazardous materials users to store these materials appropriately and to train employees to manage them safely. A number of agencies participate in enforcing hazardous materials management requirements. For the Project Site, the KCEHSD is the agency most involved.
Hazardous Waste Handling	The California Environmental Protection Agency's (Cal EPA) Department of Toxic Substances Control (DTSC) regulates the generation, transportation, treatment, storage, and disposal of hazardous material waste. These laws impose "cradle to grave" regulatory systems that require generators of hazardous materials waste to handle it in a manner that protects human health and the environment to the extent possible. The DTSC permits and oversees hazardous materials waste treatment, long-term storage, and disposal facilities.
Hazardous Materials Transportation	The DOT regulates hazardous materials transportation between states. Within California, the state agencies with primary responsibility for enforcing federal and state regulations and for responding to transportation emergencies are the California Highway Patrol (CHP) and the California Department of Transportation (Caltrans). Together, federal and state agencies determine driver-training requirements, load labeling procedures, and container specifications. Although special requirements apply to transporting hazardous materials, requirements for transporting hazardous waste are more stringent, and hazardous waste haulers must be licensed to transport hazardous waste on public roads.
Pipeline Safety (Hazardous Liquids or Highly Volatile Liquids)	The Federal Hazardous Liquid Pipeline Safety Act of 1979 established the basic safety standards for the transportation of hazardous liquids and pipeline facilities. Authority for enforcement of this law rests with the DOT's Office of Pipeline Safety. Specific federal regulations concerning the safety of hazardous liquid pipelines are found in parts 190, 195, 199 and 40 of the Code of Federal Regulations. Title 49 CFR, Part 195 (Transportation of Hazardous Liquids by Pipeline) was amended on October 1, 2001 to include Pipeline Integrity Management and defines high consequence areas, requires preparation of an Integrity Management Plan, and the performance of integrity assessments. The most current version of 49 CFR 195, revised on July 3, 2008, regulates rural low-stress and gathering

4.7 HAZARDS AND HAZARDOUS MATERIALS

TABLE 4.7-3: APPLICABLE HAZARDOUS MATERIALS LAWS AND REGULATIONS	
Law/Regulation	Context
	pipelines within a prescribed buffer of an Unusually Sensitive Area. The Elder California Pipeline Safety Act of 1981, authorized the California State Fire Marshal to exercise exclusive safety and enforcement authority over intrastate hazardous liquid pipelines. Chapter 5.5 of the California Government Code, Sections 51010-51019.1.
Injection Well Regulations	Section 1425 was added to the Safe Drinking Water Act in 1980. This section deals with underground injection wells related to the recovery and production of oil and natural gas (Class II injection wells). This addition to the Safe Drinking Water Act allows states with programs that effectively protect drinking water sources through the regulation of Class II injection wells to continue their programs in full compatibility with the Safe Drinking Water Act.
Soil and Groundwater Contamination	The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 and associated Superfund Amendments provide the EPA with the authority to identify hazardous sites, to require site remediation, and to recover the costs of site remediation from polluters. California has enacted similar laws intended to supplement the federal program. The DTSC is primarily responsible for implementing California's Superfund Law.
Emergency Response	California has developed an emergency response plan to coordinate emergency services provided by federal, state, and local government and private agencies. Responding to hazardous materials incidents is one part of this plan. The plan is administered by the California Emergency Management Agency, which coordinates the responses of other agencies, including Cal EPA, CHP, the California Department of Fish and Game (CDFG), the State Regional Water Quality Control Board (RWQCB), and the local fire department. The fire department provides first response capabilities, if needed, for hazardous materials emergencies within the Project area.

4.7.3.1 Kern County

The policies, goals, and implementation measures in the Kern County General Plan for hazards and hazardous materials applicable to the proposed Project are provided below. The Kern County General Plan contains additional policies, goals, and implementation measures that are more general in nature and not specific to development such as the Project. Therefore, they are not listed below, but, as stated in Chapter 2, "Introduction," all policies, goals, and implementation measures in the Kern County General Plan are incorporated by reference.

4.7 HAZARDS AND HAZARDOUS MATERIALS

Kern County General Plan

Safety Element

Wildland and Urban Fire

Goals

Goal 1. Minimize injuries and loss of life and reduce property damage.

Policies

Hazard Identification

Access and Evacuation Routes. All developments must be planned with circulation routes that will ensure safe access for fire and other emergency equipment. The circulation routes must include secondary means of ingress and egress, consistent with topography, to meet emergency needs. The general circulation routes presently provided throughout Kern County by federal, state, and County-maintained road systems are adequate for access and evacuation. State and county laws regulate standards for new public circulation routes. Private circulation routes that are not maintained by the state or county are subject to the standards set forth in Kern County Ordinance No. G-1832.

Clearance of Vegetative Cover for Fire Control. In accordance with the 1963 State Public Resources Code clearance law, a minimum vegetative growth around structures, especially in brush- and tree-covered watershed areas, must be kept to a minimum. The enactment of a local ordinance is necessary where more restrictive fire safety clearance measures are desirable to meet local conditions.

Fuel Breaks and Firebreaks. Fuel breaks and/or firebreaks separating communities or clusters of structures from the native vegetation may be required. Such fuel breaks may be “greenbelts,” as all vegetation need not be removed but rather thinned or landscaped to reduce the volume of fuel. All fuel and firebreaks are required to meet the minimum design standards of the Kern County Fire Chief. The Fire Department’s Chief may require a fire plan during the critical fire season; the plan is to reflect the proposed plan of operation on the development for fire prevention and suppression. The parcel size and setback distances of buildings placed thereon should be such that adequate clearance of flammable vegetation cover may be performed within the limits of the owner’s parcel of land. Should the owner of a property fail to create the required firebreak clearance following proper notice, the County may require the clearing to be done and make the expense of such clearing a lien against the property upon which the work was accomplished.

Water Supply for Fire Control. An adequate and reliable water supply must be provided specifically for fighting fires. Minimum requirements of water flow are determined by the Kern County Fire Chief. The fire department promotes the installation of fire hydrants in areas served by water companies. In areas served by a water purveyor, single-family residences constructed on existing parcels of record

4.7 HAZARDS AND HAZARDOUS MATERIALS

may be provided with a suitable water supply for firefighting based on County requirements.

Hazardous Fire Area. The Kern County Hazardous Fire Area was established by an addendum to the Uniform Fire Code, Section I.49H, under Section 4016 of the Kern County Ordinance. The boundaries of the Hazardous Fire Area are determined and publicly announced before the start of each annual fire season, normally the period from April 15 to December 01, except when the fire chief extends this period. The Hazardous Fire Area consists mainly of wildlands, which are mountain and hill land in an uncultivated, more or less natural state, covered with timber, wood, brush, and grassland. The Hazardous Fire Area also includes some urban influence and agricultural uses where it occurs adjacent to wildland areas. The wildlands include valuable watersheds that must be preserved for receiving and passing water into surface streams and underground storage. Protection of the watersheds will prevent erosion and flood damages or the protection of wildlands, it is necessary to consider all factors that will aid in fulfilling the policy stated in CEQA Public Resources Code Section 21000 et seq., to "create and maintain conditions under which man and nature can exist in productive harmony to fulfill the social and economic requirements of present and future generations."

Policies

Policy 1. Require discretionary projects to assess impacts on emergency services and facilities.

Policy 2. The County will encourage the promotion of public education about fire safety at home and in the work place.

Policy 3. The County will encourage the promotion of fire prevention methods to reduce service protection costs and costs to taxpayers.

Policy 4. Ensure that new development of properties have sufficient access for emergency vehicles and for the evacuation of residents.

Policy 5. Require that all roads in wildland fire areas are well marked and that homes have addresses prominently displayed.

Policy 6. All discretionary projects shall comply with the adopted Fire Code and the requirements of the Fire Department.

Implementation Measures

Implementation Measure A. Require that all development comply with the requirements of the Kern County Fire Department or other appropriate agency regarding access, fire flows, and fire protection facilities.

4.7 HAZARDS AND HAZARDOUS MATERIALS

Safety Element

Hazardous Materials

Policies

Policy 1. The proposed siting or expansion of hazardous waste facilities will be in conformance with the adopted Kern County and Incorporated Cities Hazardous Waste Management Plan.

Policy 2. Innovative technologies to manage hazardous waste streams generated in Kern County will be encouraged.

Implementation Measures

Implementation Measure A. Facilities used to manufacture, store, and use of hazardous materials shall comply with the Uniform Fire Code, with requirements for siting or design to prevent on-site hazards from affecting surrounding communities in the event of inundation.

Implementation Measure B. The proposed siting or expansion of hazardous waste facilities will be in conformance with the adopted Kern County and Incorporated Cities Hazardous Waste Management Plan.

Circulation Element

Airport Land Use Compatibility Plan (ALUCP)

Goals

Goal 1. Plan for land uses that are compatible with public airport and military bases and mitigate encroachment issues.

Policies

Policy 1. Review land designations and zoning near public and private airports, Edwards Air Force Base (EAFB) and Naval Air Weapons China Lake (China Lake) for compatibility.

Policy 2. To the extent legally allowable prevent encroachment on public airport and military base operations from incompatible, unmitigated land uses.

Implementation Measures

Implementation Measure A. Review discretionary land use development applications within the airports influence area and the military base operating area as shown in the ALUCP for consistency.

Implementation Measure B. Coordinate and cooperate with airport operators, the County Department of Airports, Caltrans, Division of Aeronautics, affected cities, EAFB, China Lake, and the

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U.S. Department of Defense (DOD) on ALUCP, review of land use applications, public education and encroachment issues.

Kern County ALCUP-Section 1.0 General Applicability

Section 1.7.1(c). Prior to the approval of a proposal involving any type of land use development, as stated in Section 1.6.1, or other review as required by a Specific Plan, specific findings shall be made that such development is compatible with the training and operational missions of the military aviation installations. Incompatible land uses that result in significant impacts on the military mission of DOD installations or to the Joint Service Restricted R-2508 Complex that cannot be mitigated, shall not be considered consistent with this plan.

Circulation Element

Transportation of Hazardous Materials

Goals

Goal 1. Reduce risk to public health from transportation of hazardous materials.

Policies

Policy 1. The commercial transportation of hazardous material, identification, and designation of appropriate shipping routes will be in conformance with the adopted Kern County and Incorporated Cities Hazardous Waste Management Plan.

Policy 2. Kern County and affected cities should reduce use of County-maintained roads and city-maintained streets for transportation of hazardous materials.

Implementation Measures

Implementation Measure A. Roads and highways utilized for commercial shipping of hazardous waste destined for disposal will be designated as such pursuant to Vehicle Code Sections 31303 et seq. Permit applications shall identify commercial shipping routes they propose to utilize for particular waste streams.

Kern County Zoning Ordinance

Interpretation and General Standards

Section 19.08.160 Height of Structures. This section restricts the height of structures or buildings to the maximum permitted heights shown in Figure 19.08.160 unless the military authority responsible for operations in that flight area first provides the planning director with written concurrence that the height of the proposed structure or building would create no significant military

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mission impacts. Nearly the entire Project Site is located within an area on Figure 19.08.160 shown as red and structures are limited to 200 feet above ground elevation.

Kern County Wildland Fire Management Plan

The Kern County Wildland Fire Management Plan documents the assessment of wildland fire situations throughout the State Responsibility Areas (SRA) within the County. The Kern County Fire Department Wildland Fire Management Plan provides for systematically assessing the existing levels of wildland protection services and identifying high-risk and high-value areas that are potential locations for costly and damaging wildfires. The goal of the plan is to reduce costs and losses from wildfire by protecting assets at risk through focused pre-fire management prescriptions and increasing initial attack success. Based on this assessment, preventive measures are implemented, including the creation of wildfire protection zones.

Kern County Hazardous Waste Management Plan

In response to the growing public concern regarding hazardous waste management, State Assembly Bill 2948 (Tanner 1986) enacted legislation authorizing local governments to develop comprehensive hazardous waste management plans. The intent of each plan is to ensure that adequate treatment and disposal capacity is available to manage the hazardous wastes generated within the local government's jurisdiction.

The Kern County and Incorporated Cities Hazardous Waste Management Plan (Hazardous Waste Plan) was first adopted by Kern County and each incorporated city before September 1988 and was subsequently approved by the State Department of Health Services. The Hazardous Waste Plan was updated and incorporated by reference into the Kern County General Plan in 2004 as permitted by Health and Safety Code Section 25135.7(b), and thus must be consistent with all other aspects of the Kern County General Plan. The Hazardous Waste Plan provides policy direction and action programs to address current and future hazardous waste management issues that require local responsibility and involvement in Kern County. In addition, the Hazardous Waste Plan discusses hazardous waste issues and analyzes current and future waste generation in the incorporated cities, county, and state and federal lands. The purpose of the Hazardous Waste Plan is to coordinate local implementation of a regional action to effect comprehensive hazardous waste management throughout Kern County. The action program focuses on development of programs to equitably site needed hazardous waste management facilities; to promote on-site source reduction, treatment, and recycling; and to provide for the collection and treatment of small quantity hazardous waste. An important component of the Hazardous Waste Plan is the monitoring of hazardous waste management facilities to ensure compliance with federal and state hazardous waste regulations. The siting criteria and any subsequent environmental documentation required pursuant to the CEQA would also ensure the mitigation of adverse impacts associated with the siting of any new hazardous waste facility.

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Kern County Airport Land Use Compatibility Plan

The Kern County ALUCP has been prepared to establish procedures and criteria by which Kern County and the affected incorporated cities can address compatibility issues when planning and discussing airports and the land uses around them. The plan addresses all properties on which land uses could be affected by present or future aircraft operations at 16 airports. The operation nearest to the Project Site is the Elk Hills – Buttonwillow Airport (approximately 4 miles north of Project Site). The Project Site is not within the sphere of influence of the Elk Hills – Buttonwillow Airport.

Kern County Multi-Hazard Mitigation Plan

The purpose of hazard mitigation plans is to reduce or eliminate long-term risk to people and property from natural hazards. All Multi-Hazard Mitigation Plans must be prepared to meet the Disaster Mitigation Act of 2000 (DMA 2000) requirements in order to maintain eligibility for the Federal Emergency Management Agency (FEMA) Pre-Disaster Mitigation (PDM) and Hazard Mitigation Grant Programs (HMGP). The Kern County Hazard Mitigation Planning Committee (HMPC) comprised of key County, City, Special District and Stakeholder representatives is responsible for the preparation of the Kern County Multi-Hazard Mitigation Plan. The planning process examined the recorded history of losses resulting from natural hazards, and analyzed the future risks posed to the county by these hazards. Kern County is vulnerable to several natural hazards that are identified, profiled, and analyzed in the plan. Earthquakes, wildfires, floods and drought are some of the hazards that can have a significant impact on the County.

The plan puts forth several mitigation goals and objectives that are based on the results of the risk assessment. The plan includes specific recommendations for actions that can mitigate future disaster losses. The plan also includes a review of the County's current capabilities to reduce hazard impacts. The multi-jurisdictional plan includes the County, and the incorporated municipalities Arvin, Bakersfield, California City, Delano, Maricopa, McFarland, Ridgecrest, Shafter, Taft, Tehachapi, and Wasco. This plan also covers 45 special districts that include school, recreation and park, water, community service, and other districts.

4.7.3.2 State

Soil Contamination

Soils having concentrations of contaminants higher than certain acceptable levels must be handled and disposed as hazardous waste when excavated. The CCR, Title 22, §66261.20-24 contains technical descriptions of characteristics that would cause a soil to be classified as a hazardous waste.

Hazardous Materials Management

The California Hazardous Materials Release Response Plans and Inventory Law of 1985 (Business Plan Act) requires that any business that handles hazardous materials prepare a business plan, which must include the following:

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Details, including floor plans, of the facility and business conducted at the site;

An inventory of hazardous materials that are handled or stored on site;

An emergency response plan; and

A safety and emergency response training program for new employees with annual refresher courses.

In January 1996, the Cal EPA adopted regulations implementing a Unified Hazardous Waste and Hazardous Materials Management Regulatory Program (Unified Program). The program has six elements: hazardous waste generators and hazardous waste on-site treatment; underground storage tanks; aboveground storage tanks; hazardous materials release response plans and inventories; risk management and prevention programs; and Uniform Fire Code hazardous materials management plans and inventories. The plan is implemented at the local level. The local agency that is responsible for the implementation of the Unified Program is called the Certified Unified Program Agency (CUPA), and the KCEHSD is designated as the CUPA.

Hazardous Waste Handling

Under Resource Conservation and Recovery Act (RCRA) of 1976 - 42 U.S.C. s/s 6901 et seq., individual states may implement their own hazardous waste programs in lieu of RCRA as long as the state program is at least as stringent as federal RCRA requirements. The EPA must approve state programs intended to implement federal regulations. In California, Cal EPA and the DTSC, a department within Cal EPA, regulate the generation, transportation, treatment, storage, and disposal of hazardous waste. The EPA approved California's RCRA program, called the Hazardous Waste Control Law (HWCL), in 1992. The DTSC has primary hazardous material regulatory responsibility, but can delegate enforcement responsibilities to local jurisdictions that enter into agreements with the DTSC for the generation, transport, and disposal of hazardous materials under the authority of the HWCL.

The hazardous waste regulations establish criteria for identifying, packaging, and labeling hazardous wastes; prescribe the management of hazardous wastes; establish permit requirements for hazardous waste treatment, storage, disposal, and transportation; and identify hazardous wastes that cannot be disposed of in ordinary landfills. The generator for a minimum of three years must retain hazardous waste manifests. Hazardous waste manifests provide a description of the waste, its intended destination, and regulatory information about the waste. A copy of each manifest must be filed with the state. The generator must match copies of hazardous waste manifests with receipts from treatment, storage, and disposal facilities.

Contaminated soils and other hazardous materials removed from a site during construction or remediation may need to be handled as hazardous waste. In Kern County, remediation of contaminated sites is performed under the oversight and with the cooperation of the RWQCB.

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Hazardous Materials Transportation

The State of California has also adopted DOT regulations for the intrastate movement of hazardous materials. State regulations are contained in 26 CCR. In addition, the State of California regulates the transportation of hazardous waste originating in the state and passing through the state (26 CCR). Both regulatory programs apply in California.

The two state agencies with primary responsibility for enforcing federal and state regulations and responding to hazardous materials transportation emergencies are the CHP and Caltrans.

The CHP enforces hazardous material and hazardous waste labeling and packing regulations to prevent leakage and spills of material in transit and to provide detailed information to cleanup crews in the event of an accident. Vehicle and equipment inspection, shipment preparation, container identification, and shipping documentation are all part of the responsibility of the CHP, which conducts regular inspections of licensed transporters to assure regulatory compliance. Caltrans has emergency chemical spill identification teams at as many as 72 locations throughout the state that can respond quickly in the event of a spill.

Common carriers are licensed by the CHP, pursuant to California Vehicle Code Section 32000. This section requires the licensing of every motor (common) carrier who transports, for a fee, in excess of 500 pounds of hazardous materials at one time, and every carrier, if not for hire, who carries more than 1,000 pounds of hazardous material of the type requiring placards.

Every hazardous waste package type used by a hazardous materials shipper must undergo tests that imitate some of the possible rigors of travel. While not every package must be put through every test, most packages must be able to be kept under running water for a time without leaking; dropped, fully loaded, onto a concrete floor; compressed from both sides for a period of time; subjected to low and high pressure; and frozen and heated alternately.

Hazardous Materials Emergency Response

Pursuant to the Emergency Services Act, California has developed an Emergency Response Plan to coordinate emergency services provided by federal, state, and local governmental agencies and private persons. Response to hazardous materials incidents is one part of this plan. The plan is administered by the California Emergency Management Agency. The Office of Emergency Services (OES) coordinates the responses of other agencies, including the EPA, CHP, CDFG, SJVAPCD, and local agencies.

Pursuant to the Business Plan Law, local agencies are required to develop "area plans" for response to releases of hazardous materials and wastes. These emergency response plans depend to a large extent on the Business Plans submitted by persons who handle hazardous materials. An area plan must include pre-emergency planning and procedures for emergency response, notification, and coordination of affected governmental agencies and responsible parties, training, and follow up. As

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described above under Hazardous Materials Management, the KCEHSD, which is also the CUPA, is responsible for implementing the Unified Program, which includes provisions for the implementation of hazardous materials release response plans.

In addition, California Accidental Release Prevention Program (CalARP) regulations became effective January 1, 1997, replacing the California Risk Management and Prevention Program. CalARP was created to prevent the accidental release of regulated substances. It covers businesses that store or handle certain volumes of regulated substances at their facilities. A list of regulated substances is found in Section 2770.5 of the CalARP regulations. If a business has more than the listed threshold quantity of a substance, an accidental release prevention program must be implemented and a risk management plan may be required. The KCEHSD, local CUPA, is responsible for implementing the provisions of CalARP.

Pipeline Safety

The Elder California Pipeline Safety Act of 1981 authorized the California State Fire Marshal to exercise exclusive safety and enforcement authority over intrastate hazardous liquid pipelines (Chapter 5.5 of the California Government Code, Sections 51010-51019.1). This responsibility is exercised by the California State Fire Marshal, Office of Pipeline Safety. The California State pipeline safety regulations generally mirror the federal regulations discussed further below.

Wildfires

Under Title 14 of the CCR, the California Department of Forestry and Fire Protection (CAL FIRE) has the primary responsibility for implementing wildfire planning and protection for the State Responsibility Areas (SRA). The CAL FIRE develops fire safe regulations and issues fire safe clearances for land within a fire district of the SRA. More than 31 million acres of California's privately owned wildlands are under the jurisdiction of the CAL FIRE.

In addition to wildland fires, the CAL FIRE's planning efforts involve responding to other types of emergencies that may occur on a daily basis, including residential or commercial structure fires, automobile accidents, heart attacks, drowning victims, lost hikers, hazardous material spills on highways, train wrecks, floods, and earthquakes. Through contracts with local government, the CAL FIRE provides emergency services in 36 of California's 58 counties.

4.7.3.3 Federal

Hazardous Materials and Waste

Hazardous materials and waste are regulated at the federal level by the EPA through numerous laws. The following list identifies the primary laws and their purposes:

Resource Conservation and Recovery Act (RCRA) enacted in 1976, 1076 – 40 CFR Parts 240-299. Establishes a system for controlling hazardous waste from its point of origin to its final disposal.

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Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980. Establishes prohibitions and requirements concerning closed and abandoned hazardous waste sites; provides for liability of persons responsible for release of hazardous waste at these sites; and establishes a trust fund to provide for cleanup when no responsible party can be identified.

National Oil and Hazardous Substances Pollution Contingency Plan. Outlines requirements for responding to both oil spills and releases of hazardous substances and provides for comprehensive system for reporting, spill containment, and cleanup.

Clean Water Act. Establishes the basic structure for regulating discharges of pollutants into the waters of the United States; establishes pollution control programs such as setting wastewater standards for industry; sets water quality standards for all contaminants in surface waters; and makes it unlawful for any person to discharge any pollutant from a point source into navigable waters without a permit.

Spill Prevention, Control, and Countermeasures (SPCC) Plan – 40 CFR Part 112. Requires facilities that store, handle, or produce significant quantities of hazardous material to prepare a plan to ensure that containment and countermeasures are in place to prevent release of hazardous materials to the environment.

Superfund Amendments and Reauthorization Act (SARA). Establishes a nationwide emergency planning and response program and reporting requirements for facilities that store, handle, or produce significant quantities of hazardous materials. Identifies requirements for planning, reporting, and notification concerning hazardous materials.

Occupational Safety and Health Standards (Title 29 CFR Parts 1910 and 1926). Provides regulations for safety in the workplace and provides regulations for construction safety.

Clean Air Act (CAA). Regulations (40 CFR 68) under the CAA are designed to prevent accidental releases of hazardous materials. These regulations require facilities that store a Toxic Quantity (TQ) or greater of listed hazardous materials to develop a Risk Management Plan, including hazard assessments and response programs to prevent accidental releases of certain chemicals. Section 112(r)(5) of the CAA discusses the chemicals regulated. These chemicals are listed in 40 CFR 68.130 of the regulations.

Pipeline Safety

The Federal Hazardous Liquid Pipeline Safety Act of 1979 established the basic safety standards for the transportation of hazardous liquids and pipeline facilities. The DOT Pipeline and Hazardous Material Safety Administration (PHMSA), acting through the Office of Pipeline Safety (OPS), administers the Department's national regulatory program to assure the safe transportation of natural gas, petroleum, and other hazardous materials by pipeline. OPS develops regulations and other

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approaches to risk management to assure safety in design, construction, testing, operation, maintenance, and emergency response of pipeline facilities.

Specific federal regulations concerning the safety of hazardous liquid pipelines are found in parts 190, 195, 199 and 40 CFR. These parts have been amended numerous times since their inception in 1979. Most recently, the regulations have been amended to focus on potential impacts to high consequence areas and exerting jurisdiction to rural low-stress and gathering pipelines located in close proximity to an Unusually Sensitive Area. Although CO₂ is not considered a hazardous liquid, vapors from liquefied gas are initially heavier than air and spread along the ground. Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite and potentially subject to DOT regulation when conveyed by pipeline. It is anticipated that the CO₂ lines running to the satellite stations from the CO₂ EOR Processing Facility will be subject to compliance with 49 CFR 195.

4.7.4 Impacts and Mitigation Measures

4.7.4.1 Methodology

Potential impacts on the environment and public health from hazards and hazardous materials were evaluated on the basis of the existing conditions of the Project Site and adjacent properties, and historical uses, to determine the likelihood of encountering hazardous materials.

4.7.4.2 Thresholds of Significance

The CEQA Guidelines and the Kern County CEQA Implementation Document state that a project would have a significant impact from a hazard or hazardous materials if it would:

Create a significant hazard for the public or the environment through the routine transport, use, or disposal of hazardous materials;

Create a significant hazard for the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment;

Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school;

Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, create a significant hazard to the public or the environment;

Result in a safety hazard for people residing or working in the Project area for a project located within the Kern County ALUCP;

Result in a safety hazard for people residing or working in the Project area for a project within the vicinity of a private airstrip;

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Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan; and

Expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands;

- The CO2 EOR Processing Facility is located approximately 4 miles southwest of Elk Hills Elementary School in Tupman. This significance criterion is analyzed below for potential Project impacts.

4.7.4.3 *Project Impacts*

IMPACT HAZ-1 Routine Transport, Use, or Disposal of Hazardous Materials.

Construction

The proposed Project will transport, use, dispose, and store hazardous materials during construction of the Project. These materials would primarily be limited to fuels and construction materials, including: gasoline, diesel fuel, motor oil (for construction equipment), compressed gas cylinders containing oxygen, acetylene, and argon (for welding), paint and cleaning solvents, concrete form release, miscellaneous lubricants, adhesives, and sealants (ManageTech Solutions 2010).

The majority of hazardous waste generated during construction of the proposed Project will consist of liquid waste such as waste oil from equipment maintenance, flushing and cleaning fluids, waste solvents, and waste paints or other coatings. Contractors will employ practices consistent with the proper handling of all hazardous wastes in accordance with applicable laws, ordinances, regulations and standards. Workers will be required to meet all licensing requirements, and contractors will be required to train employees where required, be aware of accumulation limits and duration, and maintain records and meet reporting requirements. All hazardous wastes will be removed from the Project Site by a licensed hazardous waste management facility (ManageTech Solutions 2010).

Contractors will maintain a set of MSDSs for each chemical that is used on the Project, as well as notify workers where the chemicals are stored and the hazard associated with the chemicals. Compliance with applicable laws, ordinances, regulations and standards will adequately mitigate the hazards associated with the transport, use, and disposal of hazardous materials. This is a less than significant impact.

Operations

Hazardous materials that may be routinely used in conjunction with the operation of the proposed Project include: compressed CO2, nitrogen, natural gas liquids, produced hydrocarbon gas, dimethyl ethers of polyethylene glycol, chemical reagents (acids/bases/standards), miscellaneous gases (acetylene, oxygen, other welding gases, calibration gases), natural gas, diesel fuel, paint, thinners,

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solvents, and adhesives (ManageTech Solutions 2010). Dimethyl ether (DME) is an organic compound that is a colorless gas used as precursor to other organic compounds and as an aerosol propellant. If storage of large quantities of chemicals is planned for operation of the proposed Project, OEHI will be required to prepare a Hazardous Materials Business Plan and submit it to the KCEHSD.

Storage, handling, and use of hazardous materials will be in accordance with applicable laws, ordinances, regulations and standards. Storage will occur in designated areas. Bulk tanks will be placed atop secondary containment to contain leaks or spills. Personnel who could potentially handle hazardous materials will be trained to perform their duties and to respond to emergency situations that may occur in the event of an accidental spill or release (ManageTech Solutions 2010). Compliance with applicable laws, ordinances, regulations and standards will adequately mitigate the hazards associated with the transport, use, and disposal of hazardous materials. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT HAZ-2 Create a Significant Hazard for the Public or the Environment through Reasonably Foreseeable Upset and Accident Conditions Involving the Release of Hazardous Materials into the Environment

Construction

The proposed Project will transport, use, dispose, and store hazardous materials during construction of the Project. These materials would primarily be limited to fuels and construction materials, including: gasoline, diesel fuel, motor oil (for construction equipment), compressed gas cylinders containing oxygen, acetylene, and argon (for welding), paint and cleaning solvents, concrete form release, miscellaneous lubricants, adhesives, and sealants (ManageTech Solutions 2010).

The most likely accidents involving hazardous materials during construction could occur from small-scale spills during refueling of equipment, cleaning, or the use of other materials in the storage areas. Any spills that occur during construction would be reported to applicable regulatory agencies (KCEHSD) and appropriately responded to and mitigated in accordance with OEHI's oil field spill response plan. In addition, all hazardous materials and wastes will be handled and disposed in accordance with applicable laws, ordinances, regulations, and standards. Construction of the proposed Project is not expected to create a significant hazard for the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment. In addition, it is the responsibility of each contractor to have a health

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and safety plan (HASP) in place in case of an accident with proper chain-of-command to be followed during the notification process. This is a less than significant impact.

Operations

Hazardous Materials Used in Existing Oil Field Operations

Hazardous materials that may be routinely used in conjunction with the operation of the proposed Project include: CO₂, nitrogen, natural gas liquids, produced hydrocarbon gas, dimethyl ethers of polyethylene glycol, chemical reagents (acids/bases/standards), miscellaneous gases (acetylene, oxygen, other welding gases, calibration gases), natural gas, diesel fuel, paint, thinners, solvents, and adhesives (ManageTech Solutions 2010).

A majority of these materials are commonly used at the Project Site during existing oil recovery operations. The safe handling of these materials is addressed through existing OEHI hazardous materials handling practices that comply with all applicable regulatory requirements. These safe handling practices in addition to the relative remoteness of the Project Site to sensitive receptors are expected to minimize potential impacts. The use of hazardous materials that are already commonly used as part of existing oil field operations are not evaluated further in this SEI.

Use of CO₂ and H₂S

The use of large volumes of pressurized CO₂ for enhanced oil recovery presents a new potential hazard to the Project Site. Because CO₂ is heavier than air, it has potential to be an asphyxiant; a release of CO₂ during an upset condition or accident has the potential to create a hazard to the public. The CO₂ provided to the proposed Project from HECA is expected to contain hydrogen sulfide with a peak concentration of 100 ppm and an average concentration of 30 ppm. As hydrogen sulfide is toxic, a release could create a hazard to the public. The hazards associated with conveyance and use of CO₂ in support of the proposed Project has been evaluated in two studies summarized below. It should be noted that the reports conclude that the only two Project components that have the potential to substantially impact the public are operation of the main CO₂ truck line from the HECA project to the CO₂ EOR Processing Facility in Section 27S and operation of the CO₂ EOR Processing Facility due to the proximity of Tupman to this facility. Due to flares operating at the CO₂ EOR Processing Facility and storage of excess CO₂ within the Northwest Stevens Reservoir, upset conditions are anticipated to be significantly reduced and have no impact on the public.

A Preliminary Hazards Review Report (Mustang, 2010) consistent with the requirements of OSHA's 29 CFR 1910.119 was prepared to identify and evaluate potential hazards of the proposed Project. A preliminary Hazards Identification (HAZID) session was conducted by the Pre-FEED Design Team over a two-day period in January 2010. In many cases, the identified hazard issue was one that is best "Deferred to FEED" (e.g., detailed engineering design). It should be noted that a majority of the potential hazards identified do not pose a substantial hazard to the public through the release of hazardous materials. The Preliminary Hazards Review Report does identify a release of CO₂ and

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H₂S from the CO₂ EOR Processing Facility and trunk line from HECA as a potential hazard that warrants further study.

CO₂ Risk Analysis

A Carbon Dioxide Pipeline Risk Analysis was prepared by HECA for the proposed CO₂ trunk line from HECA to the CO₂ EOR Processing Facility located in Section 27S. The risks associated with CO₂ release within the Project Site would be reduced after passage through the CO₂ EOR Processing Facility. This risk analysis is summarized below. The risk analysis sets forth the Risk Evaluation conducted for an accidental worst-case release scenario from the Project's CO₂ trunk line. Specifically, an Offsite Consequence Analysis was performed, using the methodology prescribed under the California Accidental Release Prevention program and the federal CAA Risk Management Program, to address the maximum potential consequence from a worst-case release from the CO₂ trunk line. The models provide an examination of the dispersion of CO₂ in the form of a vapor cloud. The modeling assumptions for a worst-case release scenario are that the total contents from the largest inventory are accidentally released into the atmosphere.

The modeling assumed worst-case atmospheric conditions during such a release, where applicable. These conditions provide conservative results because these extreme and unlikely climatic conditions maximize the vaporization to create the vapor cloud and minimize its dispersion. For purposes of this analysis, the worst-case climate condition consists of an ambient temperature of 115 degrees Fahrenheit (°F) (the highest average temperature in the Project area), a 50 percent average humidity, a wind speed of 1.5 meters per second, and a level F atmospheric stability.

The extent of potential impact from the hypothetical accidental release was computed by using the Area Locations of Hazardous Atmospheres (ALOHA) 5.4.1 air dispersion modeling program. ALOHA is a Gaussian plume model that incorporates continuous source and meteorological parameters. The ALOHA model was selected to model the release, as it is suitable for modeling the release of a heavy gas (i.e., gas that is heavier than air) such as CO₂. All the basic phenomena associated with a heavy gas release, such as horizontal spreading, the mass exchange between the plume and the plume temperature are considered through the ALOHA program. Operating through Gaussian plume dispersion, the ALOHA model also takes into consideration the specific atmospheric conditions that may affect a potential release.

In order to provide conservative results as to the extent of impact of a CO₂ release from the proposed Project, the modeling for the worst-case release scenario examined an instantaneous release from a complete lateral shear and de-pressurization of pipeline sections isolated by emergency block valves. For the worst-case release scenario, the rupturing of the CO₂ trunk line was assumed to produce a 0.8-square-foot aperture (meaning a complete severing of the 12-inch-diameter pipeline) at which CO₂ would escape. The worst-case scenario assumes that the total CO₂ volume of each section will release through the rupture within 1 minute (the minimum duration used by the ALOHA model for

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immediate releases). The atmospheric conditions modeled represent the least favorable conditions for the normal dissipation of a concentrated CO₂ release.

In addition to the gas volume released from each isolated pipeline segment, the analysis also accounted for the additional CO₂ that would be released during the reaction time for activation of the automated emergency block valves. It would take approximately 20 seconds for the CO₂ trunk line emergency block valves to activate based on pressure loss conditions identified for the pipeline. Based on the foregoing, the worst-case scenario with the highest potential to impact the public would be the release of 461,540 pounds of CO₂ from a 15,893 foot pipeline segment (longest segment between block valves). The CO₂ dispersion model results show that the immediately dangerous to life and health (IDLH) for CO₂ (40,000 ppm) can be expected to extend 2,508 feet from the release point. Considering that the community of Tupman is located approximately 1.5 miles from the proposed CO₂ trunk line, the proposed Project is not expected to create a significant hazard for the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment.

Although the dispersion modeling shows that a release of CO₂ would not create a substantial public hazard, the probability for a worst-case scenario to occur is low. In fact, based on historical data obtained from the DOT's Office of Pipeline Safety covering the period 1986 to 2008 through the National Response Center, the failure rate for this period of time was determined to equal about 0.000169 failures per mile of CO₂ pipeline per year. No record of catastrophic explosion or rupture has been recorded since the 1970s. The probability of occurrence of an actual failure event was calculated using the incident data from 1986 through 2008. As such, the historical failure rate for the 4-mile CO₂ pipeline is estimated to be about 0.0007 failures per year, which will not present a significant likelihood of occurrence.

It should be noted that the CO₂ EOR Processing Facility in Section 27S is also located approximately 1.5 miles southwest from the community of Tupman. As the CO₂ EOR Processing Facility does not have substantial CO₂ storage capacity, the risks and consequences of a release of CO₂ from the facility is not expected to create a higher level of risk or consequences compared to a release from the CO₂ trunk line. Considering the above, the proposed Project is not expected to create a significant hazard for the public or the environment through reasonably foreseeable upset and accident conditions involving the release of CO₂ into the environment. This is a less than significant impact.

In addition, due to the distance to the community of Tupman, the proposed Project is not expected to create a significant hazard for the public or the environment through reasonably foreseeable upset and accident conditions involving the release of H₂S into the environment. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

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Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT HAZ-3 Project Located on a Site Which is Included on a List of Hazardous Materials Sites Compiled Pursuant to Government Code Section 65962.5 and, as a Result, Create a Significant Hazard to the Public or the Environment

The Hazardous Waste and Substances Sites (Cortese) List is a planning document used by the State, local agencies and developers to comply with the CEQA requirements in providing information about the location of hazardous materials release sites. Government Code section 65962.5 requires the Cal EPA to develop at least annually an updated Cortese List. Listed sites are designated by the State RWQCB and listed under their leaking underground storage tanks (LUST), the Integrated Waste Board (IWB), and the DTSC.

Stantec reviewed the Cortese List to determine if any proposed Project components are located on a Cortese List site. Based on this review, the closest Cortese List site to the Project Site is located in Taft (Gardner Field), approximately 5 miles south of Project Site. The proposed Project is not located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and will not result in or create a significant hazard to the public or the environment. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT HAZ-4 Result in a Safety Hazard for People Residing or Working in the Project Area for a Project Located within the Kern County ALUCP

Elk Hills – Buttonwillow Airport is located approximately 4 miles north of the Project Site. The Project Site is not within the sphere of influence of the Elk Hills – Buttonwillow Airport. In addition, the proposed Project does not include a residential development component that has the potential to expose residents to airport safety hazards. An evaluation of the proposed Project's potential to result in obstructions to airport safety, height compatibility, and safety compatibility are discussed below.

Obstruction

The proposed Project is of sufficient distance from the Elk Hills - Buttonwillow Airport's runway that it will not obstruct airplanes taking off or landing (as defined by 14 CFR Part 77 Section 44718). The Project Site is located to the southwest of the runway approach. The south side of the runway is

4.7 HAZARDS AND HAZARDOUS MATERIALS

approximately 4 miles from the closest portion of the Project Site. This distance makes it unlikely the proposed Project will cause an obstruction.

Findings of Height Compatibility

The proposed Project does not lie under the Elk Hills - Buttonwillow Airport runway transitional zone.

The proposed Project will not pose a hazard to air navigation due to its distance from the Airport runway. The proposed Project will create a less than significant level of hazards pertaining to aircraft operations.

Findings of Safety Compatibility

Based on the following findings, the proposed CO2 EOR Project should be considered a compatible land use within the Elk Hills – Buttonwillow Airport environs and is consistent to the Caltrans Aeronautics Update of the Airport Land Use Planning Handbook regarding safety issues:

The Project Site is located outside of the Runway Protection Zones (Clear Zones) for the Elk Hills – Buttonwillow Airport.

The proposed Project will not cause an obstruction of the runway.

The proposed Project will employ a lighting design that will minimize glare and mitigate any potential navigation hazards from lights during dusk hours prior to visual flight rules requiring aviation operations to cease.

Portions of the proposed Project will be located under the flight path for the Elk Hills – Buttonwillow Airport. However, workers associated with the Project development will not be subjected to noise, vibrations, fumes, dust, fuel particles, and safety hazards associated with take off and landings of general aviation aircraft as the location of the Airport is approximately 4 miles from the closest portion of the Project Site.

Considering the above in addition to the fact that the Project Site is located outside of the Kern County ALUCP, the proposed Project will have a less than significant airport-related safety hazard impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.7 HAZARDS AND HAZARDOUS MATERIALS

IMPACT HAZ-5 Private Airstrip Operations within vicinity of proposed Project resulting in safety hazards for people residing or working in the proposed Project Site

There are no private airstrips located in proximity to the proposed Project Site that could present a safety hazard to workers. In addition, the proposed Project does not include a residential development component that has the potential to expose residents to private airstrip safety hazards. No impact would result.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT HAZ-6 Impair Implementation of or Physically Interfere with an Adopted Emergency Response Plan or Emergency Evacuation Plan

Emergency response planning includes the ability to effectively evacuate the Project Site and the vicinity in the event of an emergency. Among the agencies that would likely coordinate such responses are the California Emergency Management Agency, Kern County Sheriff's Department, and the Kern County Fire Department. Although no specific emergency evacuation routes have been designated by the County, it is expected that Highway 119 would be the main evacuation route in the event of an emergency in the Project Site.

The Project Site would have multiple access points from Highway 119, Skyline Road, Elk Hills Road, and North Access Road. This would facilitate access to the site by emergency vehicles and evacuations from the Site. The multiple access points on the roads mentioned above, would reduce the likelihood of traffic congestion and accidents during an evacuation. The proposed Project configuration would not cause any obstruction on Highway 119, Skyline Road, Elk Hills Road, or North Access Road. Impacts on emergency response or emergency evacuation would be less than significant.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT HAZ-7 Expose People or Structures to a Significant Risk of Loss, Injury, or Death Involving Wildland Fires

4.7 HAZARDS AND HAZARDOUS MATERIALS

As the proposed Project does not include residential development, it does not meet the definition of wildlands urban interface (WUI). The proposed Project is limited to utilizing CO2 EOR in an active oil field operation. The proposed Project does not include any component that will measurably increase the potential exposure of people or structures to significant risk of loss, injury, or death involving wildland fires. This is a less than significant impact.

Mitigation Measures

No mitigation measures required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.7.5 Cumulative Impacts

During construction and operation of the proposed Project various types of hazardous materials will be transported, used, and stored at the Site. Any spills of materials at the Project Site would be controlled locally. Spills of hazardous materials or discovery of hazardous materials that require cleanup would be contained, managed, and remediated. Therefore, spills at the Project Site would not be expected to have significant impacts on resources beyond the boundary of the Site. All transportation of hazardous materials would be handled in conformance with requirements of the DOT. Therefore, the proposed Project would not contribute to cumulative impacts on the environment through the release of hazardous materials beyond the Project Site.

For the reasons discussed above, the proposed Project would have less than significant cumulative impacts.

Mitigation Measures

No mitigation measures are required.

Level of Significant after Mitigation

The proposed Project would have less than significant cumulative impacts.

4.8 HYDROLOGY AND WATER QUALITY

4.8 Hydrology and Water Quality

4.8.1 Introduction

This section of the SEI addresses the environmental impact(s) of the proposed Project with regard to the issues of drainage, flooding, water quality, and groundwater. As explained in the following paragraphs, these issues are the subject of various regulatory programs that are designed to avoid adverse impacts that include the following: 1) human injury/loss of life; 2) property damage/loss; 3) harm to fisheries as well as terrestrial wildlife; 4) degradation of plant communities; and 5) economic losses.

4.8.2 Environmental Setting

Climate

The climate in the Central Valley in this region can be characterized as semi-arid with long, hot, dry summers and relatively mild winters. The average annual temperature based on the 69 years of record is 65.4 °F. The average annual precipitation in the area is 5.75 inches.

Hydrology

Surface Hydrology

The proposed Project Site is characterized as mountainous terrain with slopes averaging 30 percent or greater within the EHOE. The topography slopes from southwest to northeast towards the California Aqueduct. The elevation of the project area ranges from 1,500 to 300 feet above mean sea level (at the Aqueduct).

The FEMA Insurance Rate Maps (FIRMs) for the proposed Project Site are included in Community Panel Numbers 060075 C2200E, C2225E, C2625E, and C2650E for Kern County Unincorporated Areas. The proposed Project does not fall in a FEMA designated flood zone.

The project area is located within an unnamed basin where several ephemeral washes flow across alluvial sediments and terminate at various points north of the EHOE. Per the Occidental of Elk Hills Construction General Permit Compliance Plan (Compliance Plan), this area has no common water conveyance connections that can be defined between various channels. Two constructed structures that cross over/under the California aqueduct are located north of Section 23 and at the northern extent of the basin near Highway 58 west of the Lokern Road junction. These washes terminate in fields east of the Aqueduct and do not flow into jurisdictional waters. Furthermore, the Compliance Plan finds that the ephemeral washes are non-jurisdictional according to the analysis method provided by the U.S. EPA and the U.S. Army Corps of Engineers. No wetlands were identified as a result of a Wetland Delineation conducted in 1996.

4.8 HYDROLOGY AND WATER QUALITY

Groundwater Hydrology

The source of non-potable water for the proposed Project is the Tulare aquifer. The project site is located in the Tulare Lake Hydrologic Region, within the Kern County Subbasin of the San Joaquin Valley Groundwater Basin. The depth to groundwater ranges from 380 feet to as much as 780 feet below the surface. The groundwater has both artificial and natural sources. The artificial sources are from injection of produced water. The natural source of groundwater recharge is likely from the Temblor Range to the west. The Tulare aquifer is an exempt aquifer and currently accepts produced water from oil production activities at Elk Hills.

The groundwater in the Tulare aquifer is highly mineralized and generally poor quality. Total dissolved solids concentrations can be as high as 5,000 parts per million (ppm).

4.8.3 Regulatory Setting

4.8.3.1 Kern County

Chapter 17.28 Grading Code

Requirements of the Kern County Grading Code will be implemented with respect to hydrology and water quality as outlined in Section 17.28.140, Erosion Control.

1.9 Resource

Policies

Policy 10. To encourage effective groundwater resource management for the long-term economic benefit of the County the following shall be considered:

- a. Promote groundwater recharge activities in various zone districts.
- b. Support for the development of Urban Water Management Plans and promote Department of Water Resources grant funding for all water providers.
- c. Support the development of groundwater management plans.
- d. Support the development of future sources of additional surface water and groundwater, including conjunctive use, recycled water, conservation, additional storage of surface water and groundwater and desalination.

Policy 11. Minimize the alteration of natural drainage areas. Require development plans to include necessary mitigation to stabilize runoff and silt deposition through utilization of grading and flood protection ordinances.

4.8 HYDROLOGY AND WATER QUALITY

Policy 20. Areas along rivers and streams will be conserved where feasible to enhance drainage, flood control, recreational, and other beneficial uses while acknowledging existing land use patterns.

4.8.3.2 State

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act (Water Code Sections 13000 et seq.), passed in 1969, requires protection of water quality by appropriate designing, sizing, and construction of erosion and sediment controls. The Porter-Cologne Act established the State Water Resources Control Board (SWRCB) and divided California into nine regions, each overseen by a regional water quality control board. The SWRCB is the primary state agency responsible for protecting the quality of the state's surface and groundwater supplies and has delegated primary implementation authority to the nine Regional Water Quality Control Boards (RWQCB). The Porter-Cologne Act assigns responsibility for implementing Clean Water Act (CWA) Sections 401 through 402 and 303(d) to the SWRCB and the nine RWQCBs, including the Central Valley RWQCB, which has jurisdiction over the Project Site.

California Streambed Alteration Program

The California Lake and Streambed Alteration Program, Section 1602 of the California Fish and Game Code, regulates activities that would "substantially divert or obstruct the natural flow of, or substantially change the bed, channel, or bank of, or use material from the streambed of a natural watercourse" that supports wildlife resources. The California Department of Fish and Game (CDFG) has authority to review and regulate all proposed alterations of streambeds.

OEHI holds a 12 year site-wide streambed alteration maintenance permit as required by 14 CCR Sections 1601 and 1603 of the Fish and Game Code. The current permit for OEHI expires in the year 2020. If it is determined that the activity may substantially adversely affect fish and wildlife resources within state jurisdictional waters, a Lake or Streambed Alteration Agreement will be prepared.

4.8.3.3 Federal

Clean Water Act

The CWA is intended to restore and maintain the chemical, physical, and biological integrity of the nations waters (33 Code of Federal Regulations [CFR] 1251). The regulations implementing the CWA protect waters of the U.S., streams and wetlands (33 CFR 328.3). The CWA ensures that water quality within aquatic ecosystems is maintained at a level of integrity that enables biological resources to exist and function properly. The following paragraphs provide details on specific sections of the CWA.

4.8 HYDROLOGY AND WATER QUALITY

Section 401, Water Quality Certification

Compliance with Section 401 of the CWA is required for applicants who require a Section 404 permit from the United States Army Corps of Engineers (USACE) because of potential discharges and impacts on waters of the U.S. or wetlands. If issued, a Section 401 certification from the SWRCB/RWQCB indicates that discharges and impacts will also comply with state water quality standards. The SWRCB has a policy of no net loss of wetlands in effect and typically requires mitigation for all impacts on wetlands before it will issue a water quality certification or waiver thereof.

Section 402, National Pollutant Discharge Elimination System as Related to Oil/Gas Construction Activities

Section 402 of the CWA regulates construction-related stormwater discharges to surface waters through the National Pollutant Discharge Elimination System (NPDES) program, administered by the EPA with implementation authority delegated to the SWRCB in California, Order 2009-0009-DWQ. The issue of whether oil/gas construction activities require NPDES permit coverage has recently been the subject of litigation in the Ninth Circuit of the US Court of Appeals. In a May 18, 2010 memo published by the State Water Board titled "Impact of Natural Resources Defense Council (NRDC) v. U.S. EPA on the Regulation of Storm Water Discharges of Sediment from Oil and Gas Construction Activities", the State Board advises that oil and gas construction activities that discharge storm water contaminated only with sediment are now subject to California and federal NPDES permitting requirements, if the discharge of sediment contributes to a violation of a water quality standard. The Construction General Permit is not required if stormwater runoff:

1. Is not contaminated by contact with, or does not come into contact with, any overburden, raw material, intermediate products, finished product, byproduct, or waste products;
2. Is contaminated by or only comes into contact with sediment; and
3. Does not contribute to a water quality violation.

Since stormwater runoff at EHOE does not enter jurisdictional waters, a Construction General Permit is not required for construction activities at EHOE. However, as part of OEHI's ongoing operations, a Storm Water Compliance Plan was created to implement requirements of the 2009 General Construction Permit throughout the property.

4.8.4 Impacts and Mitigation Measures

4.8.4.1 Methodology

This section analyzes impacts on hydrology and water quality from the implementation of the proposed Project based on changes to the environmental setting described above within the CEQA guidelines for the thresholds of significance.

4.8 HYDROLOGY AND WATER QUALITY

4.8.4.2 *Thresholds of Significance*

Appendix G of the CEQA Guidelines and the Kern County CEQA Implementation Document state that a project would have a significant impact on hydrology and water quality if it would:

Violate any water quality standards or waste discharge requirements;

Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted);

Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on-site or off-site;

Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on-site or off-site;

Create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff;

Otherwise substantially degrade water quality;

Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map;

Place within a 100-year hazard area structures that would impede or redirect flood flows;

Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam; or

Expose people or structures to a significant risk of loss, injury, or death due to inundation by seiche, tsunami, or mudflow.

4.8.4.3 *Project Impacts*

IMPACT HYD-1 Violate Any Water Quality Standards or Waste Discharge Requirements

Construction activities would disturb soils in the proposed Project Site, making them more susceptible to erosion and more likely to be transported by stormwater runoff into nearby drainages. Hazardous materials such as transportation fuel, hydraulic fluid, and paint are also potential pollutants during construction. OEHI will implement measures to minimize and contain erosion and sedimentation as

4.8 HYDROLOGY AND WATER QUALITY

well as other pollutants as outlined in the OEHI Storm Water Compliance Plan and in accordance with the Kern County Grading Ordinance.

Normally, for a proposed Project that would disturb more than one acre, the applicant would be required to obtain coverage under the Construction General Permit for Discharges of Storm Water Related to Construction Activities (Order 2009-0009-DWQ). However, oil and gas construction activities discharging sediment only are subject to NPDES permitting requirements only if discharge of sediment contributes to a violation of a water quality standard. The OEHI Storm Water Compliance Plan demonstrates that storm water runoff from the EHO does not have the potential to violate a water quality standard or impact Waters of the United States. Therefore, the Project will have a less than significant impact on water quality standards.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT HYD-2 Deplete Groundwater Supplies or Interfere with Groundwater Recharge

The Project proposes the use of five existing make-up water wells with the permitted capacity of producing 50,000 barrels of water per day each. OEHI anticipates that approximately 10,000 barrels of water for each well per day will be produced to support the Project. There are no other pre-existing wells located nearby that could be affected by OEHI's proposed use of the five groundwater production wells such that production rates of other wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted. The proposed Project will therefore not substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level which would have the potential to adversely affect other existing or planned uses of the Tulare Aquifer. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.8 HYDROLOGY AND WATER QUALITY

IMPACT HYD-3 Result in Impacts on the Existing Drainage Patterns

Potential project impacts to the natural drainage ways, associated riparian vegetation, and the wildlife that depend on them include but are not limited to: increased sediment input from storm water runoff and impervious areas and altered drainage patterns at Project facility locations.

As discussed above, short-term increases in erosion (including sedimentation build-up caused by access roads) as a result of ground disturbance would be minimized via implementation of the project-specific OEHI Storm Water Compliance Plan. Construction and operation of the proposed Project would not require permanently altering the course of any of the drainages. Therefore, there would be no long-term effect on drainage patterns from the proposed Project that could result in substantial erosion and siltation on- or off-site.

The project will be designed to minimize the footprint of new disturbed area by attempting to use as many existing wells and pipelines in previously disturbed acreage as much as possible. In addition, the project will comply with Kern County grading and drainage ordinances. Therefore, this is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT HYD-4 Alter Existing Drainage Patterns of the Site or Area, Causing Flooding

The project will not alter drainage patterns and therefore will not cause flooding. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT HYD-5 Result in Impacts on Runoff Water and Drainage Capacity

The proposed Project will not substantially increase impervious surfaces that will affect runoff water and drainage capacity. The proposed Project would comply with the goals, policies, and implementation measures of Kern County requirements. Therefore, this impact is less than significant.

4.8 HYDROLOGY AND WATER QUALITY

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT HYD-6 Place Housing within a 100-year Flood Hazard Area

The proposed Project does not involve placement of housing within a FEMA flood zone. No impact will occur.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impacts.

IMPACT HYD-7 Place within a 100-Year Hazard Area Structures that would Impede or Redirect Flood Flows

Flooding is not a concern on the Project site as it is outside the FEMA designated 100-year flood zone. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT HYD-8 Expose People or Structures to a Significant Risk of Loss, Injury, or Death involving Flooding.

The proposed Project will not change the existing drainage patterns and will not increase offsite flooding. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.8 HYDROLOGY AND WATER QUALITY

IMPACT HYD-9 Result in Impacts Caused by Seiche, Tsunami, or Mudflow

Because of the inland location of the proposed Project Site and elevation, the potential for tsunami-related damage or a seismic seiche is low. The lands within and surrounding the proposed Project Site are not subject to mudflows or other forms of natural slope instability because of the dense, relatively hard, and massive nature of the crystalline bedrock underlying the mountainous portion of the proposed Project Site. The proposed Project would comply with the goals, policies, and implementation measures of the Kern County General Plan. No impacts would occur.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impact.

4.8.5 Cumulative Impacts

OEHI has designed the proposed Project to minimize impacts on hydrology and water quality by limiting the area of disturbed land and utilizing as many existing wells, drilling pads, and existing pipeline corridors as possible. The Project would add limited amounts of impervious areas to the watershed, but the Project does not directly discharge to surface water. Therefore, the proposed Project would not contribute to a significant cumulative impact on hydrology and water quality and no significant cumulative impacts are anticipated.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

In view of the applicability of ordinances, laws, and regulation that would avoid the occurrence of significant hydrological and water quality impacts, it is concluded that cumulative hydrology and water quality impacts would not be significant. The proposed Project would have less than significant cumulative impacts.

4.9 LAND USE AND PLANNING

4.9 Land Use and Planning

4.9.1 Introduction

This section describes the potential environmental impacts of the proposed Project related to land use.

4.9.2 Environmental Setting

Existing Land Uses

Kern County

Kern County is the third largest county (8,142 square miles) in California, behind Inyo and San Bernardino Counties, with a population of more than 810,000 residents (California Department of Finance, 2008). Agriculture, mineral extraction, petroleum production, recreation, and urban development are the predominant land uses. Kern County (County) has the distinction of producing more oil than any other County in California. In addition, borate minerals, cement production, and construction aggregates constitute major economic mineral resources. Furthermore, the development of major water projects has greatly increased the amount of land in agricultural production during the last two decades.

Kern County's varied geomorphic terrains, devotion to agricultural land uses, and preservation of mineral resources has resulted in the development of many population centers throughout the County. However, most of the residential, commercial and industrial development is located in the City of Bakersfield and its surrounding metropolitan area. The Bakersfield metropolitan population was 503,800 in 2010, according to the Bakersfield Planning Department.

Within Kern County, the Federal government owns and manages a large amount of land. Major Federal land holdings within the area include the Sequoia National Park, Sequoia National Forest and Los Padres National Forests, Kern National Wildlife Refuge, Edwards Air Force Base (EAFB), and China Lake Naval Weapons Center. In addition, the Bureau of Land Management (BLM) manages extensive Federal land holdings, especially in the eastern portion of the County and along the northern edge of the Subject property. The mountain, desert, and valley environments provide a variety of recreational opportunities such as camping, hiking, hunting, and biking.

The County is connected by major transportation corridors that include Interstate 5 (I-5), California State Route 99 (SR 99), and a network of other state, County, and local roads. In addition, the Governor Edmund G. Brown California Aqueduct (California Aqueduct), which is located approximately one mile north of the Project, is a system of canals, tunnels, and pipelines that conveys water collected from the Sierra Nevada Mountains and valleys of Northern- and Central California to Southern California.

4.9 LAND USE AND PLANNING

Elk Hills Project Area

The EHOE is located approximately 26 miles west of the City of Bakersfield in Kern County and has been used for petroleum extraction and processing since the early 1900s. Oil production, gathering, and processing dominate the land uses within the Project. It is anticipated that the Project will continue to be used for petroleum extraction and processing for several decades.

EHOE contains various state, county and private roads. For example, State Route 119 extends through the southeastern section of the EHOE, and Elk Hills Road (County) and Skyline Road (private) intersect towards the center of the EHOE in a north to south and east to west direction, respectively. In addition, many paved and unpaved access roads run throughout the EHOE. However, the entire EHOE is restricted from public access and is accessible from locked gates located throughout the Project.

The primary land use designation for the Project as established by the Kern County Land Use, Open Space and Conservation Element of the General Plan is 8.1 (Intensive Agriculture), 8.3 (Extensive Agriculture) and 8.4 (Mineral and Petroleum). Land use and zoning designations for the Project and surrounding area are shown in Figures 4.9-1 and 4.9-2, respectively.

The following is a description of the above land use designations:

Map Code 8.1 (Intensive Agriculture) - Areas devoted to the production of irrigated crops or having a potential for such use. Other agricultural uses, while not directly dependent on irrigation for production, may also be consistent with the intensive agriculture designation. Minimum parcel size is 20 acres gross.

Map Code 8.3 (Extensive Agriculture) - Agricultural uses involving large amounts of land with relatively low value-per-acre yields, such as livestock grazing, dry land farming, and woodlands. Minimum parcel size is 20 acres gross, except lands subject to a Williamson Act (officially, the California Land Conservation Act of 1965) Contract/ Farmland Security Zone Contract, in which case the minimum parcel size shall be 80 gross acres.

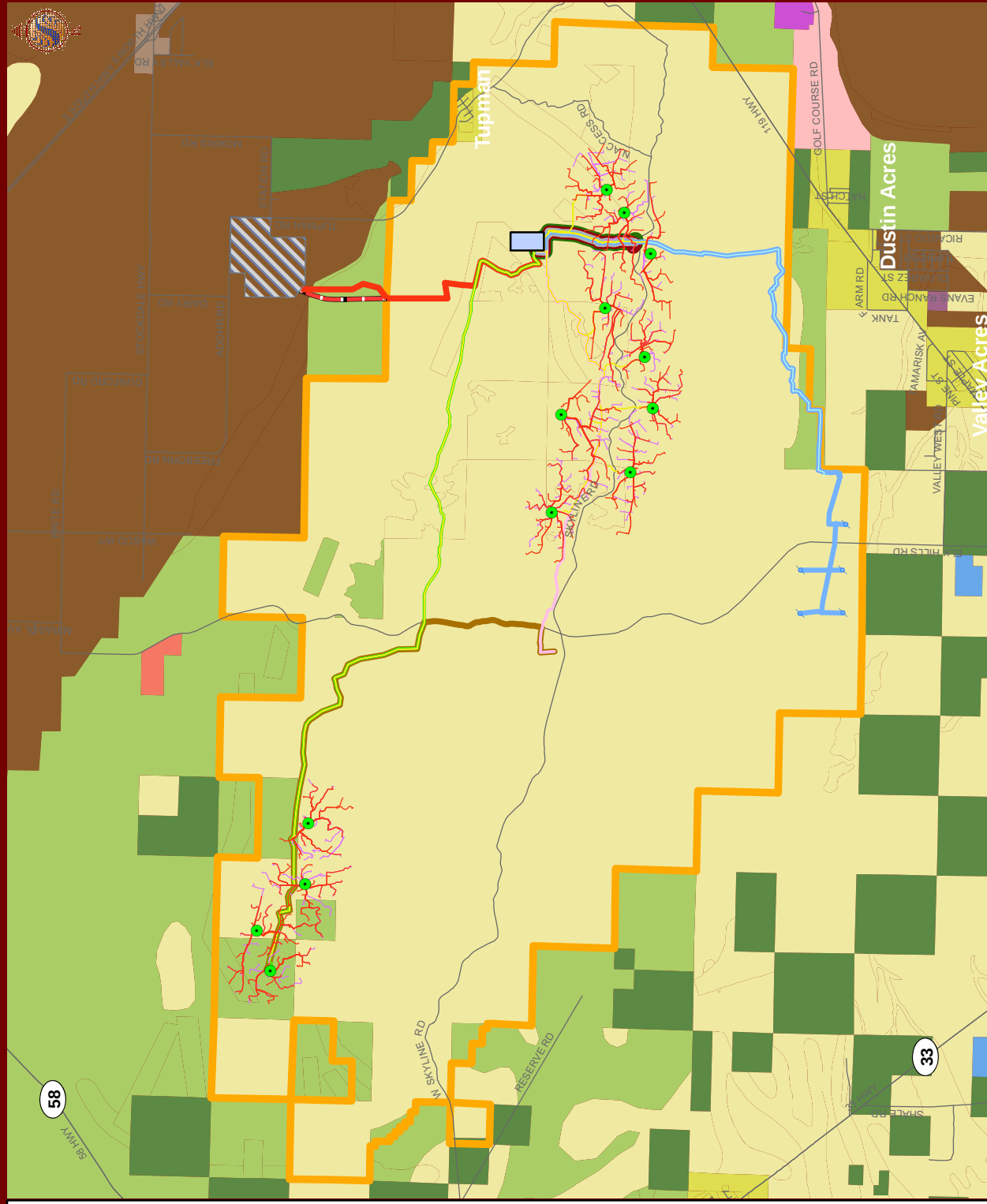
Map Code 8.4 (Mineral and Petroleum) - Areas which contain producing or potentially productive petroleum fields, natural gas, and geothermal resources, and mineral deposits of regional and Statewide significance. Uses are limited to activities directly associated with the resource extraction. Minimum parcel size is five acres gross. Uses shall include, but are not limited to, the following: Mineral and petroleum exploration and extraction, including aggregate extraction; extensive and intensive agriculture; mineral and petroleum processing (excluding petroleum refining); natural gas and geothermal resources; pipelines; power transmission facilities; communication facilities; equipment storage yards; and borrow pits.

LEGEND

- Elk Hills Oil Field
- Hydrogen Energy California
- EOR Processing Facility
- Satellite Facility
- Water Wells
- Producing Lines
- Injection Lines
- Gathering Lines
- CO2 Trunk Line
- Oil Line
- NGL Line
- Water Line
- Fuel Gas Line
- Residue Gas Line
- Nitrogen Line
- Propane Line
- Prop. HECA CO2 Supply Line
- Alt. HECA CO2 Supply Line
- Roadways

General Plan Land Use

- 1.1 State or Federal Land
- 3.1 Public or Private Recreation
- 3.3 Other Facilities
- 3.4 Solid Waste Facilities
- 4.1 Public or Private Recreation
- 4.3 Specific Plan Required
- 5.4 Max. 4 Units/Net Acre
- 5.7 Min. 5 Gross Acres/Unit
- 6.3 Highway Commercial
- 7.2 Service Industrial
- 7.3 Heavy Industrial
- 8.1 Intensive Agriculture
- 8.3 Extensive Agriculture
- 8.4 Mineral and Petroleum
- 8.5 Resource Management



Stantec

2550 Venture Oaks Way, Sacramento, CA 95833
Phone 916.569.2500 Fax 916.921.9274 www.stantec.com
Project # 185602314

Stantec does not certify the accuracy of the data. This map is for reference only and should not be used for construction.

Cartographic Design By: C. Flinders | Environmental Remediation

Fig. 4.9-1

Project Site General Plan Land Use

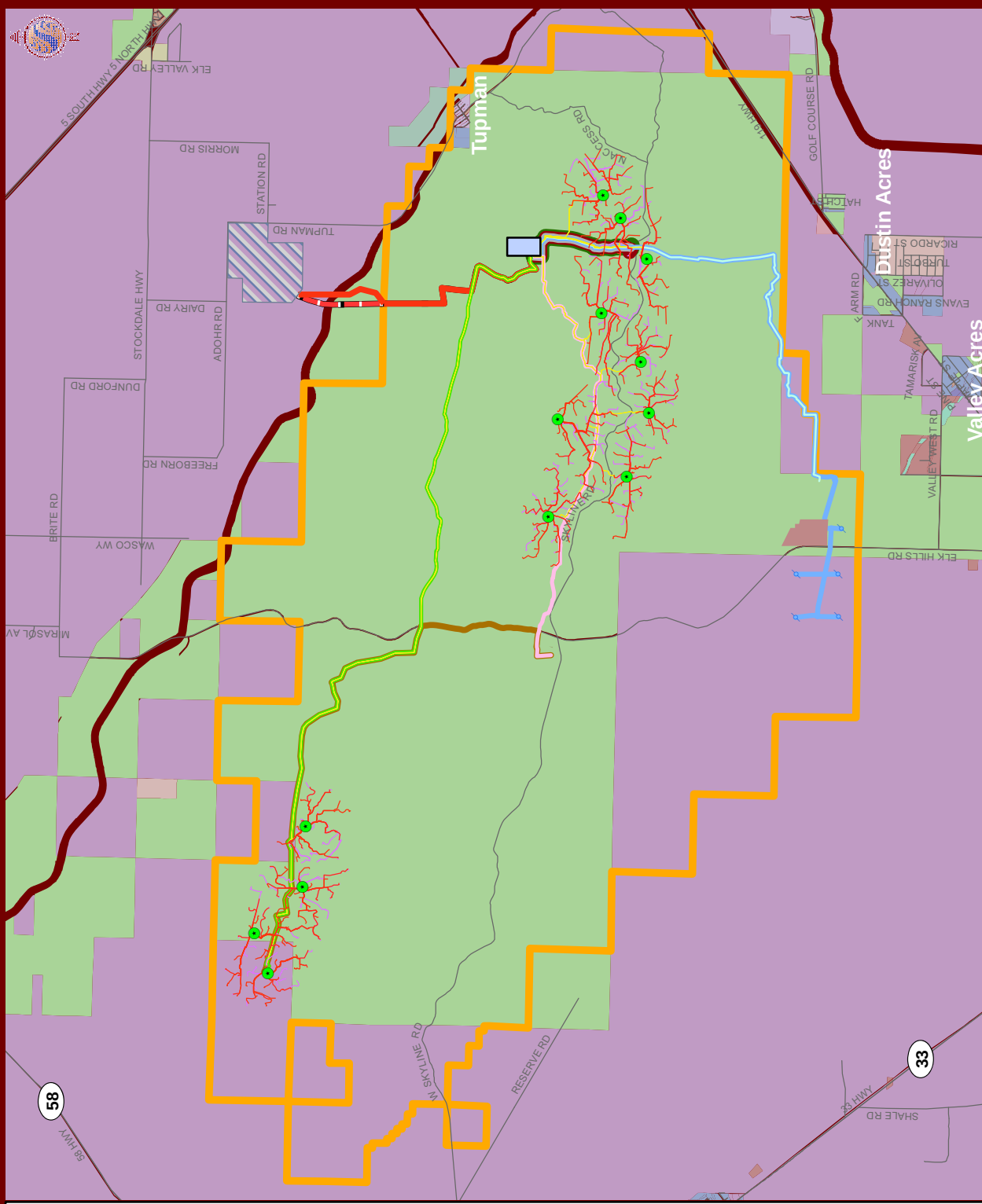
OEHI CO2 EOR Project - Supplemental Environmental Information

LEGEND

- Elk Hills Oil Field
- Hydrogen Energy California
- EOR Processing Facility
- Satellite Facility
- Water Wells
- Producing Lines
- Injection Lines
- Gathering Lines
- CO2 Trunk Line
- Oil Line
- NGL Line
- Water Line
- Fuel Gas Line
- Residue Gas Line
- Nitrogen Line
- Propane Line
- Prop. HECA CO2 Supply Line
- Alt. HECA CO2 Supply Line
- Roadways

Zoning

- A Exclusive Agriculture
- A-1 Limited Agriculture
- C-1 Neighborhood Commercial
- C-2 General Commercial
- CH Highway Commercial
- E Estate, Residential
- FPP Floodplain Primaty
- M-1 Light Manufacturing
- M-2 Medium Industrial
- M-3 Heavy Industrial
- NR Natural Resource
- OS Open Space
- PL Platted Lands
- R-1 Low Density Residential



Stantec

2550 Venture Oaks Way, Sacramento, CA 95833
Phone 916.599.2500 Fax 916.921.9274 www.stantec.com
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Fig. 4.9-2

Project Site Zoning

OEHI CO2 EOR Project - Supplemental Environmental Information

4.9 LAND USE AND PLANNING

Portions of the Project area have combined land use designations including 2.1 (Seismic Hazard) defined as Alquist-Priolo Special Study Zone and other recently active fault zones as well as 2.4 (Steep Slope) defined as land with an average slope of 30 percent or steeper. Special considerations should be taken when developing these areas (see Section 4.6 – Geology and Soils).

The Project is zoned primarily as A-1 (Limited Agriculture) and partly as A (Exclusive Agriculture) per the Kern County Zoning Ordinance Map. Oil and gas exploration and production is a permitted use in the A-1 and A zones, provided the activity is conducted in accordance with Chapter 19.98 (Oil and Gas Production) of the Kern County Zoning Ordinance.

Military review requirements are established for large portions of the Project. The majority of the Project requires a review of all structures over 200 feet in height; the eastern portion of the Project requires a review of all structures over 500 feet in height. Additionally, a small private airport runway (Elk Hills-Buttonwillow Airport) is north of EHOFF.

Habitable and commercial structures are located adjacent to the north eastern corner of the Project Area in the community of Tupman. However, the nearest residence is located approximately 1.5 miles from the nearest proposed infrastructure associated with the proposed Project.

Surrounding Land Uses

Land uses in the area surrounding the Project are dominated by agriculture and oil and gas extraction and production. Surface and mineral rights on lands surrounding the Project are owned primarily by major oil companies, The Kern County General Plan (Kern County Planning Department 2007) acknowledges the economic importance of petroleum and agricultural resources and states that one of its goals is "The County will support programs and policies that provide tax and economic incentives to ensure the long-term retention of agriculture, timber, and other resource lands".

The major types of land uses surrounding the Project are presented below:

Agriculture and Open Space

Much of the area surrounding the Project consists of agricultural land and open space, with oil extraction occurring as a compatible land use. Intensively irrigated agriculture occurs to the north and east of the Project near the California Aqueduct. Numerous canals, ditches, drains and wells serve the farms in this area. The BLM's land holdings in the area are leased for grazing and numerous oil extraction facilities coexist with these agricultural activities.

Oil and Gas Production

Since the early 1900's, the area surrounding the Project has been a major oil producer. Currently this area supplies about two-thirds of California's total oil production and over one-third of the state's natural gas. The Buena Vista Oil Field (previously referred to as the Naval Petroleum Reserve # 2 [NPR-2]) lies immediately to the south of the Project. Several large and extensively developed oil

4.9 LAND USE AND PLANNING

fields, each covering thousands of acres, are located east, south and west of the Project. Elements of the infrastructure associated with petroleum production are found throughout this area. For example, drilling rigs, pumps, pipelines, storage tanks, processing facilities, utility lines and communication towers are prevalent.

Water Banking

Water management and storage (known as water banking) is an important activity in Kern County. The Kern Water Bank Plan is part of the California State Water Project for recharging, extracting, and storing State Water Project water.

Parks and Recreation

Sequoia National Park (94.8 miles northeast of the Project), Sequoia National Forest (73.3 miles northeast of the Project) and the Los Padres National Forest (74.0 miles west of the Project) of the Subject Property are located within the County. The Kern National Wildlife Refuge is located near the Project. In addition, the two major parks in the vicinity of the Project are the 1,585-acre Kern County Buena Vista Aquatic Recreation Area and the 955-acre Tule State Reserve. The Tule Elk State Reserve shelters a small herd of elk and is considered ecologically sensitive. The Kern County Buena Vista Aquatic Recreation Area, located about two miles east of the Project, is an extremely popular local recreational area, featuring boating on two lakes, camping, picnicking, swimming and fishing. Fishing also occurs along portions of the California Aqueduct and the Kern River. A 165-acre golf course and park complex is located west of the recreational area at.

Local Community Development

Development surrounding the Project includes the City of Taft and numerous unincorporated communities of Tupman, Buttonwillow, Derby Acres, McKittrick, Dustin Acres and Valley Acres. The city of Taft had a population of 6,400 in 2000 (U.S. Census Bureau, 2000).

4.9.3 Regulatory Setting

4.9.3.1 Local

The Kern County General Plan provides a general and comprehensive statement of land use policies that will guide future growth of the County. The County's ordinances, in contrast, provide a specific regulatory mechanism used by the County to implement its land use policies. Zoning ordinances give jurisdictional properties a zoning classification, which corresponds to a set of "permitted" and "conditional" uses. Each of the County's land use zones, or districts, is subject to specific development standards and restrictions. In addition to these basic land use policies, there may be regional land use controls, such as Airport Land Use Plans, Regional Transportation Plans, and Regional Housing Allocation Plans.

4.9 LAND USE AND PLANNING

The General Plan contains goals, objectives, and policies and provides an overall foundation for establishing land use patterns. For this land use impact analysis, this section lists all relevant goals, objectives, policies, and implementation measures related to the proposed Project from the Kern County General Plan.

The Zoning Ordinance contains regulations through which the General Plan's provisions are implemented. The most relevant regulations pertaining to the proposed Project are presented below.

Kern County General Plan

The State of California Government Code 65300 requires the County to prepare and adopt a general plan. The Kern County General Plan was originally adopted in 2004 and most recently updated in 2007. Its purpose is to give long-range guidance to county officials making decisions affecting the growth and resources of unincorporated Kern County. The range of the Kern County General Plan is set at 25 years. The Kern County General Plan helps to ensure that day-to-day planning and land use decisions are in conformance with the long-range program designed to protect and further the public interest. It will be periodically reviewed and updated as the goals and requirements of the County evolve and change (Kern County 2004a). Following are goals, policies and implementation measures applicable to the proposed Project.

Chapter 1. Land Use Open Space and Conservation Element

1.3 Physical and Environmental Constraints

Policies

Policy 1. The County will ensure that new developments will not be sited on land that is physically or environmentally constrained ((Map Code 2.1 (Seismic Hazard), Map Code 2.2 (Landslide), Map Code 2.3 (Shallow Groundwater), Map Code 2.5 (Flood Hazard), Map Codes from 2.6 – 2.9, Map Code 2.10 (Nearby Waste Facility), and Map Code 2.11 (Burn Dump Hazard)) to support such development unless appropriate studies establish that such development will not result in unmitigated significant impact.

Policy 6. Regardless of percentage of slope, development on hillsides will be sited in the least obtrusive fashion, thereby, minimizing the extent of topographic alteration required and reducing soil erosion while maintaining soil stability.

Policy 7. Ensure effective slope stability, wastewater drainage, and sewage treatments in areas with steep slopes are adequate for development.

Implementation Measures

Implementation Measure E. Development proposed in areas with steep slopes will be reviewed for conformity to the adopted Hillside Development Ordinance to ensure that appropriate soil stability, drainage, and sewage treatment will result.

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3.2 Noise Sensitive Areas

Policies

Policy 4. Utilize good land use planning principles to reduce conflicts related to noise emissions.

Implementation Measures

Implementation Measure A. Utilize zoning regulations to assist in achieving noise-compatible land use patterns.

Airport Land Use Compatibility Plan (ALUCP)

Objective. The County's public-use airports, military bases, and military airspace complex represent a major public investment and contribution to the County's economy. Kern County has adopted an Airport Land Use Compatibility Plan (ALUCP) and alternative process to comply with the State Aeronautics Act (Public Utilities Code commencing with Section 21670).

Issues. Public-use airports and military bases are important to the economic future of communities, but incompatible development can create public safety issues and adverse noise impacts. Encroachment of incompatible uses can adversely affect airport and military base operations and even result in the curtailment of their use. It is imperative that property near airports be developed with compatible uses and that there be clear guidance and information for affected property owners.

Goals

Goal 1. Plan for land uses that are compatible with public airport and military bases and mitigate encroachment issues.

Policies

Policy 1. To the extent legally allowable, prevent encroachment on public airport and military base operations from incompatible, unmitigated land uses.

Implementation Measures

Review discretionary land use development applications within the airports influence area and the military base operating area as shown in the ALUCP for consistency.

Coordinate and cooperate with airport operators, the County Department of Airports, the California Department of Transportation, Division of Aeronautics, affected cities, EAFB, NAWS China Lake and the Department of Defense (DOD) on the ALUCP, review of land use applications, public education and encroachment issues.

4.9 LAND USE AND PLANNING

4.9.3.2 State

State laws and regulations that apply to the proposed Project and land use include:

California Aeronautics Act

The California Aeronautics Act, Public Utilities Code Section 21001 et seq., sets out requirements for Airport Land Use Commissions and authority to regulate land uses surrounding public use airports and the requirement of a comprehensive airport land use plan.

4.9.4 Impacts and Mitigation Measures

4.9.4.1 Methodology

Land use issues for the proposed Project have been identified and evaluated based on onsite reconnaissance surveys, a review of current U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle maps, aerial photography, a review of local land use ordinances, a review of the land use goals and policies identified in Kern County General Plan, and associated land use and zoning maps. The proposed Project was evaluated with respect to the existing and planned land uses in the surrounding area to determine whether the significance thresholds would be exceeded.

4.9.4.2 Thresholds of Significance

Appendix G of the CEQA Guidelines and the Kern County CEQA Implementation Document state that a project would have a significant impact on land use if it would:

Physically divide an established community;

Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to, the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect; or

Conflict with any applicable habitat conservation plan or natural community conservation plan.

4.9.4.3 Project Impacts

IMPACT LU-1 Physically Divide an Established Community

Much of the area surrounding the proposed project area consists of agricultural land and open space, with oil extraction and habitat conservation occurring as compatible land uses. The proposed Project would not alter existing land uses and does not include any component that has the potential to physically divide an established community. No impact will result.

Mitigation Measures

No mitigation measures are required.

4.9 LAND USE AND PLANNING

Level of Significance after Mitigation

No Impact.

IMPACT LU-2 Conflict with any Applicable Land Use Plan, Policy, or Regulation of an Agency with Jurisdiction over the Project

The proposed Project is consistent with the land use and zoning designation for the area. The proposed Project would also comply with the applicable sections of the Kern County Zoning Ordinance's Oil and Gas Production Chapter (Chapter 19.98). The Kern County General Plan's Land Use, Open Space and Conservation Element states that petroleum exploration and extraction are "compatible" uses with agricultural designations. As all project activities are proposed to occur on lands already designated for oil extraction activities and agricultural purposes, the proposed Project is not expected to conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the Project. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT LU-3 Conflict with any Applicable Habitat Conservation Plan or Natural Community Conservation Plan

The proposed Project is within the jurisdictional boundaries of the Elk Hills Habitat Conservation Plan (HCP). The construction of the Project is within the covered land use activities detailed in the HCP. The proposed Project will not be in conflict with the Land Use within the HCP.

The Northern edge of the Subject property is against the Lokern Area of Critical Concern (ACEC) boundary. The Lokern area has been identified by the US Fish and Wildlife Service, California Department of Fish and Game and in the Kern County HCP as a location important for the management of lands to promote the conservation and recovery of endangered species. These land use stipulations will also include stipulations detailed in the Elk Hills HCP for the protection of listed species. The proposed Project will not conflict with the BLM ACEC stipulations, Elk Hills HCP, or the Kern County HCP. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.9 LAND USE AND PLANNING

4.9.5 Cumulative Impacts

Under cumulative conditions, the proposed Project, in combination with other reasonably foreseeable projects in the County would be generally consistent with the Kern County General Plan and Zoning Ordinance provisions. Changes to existing land use patterns as a result of cumulative project implementation could result in conflicts with adjacent land uses and cumulative land use impacts. However, the proposed Project would not require a change in existing land uses nor will it include any residential component that has the potential to add the cumulative impacts of urban sprawl in the County leading to the premature conversion of open space and agricultural lands. Therefore, the proposed Project is not expected to substantially contribute to a cumulative land use impact. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

The proposed Project would have less than significant cumulative impacts.

4.10 MINERAL RESOURCES

4.10 Mineral Resources

4.10.1 Introduction

This section of the SEI addresses potential impacts of the proposed Project on mineral resources. Kern County's (the County) abundant mineral resources have contributed greatly to the history and development of the San Joaquin Valley. The yearly value of petroleum fuels alone, about 75 percent of the value of all mineral products, typically exceeds the value of agricultural products from the County. Borate minerals, cement, clay, gold, gypsum, pumice, halite, sand and gravel, silver, and tungsten are important mineral products of the County, exclusive of petroleum. Among these, gold ranks first in total value of the metallic mineral products. The two largest gold mines that have operated in the County were the Golden Queen Mine located within the Soledad Mountain district near Mojave and the Yellow Aster Mine near Randsburg. It is estimated that 276 gold mines have operated in Kern County from 1880 to 1957 (Kern County Mining history 2010). Clay, limestone, boron, sand and gravel are the most highly valued non-metallic minerals. Additionally, the County has yielded a significant proportion of California's roofing granules. Kern County's mineral deposits, excluding petroleum, are grouped into 16 individual Mining Districts as illustrated on Figure 4.10-1, Kern County Mining Districts.

4.10.2 Environmental Setting

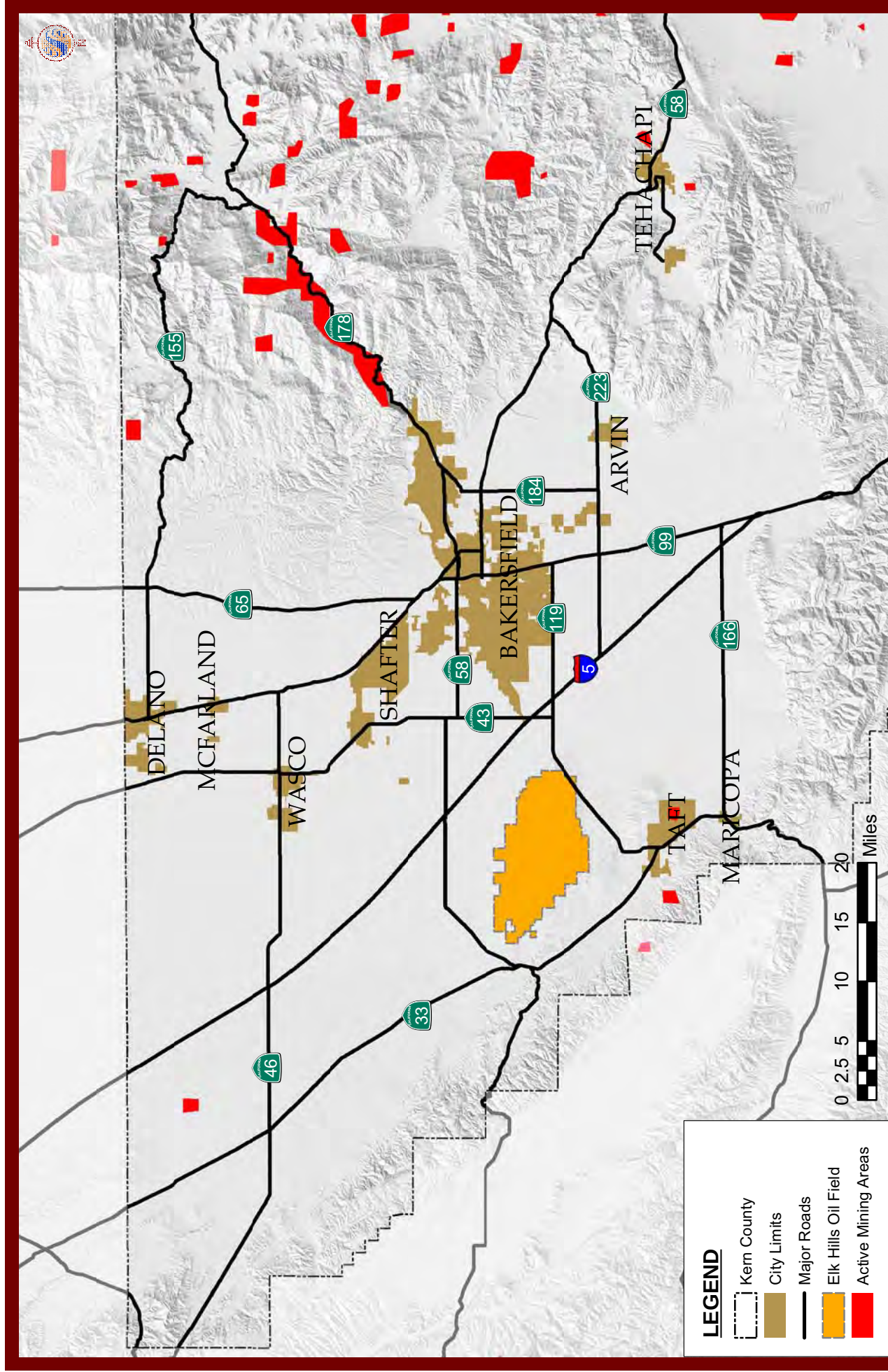
Kern County Regional Setting

Public policy states that the non-renewable characteristic of mineral deposits necessitates the careful and efficient development of mineral resources, in order to prevent the unnecessary waste of these deposits due to careless exploitation and uncontrolled urbanization. Management of these mineral resources will protect not only future development of mineral deposit areas, but will also guide the exploitation of mineral deposits so that adverse impacts caused by mineral extraction will be reduced or eliminated.

The mineral resources addressed in this section pertain to those resources that are classified under the Surface Mining and Reclamation Act of 1975 (SMARA). The SMARA requires the California State Mining and Geology Board (SMGB) to adopt State policy for the reclamation of mined lands and the conservation of mineral resources. The SMARA provides a comprehensive surface mining and reclamation policy with the regulation of surface mining operations to assure that adverse environmental impacts are minimized. The SMARA also encourages the production, conservation, and protection of the State's mineral resources. The SMARA was amended in 1980 to provide for the classification of non-urban area subject to land-use threats incompatible with mining. The classification of land within California takes place according to a priority list that was established by the SMGB in 1982, or when the SMGB is petitioned to classify a specific area. Currently, the State Geologist's SMARA classification activities are carried out under a single program for urban and non-urban areas of the state. Mineral lands are mapped using the California Mineral Land Classification

4.10 MINERAL RESOURCES

System. Priority is given to areas where future mineral resource extraction could be precluded by incompatible land use or to mineral resources likely to be mined during the 50-year period following their classification. Detailed mineral land classification and designation reports provided by the SMGB are on file at the County.



Cartographic Design By: C. Flinders | Environmental Remediation

Fig. 4.10-1

Kern County Mining Districts

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2590 Venture Oaks Way, Sacramento, CA 95833
 Phone 916.569.2500 Fax 916.921.1974 www.stantec.com
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4.10 MINERAL RESOURCES

Pursuant to SMARA, the California Geological Survey within the State of California, Department of Conservation designates Mineral Resource Zones (MRZ) in portions of the State that are considered to have potentially significant mineral deposits. "Mineral resources" are those economical mineral concentrations in such form and amount that the economic extraction of a commodity from the concentrations is currently potentially feasible. A "reserve" is that part of the resource base which could be economically extracted or produced within the foreseeable future. For any given mineral resource, an area may be classified as follows:

MRZ-1: Areas where the available geologic information indicates that no significant mineral deposits are present, or where it is judged that no significant likelihood exists for their presence.

MRZ-2a: Areas where the available geologic information indicates that significant mineral deposits are present.

MRZ-2b: Areas where the available geologic information indicates that there is likelihood for the presence of significant mineral deposits.

MRZ-3a: Areas where the available geologic information indicates that mineral deposits exist, the significance of which cannot be evaluated from existing data.

MRZ-3b: Areas where the available geologic information indicates that mineral deposits are likely to exist, the significance of which cannot be determined from available data.

MRZ-4: Areas where available geologic information is inadequate for assignment into any other MRZ, or where there is not enough information available to determine the presence or absence of mineral deposits.

The MRZ classifications are applied based on available geologic information and upon geologic appraisal of the mineral resource potential of the land, including geologic mapping and other information on surface exposures, drilling records, and mine data; and on socioeconomic factors such as market conditions and urban development patterns. Within the Bakersfield production-consumption region (including the EHOFF) only MRZ-1 through MRZ-3 are used.

Kern County is one of the largest producers of mineral products in California with a production value of almost one-quarter of the State's total. The primary mineral product of the County is petroleum and related products, which contribute approximately 75 percent of the total valuation of all County mineral products. The remaining 25 percent is comprised of sand and gravel, borax, cement products, and other construction and gem-like minerals, such as gold. The Kern County General Plan Land Use designation for areas that produce or could potentially produce productive petroleum fields, natural gas, geothermal resources, and/or mineral deposits is 8.4 – Mineral and Petroleum (minimum parcel size restricted to 5 gross acres). Land uses within the 8.4 General Plan land use designation are limited to activities directly associated with the resources that are extracted.

4.10 MINERAL RESOURCES

Oil Resources

Kern County produces more oil than any other county in California, and is one of the nation's leading petroleum-producing counties. Oil is found in 15 of the 58 counties in California. Mineral and petroleum resources are essential to the County's economy. As new recovery technologies are introduced, petroleum extraction should continue to be of economic importance to the County. And as long as new urbanization is restricted in areas having important mineral and petroleum resources, the future production of these resources remains promising.

The oil industry dates back to the nineteenth century. The first developed oil field in the County was at the McKittrick Field in 1898. Development was facilitated by existence of the Southern Pacific Railroad from Bakersfield to McKittrick Field.

The Kern River Oil Field was established in 1899 and by 1903, 796 wells produced almost 17 million barrels of oil from the Kern River Field. In 1911, the EHOFF was discovered, and in 2008 the EHOFF was ranked fifth in recovery of California's Giant oil fields. In the mid-1930's, several valley oil fields were found in large anticlines in Miocene oil sands beneath the valley floor. These discoveries were made following the advent of the reflection seismograph. Discoveries included the Ten Section, Greeley, Rio Bravo North, Coles Levee, South Coles Levee, and Strand oil fields. A summary of oil fields and their total production through 2008 is provided below in Table 4.10-1, Summary of Kern County Oil Fields.

TABLE 4.10-1: SUMMARY OF KERN COUNTY OIL FIELDS			
Rank	Field	Date Established	Total Production Through 2008
3	Kern River	1899	2,035 million barrels
5	Elk Hills	1911	1,316 million barrels
29	Kern Front	1912	212 million barrels
38	Edison	1928	149 million barrels
42	Fruitvale	1928	125 million barrels
43	Rio Bravo	1937	118 million barrels
46	Greeley	1936	116 million barrels
47	Round Mountain	1927	113 million barrels
Source: Division of Oil, Gas and Geothermal Resources (2008 Annual Report)			

A significant portion of the oil extracted from Kern County is known as "heavy oil", which is very thick and is difficult to pump from the ground. One of the innovations of the industry is to inject steam into the well in order to heat up the oil, thus making it easier to pump out of the ground. This extends the life of the oil fields, but is also expensive. Drilling activity in Kern County hit its peak in the 1950's, and has now stabilized with the number of new wells being drilled.

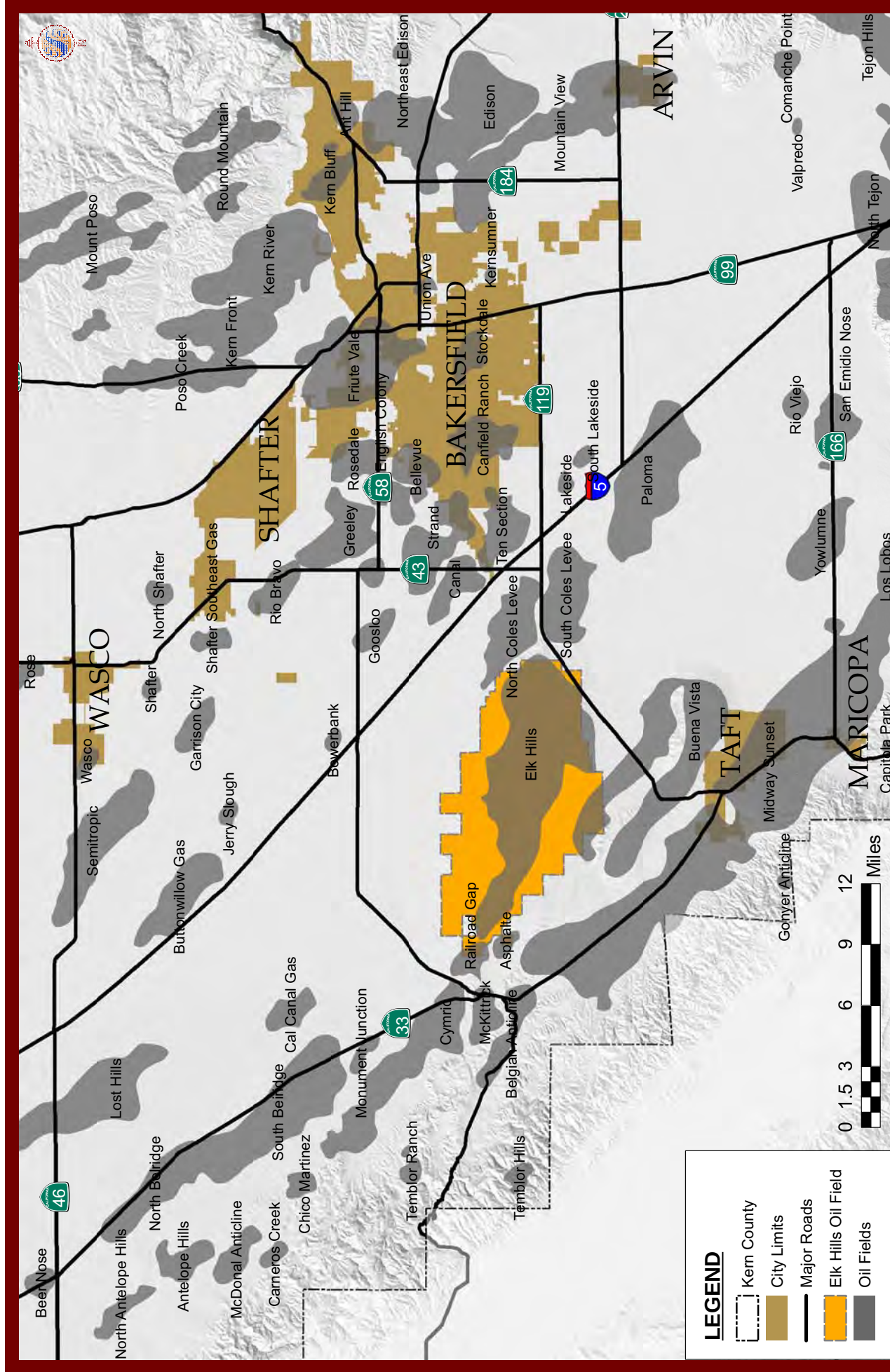
In 2008, the County produced approximately 162.2 million barrels of oil, representing approximately 68 percent of the total 214.6 million barrels of oil produced statewide, which includes

4.10 MINERAL RESOURCES

the Outer Continental Shelf (2008 Annual Report, Division of Oil, Gas and Geothermal Resources [DOGGR]). According to the BLM, if Kern County were a state, it would be the fourth most productive state in the nation in terms of oil production, and if it were a country, its production figures would qualify it for membership within the Organization of the Petroleum Exporting Countries (OPEC).

Kern County is located within District #4 of the State Department of Conservation, Division of Oil, Gas, and Geothermal Resources. With the exception of about one percent, which comes from Tulare, Kings and San Luis Obispo Counties, all resources produced in District #4 listed in State publications are from Kern County.

The proposed Project Site is located within the EHOF, an active operating oil field (Figure 4.10-2: Kern County Oil Fields Map).



Stantec

2590 Venture Oaks Way, Sacramento, CA 95833
 Phone 916.569.2500 Fax 916.921.1924 www.stantec.com
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Fig. 4.10-2

Kern County Oil Fields Map

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4.10 MINERAL RESOURCES

Natural Gas

Natural gas is produced in two basic forms. Associated gas is produced along with crude oil while non-associated gas is produced from gas fields that do not produce any crude oil. Natural gas is produced from reservoirs underground and compressed for transportation through pipelines. Because natural gas usually has no odor and cannot be seen, it is mixed with a chemical that gives it an easy to detect smell in the event of an accidental leak. Natural gas is distributed through underground pipes to its ultimate destination to residential, commercial, manufacturing and utility customers.

California is a major producer of natural gas and Kern County produces more than half of the gas produced in the state. California's net natural gas production in the year 2008 reportedly totaled approximately 296.9 billion cubic feet. According to the 2008 DOGGR report, the EHOFF is the largest producer of associated natural gas in California, with a net gas production of 100 billion cubic feet in 2008. The State of California uses over six times the amount of natural gas than it produces.

Sand and Gravel Resources

Major sand and gravel deposits are concentrated primarily along the floodplain and alluvial fan of the Kern River, where clean, coarse deposits have been left by major floods over geologic time. With increasing distance from the Kern River, alluvial deposits tend to become finer grained, and have been harvested to a lesser degree. Sand and gravel are an important resource for construction, development, and physical maintenance of structures. The availability of sand and gravel affects construction costs, tax rates, and affordability of housing and commodities. The State has statutorily required the protection of sand and gravel operations. As transportation costs are a significant portion of the cost of sand and gravel, the long-term availability of local sources of this resource is an important factor in maintaining the economic attractiveness of a community to residents, business and industry.

The major resources of sand and gravel within the County are in the stream deposits along the eastern side of the San Joaquin Valley and in the Sierra Nevada foothills, and in alluvial fan deposits along the north flank of the San Emidio and Tehachapi Mountains. Most of the recent alluvium in the San Joaquin Valley floor is composed of sand used as a source of road base material. The Buttonwillow Compaction Products Mine is located northwest of the Project Site and is designated MRZ-2 for base and fill material.

The proposed Project Site is state-designated as MRZ-3 (PCC) on the 2009 production/consumption region for portland cement concrete grade aggregate (sand and gravel) resources; therefore, it is located within an area containing mineral deposits the significance of which cannot be evaluated from available data (Special Report 210, 2009). The proposed Project Site is located within a currently active oil field and does not contain sand and gravel resources that are currently being extracted. In addition, there was no evidence of past or current sand and gravel extraction occurring within the proposed Project Site.

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Other Mineral Resources

Gold has been the most important metallic mineral mined in Kern County, in terms of the total dollar value. It has been recovered by both placer and lode mining mainly in the Sierra Nevada and desert regions. Associated with gold in the veins are silver, copper, antimony, and lead minerals. While fluctuation in gold prices has caused a reactivation of interest in the commodity over the last two decades, continuous mining activity has been somewhat limited. Placer gold was first mined prior to 1900, with the greatest number of deposits being mined during the late 1920's and 1930's. Principal placer deposits are in the Rand District, El Paso Mountains and along the Kern River. About 1,500 gold claims have been registered in Kern County with approximately 280 of those claims activated as either lode or placer mines. The total amount of gold that was extracted from the Kern County sites is not available, as records were not kept during the more active lode mining activities prior to 1900.

There is no evidence of gold or other precious metal mineral resources located within the proposed Project Site.

Site Characteristics

The general geologic conditions in the proposed Project Site are described in Section 4.6, Geology and Soils. Although portions of Kern County are rich in mineral deposits, the proposed Project Site is not located in an area known for mineral resources of statewide or regional importance (Stickney 2006). There are no mining districts in the proposed Project Site. The closest gold mine is approximately 75 miles southeast of the proposed Project Site, between Rosamond and Mojave known as the Soledad Mountain Mine operated by Golden Queen Mining Company, Ltd.

4.10.3 Regulatory Setting

Oil, gas, and minerals, like land, are considered forms of property. The mineral resources that are beneath a parcel of land (i.e., the mineral estate or subsurface estate) can be owned, and the ownership provides the holder with the mineral rights or subsurface rights; whereas, surface rights refer to ownership of the land, the surface estate, and the right to use that surface. When different parties own the surface and subsurface estates, it is referred to as a "split estate" or "severed estate lands".

The separation of surface and subsurface rights can occur through a mineral reservation. Severance by mineral reservation may occur if a party owning both surface and subsurface rights sells the land, but retains (or reserves) all or a portion of the mineral, oil, and/or gas rights. To preserve title to the subsurface estate, the mineral owner has to record their mineral reservation with the county clerk and recorder's office or some other government land title office. Mineral reservations often occur when lands are originally patented (i.e., the federal government sells the land, but remains the owner of the mineral rights).

4.10 MINERAL RESOURCES

The owners (OEHI and Chevron) of the EHOE own both the surface and mineral rights of the project Site.

The following regulatory discussion provides applicable Federal, State, and County goals, policies, regulations, pertinent to development and operation of the proposed Project.

4.10.3.1 Kern County

Kern County General Plan

The goals, policies, and implementation measures in the Kern County General Plan for mineral resources that are applicable to the proposed Project Site are provided below. In addition, the Kern County General Plan does contain other goals and policies that are more general in nature and are not specific to development such as the proposed Project. Therefore, these goals and policies are not listed below.

Goals

Goal 1. To contain new development within an area large enough to meet generous projections of foreseeable need, but in locations that will not impair the economic strength derived from the petroleum, agriculture, rangeland, or mineral resources or diminish the other amenities that exist in the County.

Goal 2. To protect areas of important mineral, petroleum, and agricultural resource potential for future use.

Goal 3. To ensure that the development of resource areas minimizes effects on neighboring resource lands.

Policies

Policy 14. Emphasize conservation and development of identified mineral deposits.

Implementation Measures

Implementation Measure H. Use the California Geological Survey's latest maps to locate mineral deposits until the regional and statewide importance mineral deposits map has been completed, as required by the SMARA.

Implementation Measure K. Protect oilfields and mineral extraction areas through the use of appropriate implementing zone districts: A (Exclusive Agriculture), DI (Drilling Island), NR (Natural Resource), or PE (Petroleum Extraction).

4.10 MINERAL RESOURCES

4.10.3.2 State

Surface Mining and Reclamation Act of 1975

SMARA, Chapter 9, Division 2 of the Public Resources Code, requires the SMGB to adopt State policy for the reclamation of mined lands and the conservation of mineral resources. These policies are prepared in accordance with the Administrative Procedures Act (Government Code) and are found in California Code of Regulations, Title 14, Division 2, Chapter 8, Subchapter 1.

The intent of the SMARA is to promote production and conservation of mineral resources, minimize environmental effects of mining, and to ensure that mined lands will be reclaimed to conditions suitable for alternative uses. In accordance with SMARA, permits are required for all mining industries commencing operation on or after January 1, 1976.

SMARA mandates the classification of valuable lands in order to protect mineral resources within the State of California subject to urban expansion or other irreversible actions. SMARA also allows the State to designate lands containing mineral deposits of regional or statewide significance.

State Geological Survey

The State Geological Survey has the responsibility to identify and assist in the utilization of mineral deposits, and to identify geological hazards, including fault locations.

Special Publication 51

This publication contains the policies and procedures outlined in the SMARA. This publication is prepared by the SMGB in cooperation with the Office of Mine Reclamation and the California Geological Survey.

Division of Oil, Gas, and Geothermal Resources

DOGGR within the State of California, Department of Conservation supervises the drilling, operation, maintenance, and abandonment of oil, gas, and geothermal wells in order to protect the environment, public health and safety, and encourage good conservation practices. DOGGR collects data on the location of groundwater, oil, gas, and geothermal resources as well as records the location of all drilled and abandoned wells.

4.10.3.3 Federal

Bureau of Land Management (BLM)

The BLM is an agency within the United States Department of the Interior, which administers 261 million surface acres of America's public lands, located primarily in the Western States. The BLM preserves the health, diversity and productivity of public lands for the use and enjoyment of present and future generations. The public lands provide a myriad of opportunities for commercial activities.

4.10 MINERAL RESOURCES

Commercially valuable natural resources include energy and mineral commodities, forest products, grazing forage and special uses such as rights-of-way for pipelines and transmission lines.

The BLM is responsible for managing commercial energy and mineral production from the public lands in an environmentally responsible manner. The BLM is responsible for the leasing of Federal oil, gas and geothermal minerals, as well as for supervising the exploration, development and production operations of these resources on both Federal and Native American Lands. The proposed Project Site is privately owned and is not, in part or whole, under ownership of the BLM.

4.10.4 Impacts and Mitigation Measures

4.10.4.1 Methodology

An assessment of the potential for mineral loss as a result of the proposed Project was performed by assessing the proposed Project Site with respect to California Geological Survey maps, the Kern County General Plan.

4.10.4.2 Thresholds of Significance

Appendix G of the CEQA Guidelines and the Kern County CEQA Implementation Document state that a project would have a significant impact on mineral resources if it results in the following:

Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state; or

Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan.

4.10.4.3 Project Impacts

IMPACT MIN-1 Result in the Loss of Availability of a Known Mineral Resource that Would Be of Value to the Region and the Residents of the State

The proposed Project Site is located within an area that currently produces oil and natural gas that have economic value. As described above, the proposed Project Site is located within the active EHO (see Figure 4.10-2: Kern County Oil Fields above) with no other current resource mining operations located within the Project Site. The Project Site is designated MRZ-3 (PCC) and is not located in any of the County's designated sand and gravel aggregate areas or Mining Districts. According to the Department of Conservation California Principal Mineral – Producing Localities 1990-2000, the proposed Project Site is within an area that has the potential to contain Silica (Si), and Shale (SH). Given the Project Site is already an active oil field and does not have the potential to adversely impact other mineral resources, development of the proposed Project Site will result in a less than significant impact to mineral resources.

4.10 MINERAL RESOURCES

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT MIN-2 Result in the Loss of Availability of a Locally Important Mineral Resource Recovery Site Delineated on a Local General Plan, Specific Plan, or other Land Use Plan

As mentioned in IMPACT MIN-1 above, the proposed Project Site would not be located in an area that is identified in the SMARA maps for mineral resources. In the past, the proposed Project Site has been and is currently used for oil exploration and the proposed development is designed to enhance those activities. The proposed Project Site is not used for extracting sand and gravel. Therefore, the proposed Project will not result in a loss of locally important mineral resources upon implementation resulting in a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.10.5 Cumulative Impacts

As discussed above, the proposed Project is limited to utilizing CO2 enhanced oil recovery within an existing oil and gas field. The proposed project does not include any component that will contribute to a substantial cumulative impact to mineral resources. Therefore, implementation of the proposed Project will result in a less than significant cumulative mineral resources impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

The proposed Project would have less than significant cumulative impacts.

4.11 NOISE

4.11 Noise

4.11.1 Introduction

The purpose of this section is to analyze the potential noise impacts associated with construction and operation of the Project. It describes the existing noise conditions at the EHO, the regulatory setting, and the potential impacts of the Project. Sources of information used for the preparation of this section included data from the *Kern County General Plan-Noise Element*, the *Kern County Code*, and ambient noise levels measured by Stantec at sensitive receptors located in close proximity to the Project Site.

Terminology and Fundamentals of Environmental Acoustics

The measurement of any sound level requires language used specifically for the measurement of acoustical conditions. Table 4.11-1 defines technical terms that are used in this section.

4.11 NOISE

TABLE 4.11-1: DEFINITIONS OF ACOUSTICAL TERMS

Term	Definition
dB, Decibel	Unit of measurement of sound level
dBA, decibel A-Weighted	A unit of measurement of sound level corrected to the A-weighted scale, as defined in ANSI S1.4-1971 (R1976), using a reference level of 20 micropascals (0.00002 Newtons per square meter).
A – Weighted Scale	A sound measurement scale, which corrects the pressures of individual frequencies according to human sensitivities. The scale is based upon the fact that the region of highest sensitivity for the average ear is between 2,000 and 4,000 Hz. Sound levels are measured on a logarithmic scale in decibels, dB. The universal measure for environmental sound is the A-weighted sound level, dBA.
Hz, Hertz	Unit of measurement of frequency, numerically equal to cycles per second.
Loudness	A listener's perception of sound pressure incident in his ear.
L01, L10, L50, L90	The A-weighted noise levels that are exceeded 1 %, 10 %, 50 %, and 90 % of the time during the measurement period.
Leq, Equivalent Noise Level	Also called the equivalent continuous noise level. It is the continuous sound level that is equivalent, in terms of noise energy content, to the actual fluctuating noise existing at the location over a given period, usually one hour. Leq is usually measured in hourly intervals over long periods in order to develop 24-hour noise levels.
CNEL, Community Noise Equivalent Level	The CNEL is a measure of the cumulative noise exposure in the community, with greater weights applied to evening and night time periods. This noise descriptor is the equivalent noise level over a 24-hour period mathematically weighted during the evening and night when residents are more sensitive to intrusive noise. The daytime period is from 7:00 a.m. to 7:00 p.m.; evening from 7:00 p.m. to 10:00 p.m.; and nighttime from 10:00 p.m. to 7:00 a.m. A weighting factor of 1 dB is added to the measured day levels defined as 7 a.m. to 7 p.m., evening levels (7 p.m. to 10 p.m.) have a weighting factor of three and 10 dB to the night time levels (10 p.m. to 7 a.m.). The weighted levels over a 24-hour period are then averaged to produce the single number CNEL rating.
Ldn, Day/Night Noise Level	The same as CNEL except that the evening time period is not considered separately, but instead it is included as part of the daytime period. Measurements of both CNEL and Ldn in the same residential environments reveal that CNEL is usually slightly higher (by less than 1 dB) than Ldn due to the evening factor weighting.
Lmin, Lmax	The minimum and maximum A-weighted noise level during the measurement period.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

The decibel (dB) is the preferred unit used to measure sound levels utilizing a logarithmic scale to account for large range in audible sound intensities. A general rule for the decibel scale is that a 10 dB increase in sound is perceived as a doubling of loudness by the human ear. For example, a 55

4.11 NOISE

dB sound level will sound twice as loud as a 45 dB sound level. The average healthy person cannot detect differences of 1 dB whereas a 5 dB change is clearly noticeable.

Several sound measurement descriptors are used to assess the effects of sound on the human environment. These include the equivalent sound level, *Leq*, which is the level of a constant sound that has the same sound energy as the actual fluctuating sound. It is similar to the average sound level. The day-night sound level, *Ldn*, is similar to the 24-hour *Leq* except that a 10 dB penalty is added to sound levels between 10 p.m. and 7 a.m. to account for the greater sensitivity of people to sound at night. The Community Noise Equivalent Level (CNEL) also places a weighted factor on sound events occurring in the evening hours. The L90 value is the sound level (L) that is exceeded 90 percent of the time and is often used to describe the background or residual sound level. Each of these sound level descriptors is found within the *Kern County General Plan Noise Element* or the *Kern County Code Title 8 Health and Safety, Chapter 8.36 Noise Control* describing noise regulation or policy.

Acoustics is defined as the science of sound, including the generation, transmission, and effects of sound waves, both audible and inaudible. Noise, on the other hand, is generally defined as loud, unpleasant, unexpected or undesired sound that disrupts or interferes with normal human activities. Although exposure to high noise levels has been demonstrated to cause hearing loss, the principal human response to environmental noise is annoyance. The objectionable nature of sound is caused by its *pitch* or *loudness*. *Pitch* is the height or depth of a tone or sound wave, depending on the relative rapidity (frequency) of the sound vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. *Intensity* is a measure of the amplitude or height of the sound wave. *Frequency* describes the sound's pitch and is measured in Hertz (Hz), while intensity describes the sound's loudness and is measured in dB.

The *dB* is the preferred unit for measuring sound that indicates the relative amplitude (height) of a particular sound wave. The zero (0) on the decibel scale is based on the lowest sound level that a healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic scale. Thus an increase of 10 dB represents a ten-fold increase in acoustic energy, while a 20 dB increase is 100 times more intense, and a 30 dB increase is 1,000 times more intense. There is a direct relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10dB increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. The A-weighted decibel (dBA) is a method of sound measurement which assigns weighted values to selected frequency bands in an attempt to reflect how the human ear responds to sound. The range of human hearing is from 0 dBA (the threshold of hearing) to about 140 dBA which is the threshold of pain. Examples of noise and their A-weighted decibel levels are shown in Table 4.11-2. In general, a 3 to 5 dBA change in community noise levels starts to become noticeable, while 1 to 2 dBA changes are generally not perceived. Quiet suburban areas typically have noise levels in the range of 40–50 dBA, while those along arterial streets are in the 50–60 dBA or greater range. Normal conversational levels are in the 60–65 dBA ranges.

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In addition to the actual instantaneous measurements of sound levels, the duration of sound is important since sounds that occur over a long period of time are more likely to be an annoyance or cause direct physical damage or environmental stress. To analyze the overall noise levels in an area, noise events are combined for an instantaneous value or averaged over a specific time period. The time-weighted measure is referred to as equivalent sound level and represented by energy equivalent sound level (L_{eq}). The percentage of time that a given sound level is exceeded also can be designated as L_{10} , L_{50} , and L_{90} . The subscript denotes the percentage of time that the noise level was exceeded during the measurement period. Namely, an L_{10} indicates the sound level is exceeded 10 percent of the time and is generally taken to be indicative of the highest noise levels experienced at a location. The L_{90} is that level exceeded 90 percent of the time and this level is often called the base level of noise at a location. The L_{50} sound (that level exceeded 50 percent of the time) is frequently used in noise standards and ordinances. The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within ± 1 dBA.

Since the sensitivity to noise increases during the evening and at night (because excessive noise interferes with the ability to sleep) 24-hour descriptors have been developed that incorporate artificial noise penalties that are added to quiet-time noise events. The *CNEL* is a measure of the cumulative noise exposure in a community during a 24-hour period. The *Day/Night Average Sound Level (L_{dn})* is essentially the same as *CNEL*, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

Effects of Noise

Hearing Loss

While physical damage to the ear from an intense noise impulse is rare, a degradation of auditory acuity can occur even within a community noise environment. Hearing loss occurs mainly due to chronic exposure to excessive noise, but may be due to a single event such as an explosion. Natural hearing loss associated with aging may also be accelerated from chronic exposure to loud noise.

According to the California Department of Industrial Relations, Division of Occupational Safety and Health, which enforces California Occupation Safety and Health Administration (Cal/OSHA) Occupational Noise Exposure Standard is set at the noise threshold where hearing loss may occur from long-term exposures. The maximum allowable level is 90 dBA averaged over an eight (8)-hour time period.

Sleep and Speech Interference

The thresholds for speech interference indoors are 45 dBA if the noise is steady and 55 dBA if the noise is fluctuating. Outdoor thresholds are 15 dBA higher. Steady noise of sufficient intensity (above 35 dBA), and fluctuating noise levels above 45 dBA have been shown to affect sleep. Interior residential standards for multi-family residences are set by the State of California at 45 dBA L_{dn} .

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Typically, the highest steady traffic noise level during the daytime is equal to the Ldn, and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses. Typical structural attenuation is 12–17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is 20 dBA for an older structure and 25 dBA for a newer structure. Sleep and speech interference is therefore possible when exterior noise levels are 57–62 dBA Ldn with open windows and 65–70 dBA Ldn if the windows are closed. Levels of 55–60 dBA are common along collector streets and secondary arterials, while 65–70 dBA is a typical value for a primary/major arterial. Levels of 75–80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed and those facing major roadways and freeways typically need special glass windows.

Annoyance

Attitude surveys are used for measuring the annoyance felt in a community for noise intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that the causes for annoyance include interference with speech, radio, and television, house vibrations, and interference with sleep and rest. The Ldn as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. When measuring the percentage of the population highly annoyed, the threshold for ground vehicle noise is 55 dBA Ldn. At an Ldn of 60 dBA, approximately 2 percent of the population is highly annoyed. When the Ldn increases to 70 dBA, the percentage of the population increases to 12 percent highly annoyed. This corresponds to an increase of 1 percent per dBA between an Ldn of 60–70 dBA. Between an Ldn of 70–80 dBA, each increase in decibels increases the population highly annoyed by 2 percent.

People appear to respond more adversely to aircraft noise as opposed to general community noise levels. When the Ldn is 60 dBA; approximately 10 percent of the population is highly annoyed. Each decibel increase to 70 dBA adds 2 percentage points to the number of people highly annoyed. Above 70 dBA, each decibel increase results in a 3 percent increase in the percentage of the population highly annoyed. Representative outdoor and indoor noise levels in units of dBA are shown in Table 4.11-2.

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TABLE 4.11-2 TYPICAL SOUND LEVELS MEASURED IN THE ENVIRONMENT

At a Given Distance from Noise Source	A-Weighted Sound Level in dBA	Noise Environments	Subjective Impression
Civil Defense Siren (100')	140	Rock Music Concert	Pain Threshold
Jet Takeoff (200')	130		
	120		
	110		
Diesel Pile Driver (100')	100	Boiler Room Printing Press Plant	Very Loud
	90		
	80		
Freight Cars (50')	70	In Kitchen With Garbage Disposal Running Data Processing Center	Moderately Loud
Pneumatic Drill (50')			
Freeway (100')	60		
Vacuum Cleaner (10')			
	50	Department Store	Quiet
Light Traffic (100')	40		
Large Transformer (200')	30	Private Business Office Quiet Bedroom Recording Studio	Threshold of Hearing
Soft Whisper (5')	20		
	10		
	0		

Source: USEPA 1971, Barnes, et al., 1976.

4.11.2 Environmental Setting

Affected Noise Environment

The Project Site is located primarily within an area used for mineral and petroleum extraction. The eastern portion of the Project Site is located approximately 1.5 miles west of the unincorporated community of Tupman and 0.8 mile northwest of Taft Highway (State Highway 119) and extends approximately 5 miles to the west. The western portion of the Project Site is located approximately 3.4 miles to the northwest of the intersection of Skyline Road and Elk Hills Road and extends approximately 3 miles to the northwest (Northwest Stevens).

The primary noise sources at and around the Project Site are vehicular traffic from Skyline Road and Elk Hills Road and petroleum extraction operations.

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Project Noise Setting

The “acceptable” guideline level is an Ldn (or CNEL) of 65 dBA for outdoor noise levels in residential districts. If existing levels are found to be above the guideline up to 65 dBA, then the level is considered to be “conditionally acceptable” and additional acoustical analyses are required to demonstrate that noise impacts will be mitigated to a less than significant level by appropriate project design.

Noise levels generated from highway and roadway traffic on State Highway 119 and Tupman Road do not vary significantly from month to month or from season to season. Noise generated from vehicular highway traffic in the Project Site is a constant “white” noise. The steady flow of traffic does not produce sharp unsteady noises, but rather constant sounds which may increase or decrease slightly with changes in traffic flow. According to Caltrans, Traffic Operations Program-Traffic and Vehicular Data Systems (<http://traffic-counts.dot.ca.gov/2009all/Route118-133i.htm>), State Highway 119 (between Elk Hills Road and Aqueduct Service Road) and Tupman Road (which are less than 2 miles from the Project Site) have changes in monthly traffic levels from the peak month to the average month which are approximately 7 percent. This relatively small level of traffic volume change from month to month will not have a significant overall impact on the seasonal noise generation from the adjacent State Highway 119.

As a general rule, sound from localized or point sound sources spreads out as it travels away from the source, and the sound level drops at a rate of 6 dB for each doubling of distance. Any solid structure such as a berm, wall, or building that blocks the line of sight between a source and a receiver serves as a sound barrier and will result in additional sound attenuation. The amount of additional attenuation is a function of the difference between the length of the sound path over the barrier and the length of the direct-line-of-sight path. Thus, the sound attenuation of a barrier between a source and a receiver that are very far apart will be much less than the attenuation that would result if either the source or the receiver is very close to the barrier.

Sensitive Receptors

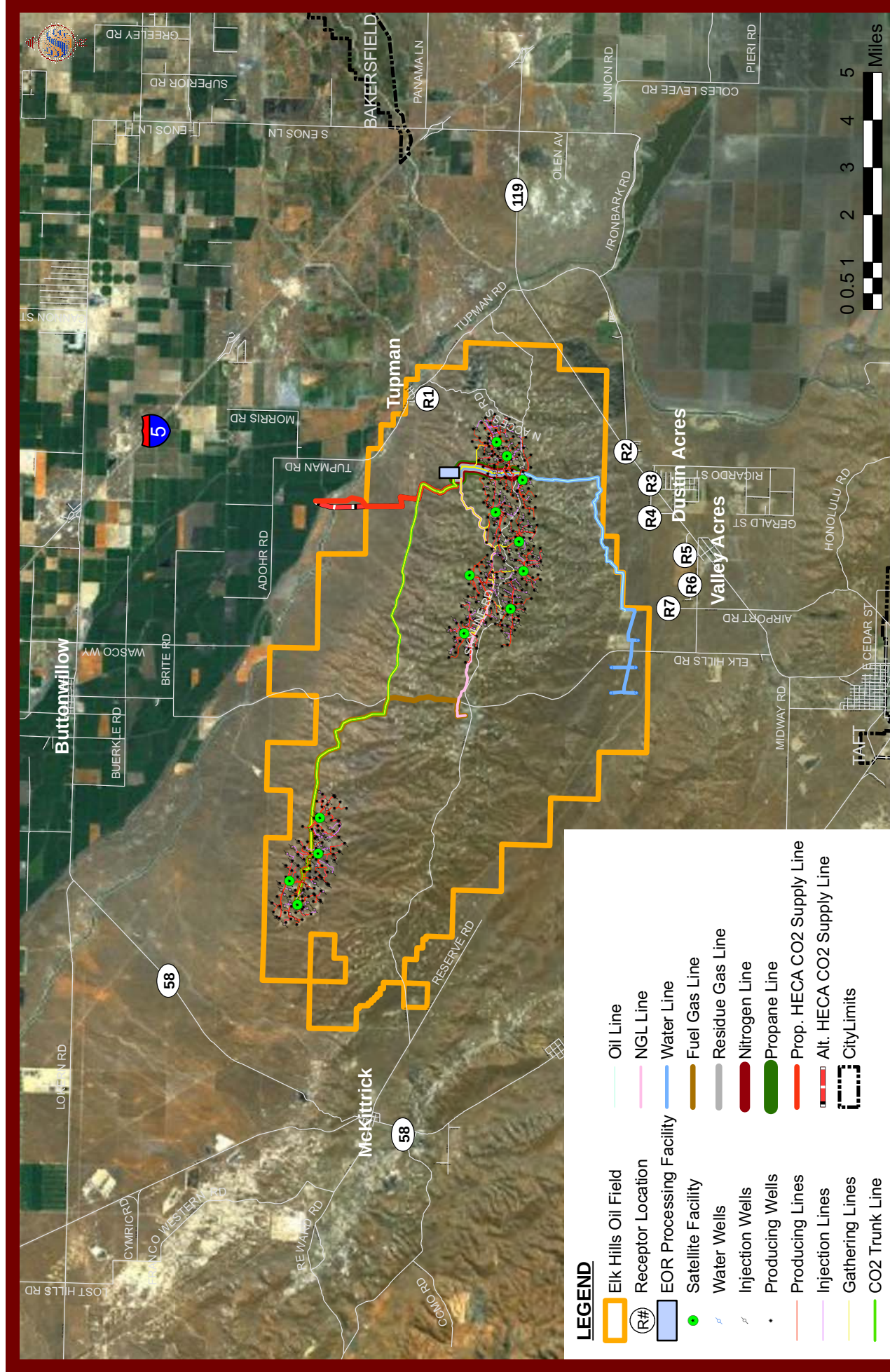
Seven sensitive receptors (residential land uses) are located within areas that could be potentially impacted by noise generated by the Project. Stantec measured the daytime ambient noise levels at each of the seven identified sensitive receptors on September 21, 2010 using a Bruel & Kjaer Type 2236 noise meter. The sensitive receptors, proximity to the Project Site, and the ambient noise level are presented in Table 4.11-3 *Sensitive Receptors in Close Proximity to Project Site*. The locations of the sensitive receptors are shown in Figure 4.11-1 *Sensitive Noise Receptor Map*.

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TABLE 4.11-3: SENSITIVE RECEPTORS IN CLOSE PROXIMITY TO PROJECT SITE

Receptor Identification	Receptor Description	Receptor Location	Daytime Ambient Noise Level (Leq)*
R1	Tupman: Intersection of Grace Avenue and Kern Street	East of construction (~1.5 miles) Northeast of operations (~1.5 miles)	62.2 dBA
R2	North of Dustin Acres: Intersection of Taft Highway (State Highway 119) and Golf Course Road	Southeast of construction (~1 mile) Southeast of operations (~3.5 miles)	73.2 dBA
R3	Dustin Acres: Intersection of Taft Highway (State Highway 119) and Tank Farm Road	Southwest of construction (~1 mile) Southeast of operations (~4 miles)	71.9 dBA
R4	Dustin Acres: Intersection of Tank Road and Tank Farm Road	Southeast of construction (~1 mile) South of operations (~4 miles)	66.8 dBA
R5	Valley Acres: Intersection of Mesquite Street (unpaved) and Tamarisk Avenue (unpaved)	South of construction (~1.2 miles) Southwest of operations (~5 miles)	63.8 dBA
R6	Valley Acres: Intersection of Escudo Drive (unpaved) and Gibbs Street (unpaved)	South of construction (~1.2 miles) Southwest of operations (~5.3 miles)	61.2 dBA
R7	Valley Acres: Airport Road (unpaved) approximately 0.5 miles South of the Intersection of Airport Road and Valley West Road	South of construction (~1 mile) Southwest of operations (~5.4 miles)	76.0 dBA

*Data collected by Stantec Personnel on September 21, 2010 during daytime hours.



Stantec

2590 Venture Oaks Way, Sacramento, CA 95833
 Phone 916.599.2500 Fax 916.921.9274 www.stantec.com
 Project # 185602314

Stantec does not certify the accuracy of the data. This map is for reference only and should not be used for construction.

Cartographic Design By: C. Flinders | Environmental Remediation

Fig. 4.11-1

Sensitive Noise Receptor Map

OEHI CO2 EOR Project - Supplemental Environmental Information

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4.11.3 Regulatory Setting

Local agencies may regulate noise levels of most sources not regulated by the Federal government, may provide standards for insulation of noise receivers either within the structure or by placement of noise barriers such as wall, and, through land use decisions, may reduce noise impacts by separating noise generator from noise sensitive uses.

4.11.3.1 Local

Kern County General Plan

The goals and policies set forth by the *Kern County General Plan Noise Element* have been established in order to protect the acoustical environment for Kern County and to assure a comfortable and calming quality of life for residents. The *Kern County General Plan Noise Element* requires indoor noise levels in habitable rooms be limited to 45 dBA Ldn. The typical attenuation factor for structures with closable windows is 20 dBA, the maximum noise level in outside living areas, such as yards, is required to be less than 65 dBA Ldn. A noise level of 65 dBA Ldn is considered the upper limit for noise-sensitive land uses such as residential areas, schools, convalescent and acute care hospitals, parks and recreation areas and churches. The Project will have to meet the goals and policies outlined in the *Kern County General Plan Noise Element*.

3.0 Noise Element

Goals

Goal 1. Ensure that residents of Kern County are protected from excessive noise and that moderate levels of noise are maintained.

Goal 2. Protect the economic base of Kern County by preventing the encroachment of incompatible land uses near known noise producing roadways, industries, railroads, airports, oil and gas extraction, and other sources.

Policies

Policy 1. Review discretionary industrial, commercial, or other noise-generating land use projects for compatibility with nearby noise-sensitive land uses.

Policy 2. Require noise levels criteria applied to all categories of land uses to be consistent with the recommendations of the California Division of Occupational Safety and Health (DOSH).

Policy 3. Encourage vegetation and landscaping along roadways and adjacent to other noise sources in order to increase absorption of noise.

Policy 4. Utilize good land use planning principles to reduce conflicts related to noise emissions.

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Policy 5. Prohibit new noise-sensitive land uses in noise-impacted areas unless effective mitigation measures are incorporated into the project design. Such mitigation shall be designed to reduce noise to the following levels:

- e. 65 dB Ldn or less in outdoor activity areas
- f. 45 dB or less within interior living spaces or other noise sensitive interior spaces.

Policy 6. Ensure that new development in the vicinity of airports will be compatible with existing and projected airport noise levels as set forth in the ALUCP.

Policy 7. Employ the best available methods of noise control.

Implementation Measures

Implementation Measure A. Utilize zoning regulations to assist in achieving noise-compatible land use patterns.

Implementation Measure B. Require proper acoustical treatment of transportation facilities, including highways, airports, and railroads.

Implementation Measure C. Review discretionary development plans, programs and proposals, including those initiated by both the public and private sectors, to ascertain and ensure their conformance to the policies outlined in this element.

Kern County General Plan Land Use Categories

The Kern County General Plan Noise Element refers to L_{50} data as the typical criteria data, which is noise occurring 50 percent of the time, i.e., the median noise value for a data set. On the other hand, the Ldn represents a single value reflecting greater weight assigned to evening and nighttime readings to account for the sensitivity of receptors at night. As defined previously, noise values measured in the evening (7 p.m. to 10 p.m.) have 3 dB added and at night (10 p.m. to 7 p.m.) have 10 dB added to them before being averaged into the Ldn value (the noise is treated as being 3 and 10 times louder). Table 4.11-4, Kern County Noise Element Land Use Categories, divides land uses into four categories below and Table 4.11-5, Noise Level Standards, describes the permitted sound levels for each land use category.

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TABLE 4.1 1-4: KERN COUNTY NOISE ELEMENT USE CATEGORIES

Insensitive Land Uses	Moderately Sensitive Land Uses	Sensitive Uses	Highly Sensitive Uses
Land Uses that are not adversely affected by any higher noise levels (no noise controls necessary). Examples: Agriculture Livestock Farms Mining and Extraction Water Areas Natural Open Space Railways and Terminals Transit Systems and Terminals Automobile Parking Warehouse Utilities Construction Yards	Included are those uses that are not adversely affected by moderate noise levels (some noise control measures should be established to control the higher level noises). Examples: Country Clubs Athletic Clubs Golf Courses Equestrian Clubs Scientific Testing Government Services Lodges, Community Associations Professional Offices	Those uses where noise controls are necessary (without noise control the uses would be greatly disrupted). Examples: Cemeteries Single-family Dwellings Multi-family Dwellings Dormitories Resort Hotels Preschools Motor Inns Mobile Home Parks Professional Research	Includes uses where any noise would be greatly disruptive (effective noise control measures are very important for these uses). Examples: Rural Single-Family Dwellings Educational Facilities Hospitals Convalescent Homes Wildlife Sanctuaries Churches Auditoriums, Concert Halls

TABLE 4.1 1-5: NOISE LEVEL STANDARDS

Land Use Category	L ₅₀ Noise Levels dBA Ldn		
	Day	Night	CNEL
Insensitive Uses	65	60	75
Moderately Sensitive Uses	60	55	70
Sensitive Uses	55	45	65
Highly Sensitive Uses	50	40	60

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Kern County Airport Land Use Compatibility Plan

The evaluation of airport/land use noise compatibility shall consider the future CNEL contours of each airport. According to the Kern County Airport Land Use Compatibility Plan, these contours are calculated based upon aircraft activity forecasts which are set forth in an airport master plan or which are considered by the local agency to be plausible.

Kern County Code

Kern County codes are intended to promote and protect public peace, health, safety, and welfare and to guide growth and development in the keeping with the Kern County General Plan. The following are prohibited sounds established by the Kern County Code, chapter 8.36.020.

It is unlawful for any person to do, or cause to be done, any of the following acts within the unincorporated areas of the County:

- e. Operate any public address system in any event when the sound emanating there from can be heard beyond the confines of any permanent building to such degree that such sound constitutes a loud and raucous noise;
- f. Operate any public address system when the sound emanating there from can be heard beyond the confines of a permanent building when such operation constitutes the promotion or advertisement of any private affair or business or commercial enterprise;
- g. Operate any public address system when the sound emanating there from can be heard beyond the confines of a permanent building when such operation is for purposes other than the promotion or advertisement of any private affair or business or commercial enterprise unless such operation shall first be declared as hereinafter provided;
- h. The provisions of subsection (D) of this section shall not prohibit the incidental sounding, between the hours of nine (9:00) a.m. and nine (9:00) p.m. of any day, of a musical sound apparatus consisting of bells or the sounding of a bell or horn when the sound thereof is not audible to a person of average hearing faculties or capacity at a distance of one hundred fifty (150) feet, when such incidental sounding is in connection with the ordinary use and operation of a tradesman's, peddler's, or huckster's cart, wagon or other vehicle; provided, however, that no such sounding in any event shall be permitted between the hours of nine (9:00) p.m. of any day and nine (9:00) a.m. of the following day;
- i. Operate or permit to be operated any public address system or sound equipment so as to be audible to a person of average hearing faculties or capacity at a distance of:
 - 1. One hundred fifty (150) feet from the public address system or sound equipment, if operated on a public street, sidewalk or any other public property, or

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2. If operated elsewhere, one hundred fifty (150) feet from the property line of the property on which the public address system or sound equipment is located, or
 3. Between the hours of eight (8:00) a.m. and midnight (12:00) a.m., one thousand (1,000) feet from the public address system or sound equipment connected with either short-term events held on public property with the consent of the responsible public agency, short-term public events held historically and regularly, or short-term events authorized by any kind of permit or license issued by the county. This subsection shall not apply to acts proscribed by Section 27007 of the California Vehicle Code, as amended from time to time. (Ord. G-6301 §§ 4, 5, 1996; prior code § 6351).
- j. To create noise from construction, between the hours of nine (9:00) p.m. and six (6:00) a.m. on weekdays and nine (9:00) p.m. and eight (8:00) a.m. on weekends, which is audible to a person with average hearing faculties or capacity at a distance of one hundred fifty (150) feet from the construction site, if the construction site is within one thousand (1,000) feet of an occupied residential dwelling except as provided below:
1. The development services agency director or his designated representative may for good cause exempt some construction work for a limited time.
 2. Emergency work is exempt from this section.

4.11.3.2 State

Two state laws address occupational noise exposure for construction workers and vehicle noise that apply to the Project. The Cal-OSHA regulations, which are the same as the federal OSHA regulations, are described below under the *Federal* subheading. The regulations are contained in 8 California Code of Regulations (CCR), General Industrial Safety Orders, Article 105, Control of Noise Exposure, Sections 5095, et seq. Noise limits for highway vehicles are regulated under the California Vehicle Code, Sections 23130 and 23130.5. The limits are enforceable on the highways by the California Highway Patrol, the Kern County Sheriff's Office, within the Project Site area. The California State Government Code, Section 65302, requires local governments (Counties and Cities) to prepare plans that contain noise provisions and standards. Kern County conforms to the Government Code requirements with the *Kern County General Plan Noise Element* outlined above.

California Energy Commission

The CEC guidelines state that the area of impact to be studied should include areas where the noise of the project plus the background exceeds the existing background levels by 5 dBA or more at the sensitive receptor, including those receptors that are considered a minority population. The CEC has considered it reasonable to assume that an increase in background noise levels up to 5 dBA in a residential setting is considered insignificant, while an increase of more than 10 dBA in a residential

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setting is considered significant. For projects where the increase is between 5 and 10 dBA, the level of an impact depends on the particular circumstances of a case. Factors to be considered in determining the significance of an impact for this plus 5 to plus 10 dB situation include:

- Resulting noise level;
- Duration and frequency of the noise;
- Number of people affected;
- Land use designation of the affected receptor sites; and
- Public concern or controversy as demonstrated at workshops or hearings, or by correspondence.

4.11.3.3 Federal

The federal government has no standards or regulations applicable to off-site noise levels from the Project. However, guidelines are available from the USEPA (1974) to assist state and local government entities in development of state and local LORS for noise.

On-site noise levels are regulated, in a sense, through the Occupational Safety and Health Act of 1970 and through the OSHA. The noise exposure level of workers is regulated at 90 dBA over an eight (8)-hour work shift to protect hearing (29 CFR 1910.95). On-site noise levels will generally be in the 70 to 85 dBA range. Areas above 85 dBA will be posted as high noise level areas and hearing protection will be required.

4.11.4 Impacts and Mitigation Measures

4.11.4.1 Methodology

Potential sources of noise associated with the Project include:

- Construction activities
 - o Vehicles on roadways;
 - o CO2 EOR Processing Facility construction;
 - o Satellite station construction;
 - o Pipeline installations; and
 - o Well installations.
- Operational activities

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- o Vehicles on roadways;
- o Routine activities typical of existing oil field operation; and
- o Pumps and compressors at the CO2 EOR Processing Facility.

Many of the above components are located in areas without the presence of nearby sensitive receptors and have not been considered further in this analysis. This analysis focuses on the potential noise impacts of the following:

- Vehicle use on roadways;
- CO2 EOR Processing Facility construction near the community of Tupman;
- Operation of the CO2 EOR Processing Facility near the community of Tupman;
- Pipeline construction near the community of Dustin Acres; and
- Pipeline construction near the community of Valley Acres.

Sound levels produced by these various sources are based on data from standard references, previous studies, and equipment manufacturers' data. Projected sound levels from these sources were estimated using a point source attenuation model. Noise from the source was assumed to attenuate at a rate of 6dB for each doubling of distance. To determine potential noise impacts, the noise levels of these activities were estimated at the closest sensitive receptor and compared to the Kern County standard noise level of 65 dBA. In addition, the Project's potential noise impacts were assessed and compared to the below significance thresholds. Where a noise level is predicted to exceed a threshold, the impact was considered significant and mitigation measures are as applicable.

4.11.4.2 Threshold of Significance

Appendix G of CEQA Guidelines and the Kern County CEQA Implementation Document state that a project would have a significant noise impact if it would result in:

Exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;

Exposure of persons to, or generation of, excessive ground borne vibration or ground borne noise levels;

Substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;

Substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;

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For a project located within the Kern County Airport Land Use Compatibility Plan, exposure of people residing or working in the project area to excessive noise levels; or

For a project within the vicinity of a private airstrip, exposure of people residing or working in the project area to excessive noise levels.

While CEQA does not specifically define what noise level increase is considered substantial, generally in high noise environments a project is considered by the County to have a significant impact if the project would: 1) substantially and permanently increase existing noise levels by more than three (3) dBA Ldn (three decibels is the minimum increase generally perceptible by the human ear); or 2) would cause ambient noise levels to exceed the guidelines established in the Kern County General Plan Noise Element. In addition, the California Energy Commission has determined that a 5 dBA increase in noise levels at residential receptors is potentially significant.

4.11.4.3 Project Impacts

IMPACT NOISE-1 Expose Persons to Noise in Excess of Standards Established in the Kern County General Plan or Noise Ordinances, or other Applicable Standards of Other Agencies

Implementation of the Project will create an increase in noise levels both during construction and operation of the Project. Construction of the Project will require the use of conventional construction equipment which has the potential to generate noise levels at sensitive receptors that exceeds Kern County's general 65 dB Ldn exterior noise level standard. The noise level would vary during the construction period, and is dependent upon the construction phase and types of equipment in use.

The closest sensitive receptor to the Project site is R1, the intersection of Grace Avenue and Kern Street in the Town of Tupman located approximately 1.5 miles northeast of the Project Site. The noise levels associated with installation of the CO2 EOR Processing Facility installation and CO2 EOR Processing Facility operation were modeled at sensitive receptor R1. In addition, noise levels associated with piping installation were modeled at sensitive receptors R2, R3, R4, R5, R6, and R7. The estimated noise levels were then compared to the Kern County exterior noise level standard of 65 dB Ldn to determine if the standard would be exceeded. A summary of the modeling results is presented in Table 4.11-6. The ambient noise levels at the sensitive receptors and a comparison of the Project additive noise impacts are summarized in Table 4.11-7. The noise model spreadsheets for each modeled scenario are included as Appendix B.

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TABLE 4.11-6: ESTIMATED NOISE LEVELS AT SENSITIVE RECEPTORS

Sensitive Receptor	Noise Scenario Modeled	Estimated Ldn at Receptor	Exceedance of County Standard?
R1 - Tupman: Intersection of Grace Avenue and Kern Street	CO2 EOR Processing Facility Installation	61.2	No
R1 - Tupman: Intersection of Grace Avenue and Kern Street	CO2 EOR Processing Facility Operation	61.2	No
R2 - North of Dustin Acres: Intersection of Taft Highway (State Highway 119) and Golf Course Road	Pipeline Installation	72.0	Yes
R3 - Dustin Acres: Intersection of Taft Highway (State Highway 119) and Tank Farm Road	Pipeline Installation	70.7	Yes
R4 - Dustin Acres: Intersection of Tank Road and Tank Farm Road	Pipeline Installation	65.6	Yes
R5 - Valley Acres: Intersection of Mesquite Street (unpaved) and Tamarisk Avenue (unpaved)	Pipeline Installation	62.6	No
R6 - Valley Acres: Intersection of Escudo Drive (unpaved) and Gibbs Street (unpaved)	Pipeline Installation	60.1	No
R7 - Valley Acres: Airport Road (unpaved) approximately 0.5 miles South of the Intersection of Airport Road and Valley West Road	Pipeline Installation	74.8	Yes

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TABLE 4.11-7: AMBIENT NOISE LEVELS AND PROJECT INCREASE

Sensitive Receptor	Noise Scenario Modeled	Ambient Noise Level at Sensitive Receptor		Estimated Noise Level at Sensitive Receptor with Project		Project's Estimated Additive Noise	
		Leq (dBA)	Ldn (dBA)	Leq (dBA)	Ldn (dBA)	Leq (dBA)	Ldn (dBA)
R1 - Tupman: Intersection of Grace Avenue and Kern Street	CO2 EOR Processing Facility Installation	62.2	61.0	62.4	61.2	0.2	0.2
R1 - Tupman: Intersection of Grace Avenue and Kern Street	CO2 EOR Processing Facility Operation	62.2	61.0	62.2	61.2	0	0.2
R2 - North of Dustin Acres: Intersection of Taft Highway (State Highway 119) and Golf Course Road	Pipeline Installation	73.2	72.0	73.2	72.0	0	0
R3 - Dustin Acres: Intersection of Taft Highway (State Highway 119) and Tank Farm Road	Pipeline Installation	71.9	70.7	71.9	70.7	0	0
R4 - Dustin Acres: Intersection of Tank Road and Tank Farm Road	Pipeline Installation	66.8	65.6	66.8	65.6	0	0
R5 - Valley Acres: Intersection of Mesquite Street (unpaved) and Tamarisk Avenue (unpaved)	Pipeline Installation	63.8	62.6	63.8	62.6	0	0
R6 - Valley Acres: Intersection of Escudo Drive (unpaved) and Gibbs Street (unpaved)	Pipeline Installation	61.2	60.0	61.3	60.1	0.1	0.1
R7 - Valley Acres: Airport Road (unpaved) approximately 0.5 miles South of the Intersection of Airport Road and Valley West Road	Pipeline Installation	76.0	74.8	76.0	74.8	0	0

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Construction

As shown in Table 4.11-6, the Kern County exterior noise standard is expected to be exceeded in Dustin Acres and Valley Acres during pipeline construction. Construction related noise impacts in Tupman will be below the Kern County standards and are therefore less than significant. However, as shown in Table 4.11-7, the ambient Ldn noise levels at all four sensitive receptors projected to exceed the Kern County exterior noise standard with inclusion of the Project already exceed the standard under baseline conditions. The existing high noise environment near the sensitive receptors in Dustin Acres and Valley Acres is attributable to vehicular traffic on State Highway 119.

The noise modeling performed as part of this analysis further demonstrates that noise from the Project will only incrementally increase noise levels by 0.2 dBA at R1 during CO2 EOR Processing Facility installation and 0.1 dBA at R6 during pipeline installation. This increase will not result in an exceedance of the Kern County exterior noise standard of 65 dBA Ldn. Due to distance, Project related noise will not increase any noise level at the other receptors considered in this analysis. As such, noise from the Project will not cause an exceedance or measurably contribute to an existing exceedance of the Kern County exterior noise level standard.

The Kern County Code prohibits noise from construction, between the hours of nine (9:00) p.m. and six (6:00) a.m. on weekdays and nine (9:00) p.m. and eight (8:00) a.m. on weekends, which is audible to a person with average hearing faculties or capacity at a distance of one hundred fifty (150) feet from the construction site, if the construction site is within one thousand (1,000) feet of an occupied residential dwelling. As shown in Table 4.1-3, the closest residential dwelling to construction sites is 5,000 feet; five times the distance threshold considered in the Kern County Code. As such, construction noise from the Project is not expected to violate the Kern County Code.

Considering the above, the Project will not expose persons to construction noise in excess of standards established by Kern County. This is a less than significant impact.

Operation

A majority of facility operations will occur many miles from sensitive receptors and will have no contribution to noise at sensitive receptor locations. Operation of the CO2 EOR Processing Facility is the only operational Project component that has the potential to impact a sensitive receptor R1. Noise associated with CO2 EOR Processing Facility operation was modeled to determine its potential affect on noise levels at R1. As shown in Table 4.11-3, noise from CO2 EOR Processing Facility operation is expected to result in a 61.2 dBA Ldn at R1 which is 0.2 dBA above ambient noise levels. As the Ldn is expected to be below the 65 dBA County standards, operation of the CO2 EOR Processing Facility is not expected to contribute to a substantial increase in noise levels at R1.

Operation of the Project is anticipated to create up to 25 full-time employment positions and the potential to add up to 25 vehicle roundtrips to area roadways. This incremental increase is not

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expected to substantially affect existing roadway noise levels or expose persons to noise levels in excess of established standards.

Considering the above, the operation of the Project will not expose persons to noise in excess of standards established by Kern County. This is a less than significant impact.

Mitigation Measure

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT NOISE-2 Expose Persons to Excessive Ground Borne Vibration or Ground Borne Noise Levels

Excessive ground borne vibration or noise levels are not anticipated during either construction or operation of the proposed Project. The most likely project component to result in ground borne vibrations would be from the operation of conventional construction equipment involved in installation of pipelines and the CO2 EOR Processing Facility. Vibration from typical construction and earthmoving activity is generally below the threshold of perception at distances of more than about 50 feet (U.S. Fish & Wildlife Service, 2006). Given the one mile distance of the nearest construction site to a sensitive receptor, excessive ground borne vibration or noise levels are not anticipated. Project operation does not include any component that has the potential to produce ground borne vibration or noise levels. The Project will have a less than significant ground borne vibration and noise level impact.

Mitigation Measure

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT NOISE-3 Cause a Substantial Permanent Increase in Ambient Noise Levels in the Project Vicinity above Levels Existing

As shown in Table 4.11-7, noise modeling performed as part of this analysis demonstrates that the Project will only incrementally increase noise levels by 0.2 dBA at R1 during CO2 EOR Processing Facility installation and operation and 0.1 dBA at R6 during pipeline installation. The Project will have no effect on ambient noise levels at other sensitive receptors or during other activities. As persons are generally only able to detect at least a 1 dBA noise level change, the 0.2 dBA (R1) and 0.1 dBA (R6) Project-related increases in noise levels will be unnoticeable. In addition, the

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incremental increase in noise levels at R1 and R6 will be temporary during construction near the receptor. Considering the above, the Project will not cause a substantial permanent increase in ambient noise levels in the Project vicinity above existing levels. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT NOISE-4 Cause a Substantial Temporary or Periodic Increase in Ambient Noise Levels in the Project Vicinity above Levels Existing

As shown in Table 4.11-7, noise modeling performed as part of this analysis demonstrates that the Project will only incrementally increase noise levels by 0.2 dBA at R1 during CO2 EOR Processing Facility installation and operation and 0.1 dBA at R6 during pipeline installation. The Project will have no affect on ambient noise levels at other sensitive receptors or during other activities. As persons are generally only able to detect at least a 1 dBA noise level change, the 0.2 dBA (R1) and 0.1 dBA (R6) Project-related increases in noise levels will be unnoticeable. Considering the above, the proposed Project will not cause a substantial temporary or periodic increase in ambient noise levels in the Project vicinity above existing levels. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT NOISE-5 Expose People Residing or Working in the Project Area to Excessive Noise Levels for a Project Located within the Kern County Airport Land Use Compatibility Plan

There are five public airport facilities within the immediate vicinity of the Project Site:

1. Elk Hills – Buttonwillow Airport –approximately 5 miles northwest of the Project Site.
2. Taft Airport – approximately 12 miles southwest of the Project Site
3. Minter Field – approximately 17 miles northeast of the Project Site
4. Meadows Field – approximately 20 miles northeast of the Project Site
5. Bakersfield Municipal – approximately 21 miles east of the Project Site

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The Project Site is not within an area identified within the Kern County Airport Land Use Compatibility Plan nor is it within an area affected by airport noise. Therefore, the Project will not expose people residing or working in the Project area to excessive noise levels for a project located within the Kern County Airport Land Use Compatibility Plan. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT NOISE-6 Expose People Residing or Working in the Project Area to Excessive Noise Levels for a Project within the Vicinity of a Private Airstrip

A private airstrip is located in the vicinity of the Project Site; however, this airstrip is no longer used. Therefore, the proposed Project will not expose people residing or working in the Project area to excessive noise levels from a private airstrip. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.11.5 Cumulative Impacts

The HECA Project is the only cumulative project considered in this analysis that has the potential to combine with noise impacts from the proposed Project to result in cumulative noise impacts in Tupman (R1). The HECA Project is located approximately 1.5 miles northwest of Tupman, while the proposed Project is located approximately 1.5 miles southwest of Tupman. Based on the construction noise modeling results of each project, noise levels are not individually or cumulatively expected to substantially increase noise levels in Tupman. Operation of the proposed Project is expected to generate an attenuated noise level of 39.2 dBA Leq at R1. Operation of the HECA Project is expected to generate an attenuated noise level of approximately 25 dBA Leq at R1. The additive noise levels of these two sources in consideration of existing ambient noise levels was estimated to be 62.2 dBA Leq (see Appendix B).

As 62.2 dBA Leq is the existing daytime ambient noise level at R1, operation of the Project and HECA Project will not measurably increase noise levels at R1. Therefore, the Project will not substantially contribute to a cumulative noise impact. This is a less than significant impact.

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Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

The proposed Project would have less than significant cumulative impacts.

4.12 POPULATION AND HOUSING

4.12 Population and Housing

4.12.1 Introduction

This section addresses potential impacts of the proposed Project on population and housing in the area and provides an overview of the regulatory setting as well as projected population growth and future housing needs.

Sources of information and data provided in this section include the *Kern County General Plan* and Housing Element, the 2007 Regional Housing Assessment Plan, and demographic information from the U.S. Census Bureau and the California Department of Finance (DOF).

4.12.2 Environmental Setting

Existing Conditions

Population

At 8,202 square miles, Kern County is the third largest county in California. Because of its size, the Kern County Housing Element divides the County into nine subareas; the proposed Project Site lies within the Westside subarea. The Westside subarea encompasses the western portion of the County. The City of Taft is located in the area, along with the unincorporated communities of Derby Acres, Dustin Acres, Fellows, McKittrick, Tupman, and Valley Acres.

Derby Acres

As of 2000, there were 376 people, 125 households, and 101 families residing in Derby Acres. The population density was 102.8 people per square mile. There were 145 housing units at an average density of 39.6 per square mile (US Census Bureau, 2000).

Dustin Acres

As of 2000, there were 585 people, 199 households, and 161 families residing in Dustin Acres. The population density was 159.7 people per square mile. There were 215 housing units at an average density of 58.7 per square mile (US Census Bureau, 2000).

Fellows

As of 2000, there were 153 people, 56 households, and 39 families residing in Fellows. The population density was 232.4 people per square mile. There were 58 housing units at an average density of 88.1 per square mile (US Census Bureau, 2000).

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McKittrick

As of 2000, there were 160 people, 54 households and 48 families residing in McKittrick. The population density was 63.8 per square mile. There were 61 housing units at an average density of 24.3 per square mile (US Census Bureau, 2000).

Taft

As of 2000, there were 6,400 people, 2,233 households, and 1,565 families residing in the city. The population density was 422.6 people per square mile. There were 2,478 housing units at an average density of 163.6 per square mile (US Census Bureau, 2000).

Tupman

As 2000, there were 227 people, 66 households, and 53 families residing in Tupman. The population density was 426.0 people per square mile. There were 75 housing units at an average density of 140.8 per square mile (US Census Bureau, 2000).

Valley Acres

As of 2000, there were 512 people, 183 households, and 144 families residing in Valley Acres. The population density was 124.6 people per square mile. There were 194 housing units at an average density of 47.2 per square mile (US Census Bureau, 2000).

Table 4.12-1 presents population trends in Kern County based on 1990 and 2000 U.S. Census Bureau. Total population includes persons from both household and group quarters.

TABLE 4.12-1: POPULATION TRENDS BASED ON U.S. CENSUS BUREAU DATA			
Area	1990 Population	2000 Total Population	Percent Change 1990 to 2000
Incorporated	282,379	396,645	40.7%
Unincorporated	262,602	265,000	0.57%
Total	544,981	661,645	21.4%
Sources: U.S. Census Bureau 1990; 2000.			
Note:			
^a 1990 U.S. Census data were updated, and revised numbers were issued in California Department of Finance Report E-4 (California Department of Finance 2006c).			

As shown in Table 4.12-1 above, population growth in Kern County is heavily concentrated in the incorporated cities. The increase in population during this period can be partially attributed to the numerous state prisons constructed and opened in Kern County during this time. The new prisons also led to increased housing and employment during the 1990s.

4.12 POPULATION AND HOUSING

Housing

Table 4.12-2 presents housing trends in Kern County based on 1990 and 2000 U.S. Census Bureau data. Housing includes single family, multiple family, and mobile homes.

Mirroring population growth, housing growth primarily occurred in the incorporated cities of Kern County. Table 4.12-3 provides housing data based on DOF estimates and projections.

TABLE 4.12-2: HOUSING TRENDS BASED ON U.S. CENSUS BUREAU DATA			
Area	1990 Total Housing Units	2000 Total Housing Units	Percent Change 1990 to 2000
Incorporated (Percent Vacant)	99,835 (No data)	130,873 (6.64 %)	31.1% (Unknown)
Unincorporated (Percent Vacant)	99,101 (No data)	100,694 (14.12 %)	1.6% (Unknown)
Total (Percent Vacant)	198,936 (No data)	231,567 (9.89 %)	16.4% (Unknown)
Source: U.S. Census Bureau 1990, 2000 data			
Note: Population estimates are projections and subject to change.			

TABLE 4.12-3: HOUSING TRENDS BASED ON CALIFORNIA DEPARTMENT OF FINANCE ESTIMATES AND PROJECTIONS					
Area	2000 Total Housing Units	2005 Total Housing Units	2006 Total Housing Units	Percent Change 2000 to 2006	Percent Change 2005 to 2006
Incorporated Percent Vacant	130,873 6.64	148,233 6.45	155,079 6.45	18.5	4.6%
Unincorporated Percent Vacant	100,694 14.12	106,182 14.23	107,855 14.29	7.1	1.5%
Total (Percent Vacant)	231,567 9.89	254,415 9.70	262,934 9.66	13.5	3.3%
Source: California Department of Finance 2006e.					

Employment

Kern County has a year-round labor force of nearly 305,000 persons, which has been growing at an average annual rate of 1.43 percent since 1994. This percentage is slightly lower than the California average of 1.48 percent; however, Kern County's annualized total employment growth of 1.78 percent was greater than California's growth of 1.71 percent between 1993 and 2004. The total

4.12 POPULATION AND HOUSING

employment in Kern County grew faster than the growth of its labor force during the same period, which suggests that the economy was adding jobs faster than new labor. Table 4.12-4 below provides an employment profile of Kern County.

TABLE 4.12-4: EMPLOYMENT PROFILE	
Class	Percent
Private Wage and Salary	71.2
Government	20.6
Self-employed	7.8
Unpaid family workers	0.5
Source: U.S. Census Bureau 2000.	

Kern County's unadjusted unemployment rate has ranged from a low of 6.3 percent in September/October 2007 to a high of 18.3 percent in March 2010. The unadjusted unemployment rate in Kern County was 16.5 percent in April 2010, down from 18.3 percent in March 2010, and up from 14.8 percent one year ago in April 2009 (Dancing Engineer, 2010).

4.12.3 Regulatory Setting

4.12.3.1 Local

Kern County General Plan

The goals and policies outlined in the Kern County General Plan for population and housing that are applicable to the proposed Project are provided below.

1.0 General Provisions

Goal 1 Ensure that the County can accommodate anticipated future growth and development while maintaining a safe and healthful environment and a prosperous economy by preserving viable natural resources, guiding development away from hazardous areas, and assuring the provision of adequate public services.

1.6 Residential

Goals

Goal 2 Minimize land use conflicts between residential and resource, commercial, or industrial land uses.

4.12 POPULATION AND HOUSING

Housing Element 2008–2013

The Housing Element is one of seven elements in the Kern County General Plan. Each city and county is required by the California Housing Law to develop a housing element in order to qualify for allocation of state regional housing funding. To receive regional housing funds, each city and county must update its General Plan Housing Element on a regular basis (generally, every five years). The Housing Element must incorporate policies and identify potential sites that would accommodate the city or county's share of the regional housing needs. Kern County adopted its current Housing Element in December 2008. The housing element incorporates the Regional Housing Needs Assessment numbers assigned by the Kern Council of Governments.

Kern Council of Governments

A council of governments (COG) acts as an area wide planning agency. COGs assist local governments with multi-jurisdictional issues such as air quality, transportation, water quality, energy, and housing. The Kern COG serves this purpose for Kern County. The primary function of the Kern COG is to address regional transportation issues, but it also functions as the state-designated Census Data Center Affiliate. The Kern COG and its member agencies include the County of Kern and the 11 incorporated cities within Kern County (Kern Council of Governments 2006). The Kern COG facilitates comprehensive planning and intergovernmental coordination.

The Kern COG has determined the additional housing construction needed by 2013 is 41,640 dwelling units county wide. The unincorporated area of Kern County has been allocated 8,602 dwelling units for the time period (Kern Council of Governments 2007).

4.12.3.2 State

California State Law requires each city and county to adopt a general plan for future growth. This plan must include a housing element that identifies housing needs for all economic segments and opportunities for housing development to meet those needs identified. At the state level, the Housing and Community Development Department (HCD) is responsible for estimating the relative share of California's projected population growth that will occur in each county. These estimates are based on the Department of Finance population projections as well as historical growth trends. HCD provides population projections to the local Councils of Governments, which then assign a share of the regional housing amount each county and each of its cities.

Each city and county is required by statute (California Government Code §65583) to update its general plan housing element on a regular basis, usually about every five years. Among other responsibilities, the housing element must incorporate policies and identify potential sites that will accommodate the city's or county's share of the regional housing need. Before adopting a housing element update, the county must submit a draft of the document to the HCD for review. HCD will then inform the local jurisdiction whether its housing element complies with the provisions of the California Housing Element Law.

4.12 POPULATION AND HOUSING

4.12.4 Impacts and Mitigation Measures

This section describes the impact analysis relating to the proposed Project's impact on population and housing. It describes the methods used to determine the proposed Project's impacts and lists the thresholds used to conclude whether an impact would be significant.

4.12.3.1 Methodology

Potential impacts on population and housing are based on the potential for construction and operation of the proposed Project to affect the population and housing resources, as described under the Environmental Setting Section above.

4.12.3.2 Thresholds of Significance

Appendix G of the CEQA Guidelines and the Kern County CEQA Implementation Document state that a project would have significant impacts on population and housing if it would:

Induce substantial population growth in an area, either directly (e.g., by proposing new homes and businesses) or indirectly (e.g., through extension of roads or other infrastructure);

Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere; or

Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere.

4.12.3.3 Project Impacts

IMPACT POP-1 Induce Substantial Population Growth

The proposed Project is limited to utilizing CO2 enhanced oil recovery and the installation of supporting facilities at an active oil field. The proposed Project does not include a growth inducing element that would substantially increase population. Personnel will be required to construct the Project over its projected 20-year execution schedule. A large number of personnel required during the construction phase will be employees or contractors already involved in existing facility operations. Some additional personnel are expected to intermittently relocate to the area during construction. This would result in a temporary, incremental increase in population to the Project region during construction. It is anticipated that these personnel will utilize temporary lodging facilities and will return to their point of origin upon conclusion of their construction tasks.

Operation of the Project is anticipated to create 25 full-time positions over the 20 year life of the Project. It is expected that a majority of these positions will be filled by individuals already residing in the Project region. It was assumed for purposes of this analysis, as a worst-case scenario, that the 25 employment positions result in the addition of 25 families to the Project region. However, this

4.12 POPULATION AND HOUSING

incremental increase is not considered substantial direct population growth. The Project does not have any component that will contribute to indirect population growth. Therefore, impacts to population and housing would be less than significant.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT POP-2 Cause a Displacement of a Substantial Number of Existing Housing, Necessitating the Construction of Replacement Housing Elsewhere

The proposed Project Site and surrounding areas are primarily used in support of crude oil and natural gas production activities. There are no residences within the proposed Project Site. Therefore, no existing households would be displaced and the proposed Project would not require construction to replace housing elsewhere. Impacts would be less than significant.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT POP-3 Cause a Displacement of a Substantial Number of People, Necessitating the Construction of Replacement Housing Elsewhere

The proposed Project would not require the removal of any existing households or displace existing residents. As described above, the proposed Project is located in an active oil field and therefore there are no residents to displace. Consequently, implementation of the proposed Project would result in a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

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4.12.5 Cumulative Impacts

The proposed Project does not include residential development or other component with the potential to substantially increase population or demand for housing. A limited number of out of area personnel are anticipated to be required during construction of the Project. However, these individuals are expected to result in only an incremental, short-term population increase. The Project is expected to create demand for up to 25 full-time employment positions. It is expected that a majority of these positions will likely be filled by individuals already residing in the Project region. It was assumed for purposes of this analysis that the 25 employment positions result in the addition of 25 families to the Project region. However, this incremental population increase is not cumulatively significant. In addition, the proposed Project will not contribute to any cumulative displacement.

Therefore the Project's contribution to cumulative impacts on population and housing, in combination with other reasonable foreseeable projects within the Project area, would be less than significant.

Mitigation Measures

No mitigation measures are required.

Level of Significant after Mitigation

The proposed Project would have less than significant cumulative impacts.

4.13 PUBLIC SERVICES

4.13 Public Services

4.13.1 Introduction

This section analyzes the proposed Project's potential impacts on public services. Unlike public facilities and utilities, public services are provided to the community as a whole, usually from a central location or from a defined set of nodes. The resource base for delivery of these services, including the physical service delivery mechanisms, is financed on a community-wide basis, usually from a unified or integrated financial system. The service delivery agency can be a city, county, service or other special district. Usually, new urban development will create an incremental increase in the demand for these services; the amount of demand will vary widely, depending on both the nature of the development (residential vs. commercial, for instance) and the type of services, as well as on the specific characteristics of the development (such as senior housing vs. family housing).

CEQA analysis is required if the increased demand is of sufficient size to trigger the need for a new or physically altered facility (such as a school or fire station), since the new or physically altered facility would have a physical impact on the environment. CEQA requires that an EIR then identify and evaluate the physical impacts on the environment that such a facility would have. The impact that must be analyzed in an EIR is the impact that would result from constructing a new public facility (should one be required), not the fiscal impact of a development on the capacity of a public service system.

4.13.2 Environmental Setting

Fire Protection/ Emergency Services

Kern County Fire Department

The Kern County Fire Department (KCFD) provides fire suppression and emergency medical services for Kern County. The area serviced by the KCFD varies from rural to metropolitan, and covers large portions of wildland and wildland/urban interface areas. The joint Kern County/Bakersfield City dispatching facility provides dispatch and emergency communications for the unincorporated areas of Kern County and all cities except Taft city. Mutual assistance agreements between the County and the cities of Bakersfield, Taft, and California City provides for protection and assistance as need and proximity dictates. The County also has service agreements with the BLM.

The KCFD staffs 46 full-time fire stations, divided into seven battalions, with 546 firefighters (KCFD 2010). Each battalion covers a large geographical area and includes seven to nine fire stations. There are four KCFD stations within the surrounding areas of the proposed Project. The following table lists the station number, location, distance from proposed Project Site, and population served for each of the four stations:

4.13 PUBLIC SERVICES

TABLE 4.13-1: FIRE DEPARTMENT RESOURCES IN THE VICINITY OF THE PROJECT AREA

Station Number	Address	Distance from Project (mi)	Response Area	Population Served
21	Taft 303 10th Street, Taft, CA	6	172 miles	9,200
23	Fellows 100 Broadway, Fellows, CA	5.5	66 miles	153
24	McKittrick 23246 2nd Street, McKittrick	5	218 miles	160
25	Buttonwillow 100 Mirasol Ave, Buttonwillow, CA	5	220 miles	1,266
Source: KCFD, 2010				

KCFD delivers a range of emergency services. These include, but are not limited to, fire and life safety education, fire prevention, emergency care, rescue, community assistance (civil defense, tourist information, weather monitoring), and arson investigation.

In addition, KCFD also manages and directs the Kern County Office of Emergency Services. This office oversees disaster preparedness and mitigation for Kern County. In a major emergency or disaster, the KCFD Office of Emergency Services oversees all emergency operations and recovery operations.

Sheriff Protection/Law enforcement

California Highway Patrol

The California Highway Patrol (CHP) provides traffic regulation enforcement; oversees response to emergency incidents on California's highways or assists other public agencies responding to emergency incidents; and promotes the safe and efficient movement of people and goods on California highways to minimize loss of life, injuries, and property damage. CHP officers patrol 102,000 miles of roadway and implement the CHP's other law enforcement activities (e.g., drug interception, vehicle theft investigation and prevention, vehicle inspections, accident investigations, and public awareness campaigns), with the support of the non-uniformed personnel assigned to area and division offices (California Highway Patrol 2006).

4.13 PUBLIC SERVICES

The CHP has eight divisions that provide services in eight areas in California. Kern County is located in both the Central and Southern County of Kern Division service areas. The Central Division includes 15 area offices, six resident posts, two commercial inspection facilities, 696 uniformed officers, and 230 non-uniformed personnel. The Southern Division includes ten area offices, one commercial inspection facility, one traffic management center, 1,135 uniformed officers, and 416 non-uniformed personnel.

Kern County Sheriff's Department

The Kern County Sheriff provides law enforcement and public safety services in unincorporated Kern County. Formed in 1866, the Kern County Sheriff's Department is the oldest law enforcement agency in the County. The Kern County Sheriff's Department mission is to "work in partnership" with the community to enhance safety, security, and quality of life for residents and visitors alike in Kern County through their professional public safety services. In addition to providing police services to the unincorporated portions of the County, the Sheriff has the responsibility for the jail system, providing bailiff service and prisoner transportation to the courts, search and rescue, coroner services, and civil process (serving lawsuit papers).

The Sheriff's Office has 1,239 sworn and civilian employees. There are 572 authorized deputy sheriff positions deployed in patrol, substations, detectives, courts services, and special investigations units. There are 336 detention deputy positions deployed in the detention facilities, and 331 Sheriff's professional support staff assigned throughout Kern County (KCPD, 2010). There are two substations within the surrounding areas of the proposed Project:

TABLE 4.13-2: POLICE DEPARTMENT RESOURCES IN THE VICINITY OF THE PROJECT AREA

Substation	Address	Distance from Project (mi)
South Area Substation	311 North Lincoln Street, Taft, CA	5.5
North Area Substation	181 E. First, Buttonwillow, CA	5
Source: KCPD, 2010		

4.13 PUBLIC SERVICES

Other Public Facilities and Services

Libraries

The Kern County Library System provides library service for Kern County. Library resources and services for the proposed Project Site are provided at the Buttonwillow and Taft Branch Libraries, along with 23 other branches, and two bookmobiles serving Kern County. The Kern County Library System has created an environment for connecting people and ideas by providing residents of all ages with the resources to pursue their educational, civic, business and personal interests. The Kern County Library system's mission is to allow for the accessibility of knowledge and ideas to the public in an "efficient and effective manner that provides for their educational, informational, cultural, and recreational needs." Each library in the system maintains a collection of reference materials, books, videos, CDs, DVDs, audio books, and periodicals designed to meet the needs of the local community. The Buttonwillow Branch is open 14 hours per week (Wed / Fri 11am to 6pm), and houses approximately 10,757 materials in its collection. The Taft Branch is open 24 hours per week (Tue/Thurs 11am to 7pm, and Sat 9am to 5pm), and houses approximately 34,846 materials in its collection.

The Division of Library Development Services of the State of California currently uses the State average of .35 square feet of library facility per capita, and 1.5 volumes per capita as standard.

Schools

Kern County contains 47 kindergarten through 12th (K-12) grade school districts (Kern County Superintendent of Schools 2006). The proposed Project is located near six Unified School Districts.

Belridge Elementary School District

Belridge Elementary

19447 Wagonwheel Rd, McKittrick, CA 93251

Buttonwillow Union School District

Buttonwillow Union Elementary

42600 Highway 58, Buttonwillow, CA 93206

Elk Hills School District

Elk Hills Elementary

501 Kern St., (P.O. Box 129), Tupman, CA 93276

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McKittrick School District

McKittrick Elementary

23250 2nd St. (P.O. Box 277), McKittrick, CA 93251

Midway School District

Midway Elementary

259 F St. (P.O. Box 39) Fellows, CA 93224

Taft City School District

Conley Elementary

623 Rose Ave. Taft, CA 93268

Jefferson Elementary

300 Taylor St., Taft, CA 93268

Lincoln Junior High

810 N. Sixth St. Taft, CA 93268

Parkview Elementary

520 A St. Taft, CA 93268

Roosevelt School (Taft)

811 N. Sixth St. Taft, CA 93268

Taft Primary School

212 Lucard St. Taft, CA 93268

Taft Union High School District

Buena Vista High School (Continuation)

901 San Emidio St. Taft, CA 93268

Taft Union High School

701 Seventh St. Taft, CA 93268

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Westside Independent Study High School

701 Seventh St. Taft, CA 93268

During the 2007-08 school year, the total number of students enrolled in Kern County schools between grades K-12 was 174,180. Of adults 25 and over, 71 percent had graduated high school and 14 percent had completed a bachelor's degree or an additional graduate degree. Nearly one-third of the population left high school before graduating. Kern County ranks second in the state for increase in school enrollment and is projected to maintain that level of growth for the next 10 to 20 years according to the California DOF.

Medical Facilities

The Emergency Medical Services Department (EMS) is the lead agency for the emergency medical services system in Kern County and is responsible for coordinating all system participants in the County. Participants include the public, fire departments, ambulance companies, other emergency service providers, hospitals, and EMT training programs throughout the County (Table 4.13-3: Kern County Hospitals and Ambulance Services). The department also provides certification and re-certification for EMT's, paramedics, specialized nurses (MICN), and specialized dispatchers (EMD).

4.13 PUBLIC SERVICES

**TABLE 4.13-3: KERN COUNTY HOSPITALS AND
AMBULANCE SERVICES**

KERN COUNTY EMS SYSTEM HOSPITALS	
Bakersfield Heart Hospital	Ambulance receiving hospital
Bakersfield Memorial Hospital	Paramedic base hospital
Delano Regional Medical Center	Paramedic base hospital
Kern Medical Center	Paramedic base hospital / trauma center
Kern Valley Hospital	Ambulance receiving hospital
Mercy Hospital	Paramedic base hospital
Mercy Southwest	Ambulance receiving hospital
Ridgecrest Regional Hospital	Ambulance receiving hospital
San Joaquin community Hospital	Paramedic base hospital
Tehachapi Valley Healthcare District	Ambulance receiving hospital
KERN COUNTY AMBULANCE PROVIDERS	
Care Ambulance Service	EOA 6 – all ground services
Delano Ambulance Service	EOA 3 – all ground services
Golden State Air Ambulance	Fixed-wing interfacility services
Hall Ambulance Service	EOAs 2,4,5,9,8,11 – all ground services
Hall Critical Care Transport	EOA A – all air services
Kern Ambulance Service	EOA 1 – all ground services
Liberty Ambulance Service	EOA 7 – all ground services
Mercy Air	EOA B – all air services
EOA – Exclusive Operating Area	
Reference: County of Kern Emergency Medical Services, January 27, 2011 http://www.co.kern.ca.us/ems/hospital.asp	

The proposed Project would utilize medical services within the Bakersfield area. The closest hospital would be Mercy Southwest located at 400 Old River Road in Bakersfield, California, approximately 20-miles southeast of the proposed Project Site. The Southwest Campus was built in 1992, and is the only acute care hospital in Bakersfield west of the 99 Freeway. The Southwest Campus offers a full range of services including emergency services, obstetrics and women's care and medical/surgical care. In 2009, the Orthopedic and Hand Center opened offering comprehensive orthopedic services to the community.

Parks and Recreation

Please refer to Section 4.14 (Recreation) for details on parks and recreation.

4.13 PUBLIC SERVICES

4.13.3 Regulatory Setting

4.13.3.1 Local

Below are the applicable policies, goals, and implementation measures for public services found in the Kern County General Plan. The Kern County General Plan contains additional policies, goals, and implementation measures that are more general in nature and not specific to development such as the proposed Project. Therefore, they are not listed below, but, as stated in Section 2, "Introduction," all policies, goals, and implementation measures in the Kern County General Plan are incorporated by reference.

Kern County General Plan

Public Services for

General Public Facilities and Services

Policy 2. The efficient and cost-effective delivery of public services and facilities will be promoted by designating areas for urban development which occur within or adjacent to areas with adequate public service and facility capacity.

Policy 3. Individual projects will provide availability of public utility service as per approved guidelines of the serving utility.

Fire Protection Services

Policy 6. The County will ensure adequate fire protection to all Kern County residents.

Law Enforcement

Policy 7. The County will ensure adequate police protection to all Kern County residents.

4.13.4 Impacts and Mitigation Measures

4.13.4.1 Methodology

The analysis contained in the following section addresses the project-specific impacts of the proposed Project on public services within Kern County. This analysis is based on information and analysis contained in applicable The Kern County General Plan and other research performed by Stantec.

4.13.4.2 Thresholds of Significance

Appendix G of the CEQA Guidelines and the Kern County CEQA Implementation Document state that a proposed Project would have significant impacts on public services if it would:

4.13 PUBLIC SERVICES

Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which would cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or to other performance objectives for any of the following public services:

1. Fire Protection
2. Police Protection
3. Schools
4. Parks
5. Other Public Facilities (medical and libraries)

4.13.4.3 Project Impacts

IMPACT PUB-1 Adversely Affect Fire Protection Services

The Project area will remain rural, and is already considered a high to moderate fire hazard area (Fire Hazard Severity Zones; frap.cdf.ca.gov). Project activities have the potential to result in fires and releases of hazardous materials that could require response by local fire departments. However, these potential response needs are already present as part of the existing EHO operations and are not expected to substantially increase with Project implementation. The proposed Project does not include the construction of residential, commercial, or substantial industrial structures that could significantly increase demand for fire protection services that would require the provision of new or physically altered fire protection facilities, the construction of which would cause significant environmental impacts. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT PUB-2 Adversely Affect Police Protection/Law Enforcement Services

The proposed Project does not include a residential component or other development that would substantially increase population growth that could require police/law enforcement services. There is a potential that crime such as theft or vandalism could occur during both the construction and operation phases of the proposed Project which could increase demand on local law enforcement services. However this is anticipated to be minor and infrequent in nature as OEHI controls contractor selection, site access and maintains 24 hours/day security operations on-site. As such, the

4.13 PUBLIC SERVICES

proposed Project will not significantly increase demand for police protection services that would require the provision of new or physically altered police protection facilities, the construction of which would cause significant environmental impacts. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT PUB-3 Adversely Affect School Capacity

Construction personnel are largely expected to be from the Project region and will not increase demand for school services. The limited number of personnel needed for project construction that are anticipated to come from out of the area are expected to reside in the Project area for short durations and will not increase demand for school services. Operation of the project is expected to create 25 additional employment positions. Assuming a conservative scenario, one in which the Project increases regional population growth by 25 families, there will be an incremental demand placed on regional school services. However, this increase is not expected to significantly increase demand for school services that would require the provision of new or physically altered school facilities, the construction of which would cause significant environmental impacts. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT PUB-4 Adversely Affect Parks and Recreational Facilities and Services

Please refer to Section 4.14 (Recreation) for a detailed discussion on the project's potential to impact recreational facilities and resources.

IMPACT PUB-5 Adversely Affect Medical Services

Construction personnel are largely expected to be from the Project region and will not increase demand for medical services. The limited number of personnel needed for project construction that are anticipated to come from out of the area are expected to reside in the Project area for short durations and will not substantially increase demand for medical services. Operation of the project is expected to create 25 additional employment positions. Assuming a conservative scenario, one in which the Project increases regional population growth by 25 families, there will be an incremental

4.13 PUBLIC SERVICES

demand placed on medical services. However, this increase is not expected to significantly increase demand for medical services that would require the provision of new or physically altered medical facilities, the construction of which would cause significant environmental impacts. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

This impact would be less than significant.

IMPACT PUB-6 Impact to Library Services

Construction personnel are largely expected to be from the Project region and will not increase demand for library services. The limited number of personnel needed for project construction that are anticipated to come from out of the area are expected to reside in the Project area for short durations and will not substantially increase demand for library services. Operation of the project is expected to create 25 additional employment positions. Assuming a conservative scenario, one in which the Project increases regional population growth by 25 families, there will be an incremental demand placed on library services. However, this increase is not expected to significantly increase demand for library services that would require the provision of new or physically altered library facilities, the construction of which would cause significant environmental impacts. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.13.5 Cumulative Impacts

The proposed Project is limited to utilizing CO2 EOR at an active oil field. The proposed Project does not include any residential development or other component that will substantially increase population growth and demand for public services. As such, the Project is expected to have a less than significant contribution to cumulative public services impacts.

4.13 PUBLIC SERVICES

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

The proposed Project would have less than significant cumulative impacts.

4.14 RECREATION

4.14 Recreation

4.14.1 Introduction

This section discusses potential impacts to recreation resources and open space in the vicinity of the proposed Project. As a basis for evaluation, the environmental setting section summarizes existing conditions related to site characteristics and recreation providers. Documents and regulations reviewed for this analysis include the Kern County General Plan and the Quimby Act (California Government Code §66477). This section also describes the environmental and regulatory settings and discusses mitigation measures to reduce impacts, where applicable.

4.14.2 Environmental Setting

Local/Regional

The Kern County Parks and Recreation Department manages 40 neighborhood parks, 8 regional parks, and performs landscape maintenance at 76 county buildings. Further, it administers use of 28 public buildings and 3 county golf courses. A current staff of 130 assumes these responsibilities.

The Kern County Parks and Recreation Department operates and maintains eight regional parks—the Buena Vista Aquatic Recreational Area, Greenhorn Mountain Park, Leroy Jackson Park, Kern River County Park, Lake Isabella, Lake Woollomes, Metro Recreation Center, and Tehachapi Mountain Park. These parks provide more than 19,422 acres of parkland for recreational purposes.

Located approximately 5 miles southeast of the proposed Project Site, the closest regional park to the proposed Project Site is the Buena Vista Aquatic Recreation Area. Recreational opportunities include fishing, boating, jet-skiing, camping, picnicking, and bicycling. Amenities include children's play equipment, two concession buildings, three covered picnic areas reserved for large groups, numerous other picnic spots throughout the park, campsites, three boat-launching sites and an RV dump station.

The municipal Buena Vista Golf Course is located to the south of the proposed Project. The golf facility is equipped with an 18-hole regulation length course and a 25 tee driving range.

The City of Taft has five (5) parks maintained by Kern County Parks and Recreation Department including A Street Park, Civic Center Park, Cougar Sports Taft, Ford City Park, and Franklin Field.

State

The California State Parks Service owns, maintains, and operates one state park (Red Rock Canyon), two state historic parks (Fort Tejon and Tomo-Kahni), and one state reserve (Tule Elk) in Kern County. Of these parks, the Tule Elk State Reserve is the closest to the Project Site (located near Tupton) which is located approximately 1.5 miles to the northeast of the Project Site. The others are located a significant distance from the proposed Project.

4.14 RECREATION

The Tule Elk State Reserve is a 956 acre fenced enclosure and is part of what was once the historical range of free roaming tule elk (*Cervus canadensis nannodes*).

National Parks and Trails

Several national parks are located in California's Central Valley, southern California, and southern desert region, which are accessible from Kern County and the proposed Project Site, although a significant distance away. These include Sequoia National Park, Death Valley National Park, Joshua Tree National Park, Kings Canyon National Park, Channel Islands National Park and Mojave National Preserve. The Pacific Crest Trail also passes through eastern Kern County near the City of Tehachapi.

4.14.3 Regulatory Setting

4.14.3.1 Local

Below are the applicable policies, goals, and implementation measures for recreation services found in the Kern County General Plan.

Kern County General Plan

Chapter 1. Land Use Open Space and Conservation Element

Public Facilities and Services

Goals

Goal 8. Provide recreation opportunities for all citizens of Kern County while avoiding duplication between jurisdictions.

Goal 12. Provide a balanced system of parks and recreational facilities to meet Kern County's diverse needs, and clearly define responsibility for the provision of these facilities.

Goal 13. Provide a variety of park and recreation programs that offer safe, equitable, and balanced recreation opportunities for all residents and visitors.

Policies

Policy 4. The provision of parks and recreational facilities of varying size, function, and location to serve Kern County residents will be encouraged. Special attention will be directed to providing linear parks along creeks, rivers, and streambeds in urban areas.

Policy 5. Seek to provide recreational facilities where deficiencies have been identified.

4.14 RECREATION

Implementation Measures

Implementation Measure F. Continue to use the accepted California and National Design Standards for both passive and active park development to accommodate programmed and spontaneous activities. Some usable area should be held as open turf for free play and community festivals.

Implementation Measure G. Continue to encourage coordination between appropriate jurisdictions in the acquisition (including cooperative agreements), development, and use of parks to avoid duplication of facilities and provide economic use of public funds.

Implementation Measure H. Continue to pursue federal, State, and private grant funding for the rehabilitation and acquisition of parks and recreation facilities.

Implementation Measure II. The Kern County Parks and Recreation Department will evaluate the possibility of alternative funding sources for the development, rehabilitation, and operation of park and recreational facilities. These funding sources shall include the possible implementation of development fees and/or special assessment districts such as used for lighting and landscaping, under a County Service Area (CSA).

4.14.3.2 State

Quimby Act of 1975

The 1975 Quimby Act (California Government Code §66477) authorized cities and counties to pass ordinances requiring that developers set aside land, donate conservation easements, or pay fees for park improvements. The goal of the Quimby Act was to require developers to help mitigate the impacts of property improvements. The Act gave authority for passage of land dedication ordinances to cities and counties, and established a State standard of five acres of parkland per 1,000 residents.

4.14.4 Impacts and Mitigation Measures

4.14.4.1 Methodology

Impacts to open space and recreation facilities were assessed based on the potential for the proposed Project to either reduce the amount of existing open space, generate an increased demand on open space and recreation facilities (which would result in the deterioration of those facilities), or conflict with the open space and recreation requirements in the General Plan.

4.14.4.2 Thresholds of Significance

Appendix G of the CEQA Guidelines and the Kern County CEQA Implementation Document state that a project would have a significant impact on recreation if it would:

Increase the use of existing neighborhood and regional parks or other recreational facilities such that

4.14 RECREATION

substantial physical deterioration of the facility would occur or be accelerated; or

Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment.

4.14.4.3 *Project Impacts*

IMPACT REC-1 Result in Increased Use of Parks

The proposed Project does not include a growth inducing element that would substantially increase population or demand for recreational facilities. Personnel will be required to construct the Project over its projected 20-year execution schedule. A large number of personnel required during the construction phase will be employees or contractors already involved in existing facility operations. Supplemental personnel mobilized to the site during construction events are expected to be local contractors. As a majority of site personnel required during construction will already be from the local area, it is anticipated that no increased demand for recreational facilities will result. The addition of a limited amount of personnel expected to intermittently relocate to the Project area during construction is not expected to substantially increase demand on recreational resources beyond existing capacity.

Operation of the Project is anticipated to create 25 full-time positions over the 20 year life of the Project. It is expected that a majority of these positions will likely be filled by individuals already residing within cities located in the Project region. It was assumed for purposes of this analysis that the 25 employment positions result in the addition of 25 families to the Project region. This addition of 25 families would increase demand for existing recreational facilities. However, this is not expected to increase demand on recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated.

As a result, impacts to recreational facilities and services would be less than significant.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT REC-2 Include Recreational Facilities or Require the Construction or Expansion of Recreational Facilities that Might Have an Adverse Physical Effect on the Environment

The proposed Project does not include recreational facilities or require the construction of recreational facilities that might have an adverse physical effect on the environment. In addition, the proposed Project does not include a growth inducing element that would substantially increase population or

4.14 RECREATION

demand for recreational facilities. The addition of a limited amount of personnel expected to relocate to the Project Site area during construction and operation of the Project is not expected to substantially increase demand on recreational resources beyond existing capacity.

As the proposed Project does not include recreation facilities or require the construction or expansion of recreation facilities no impact will occur.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impact.

4.14.5 Cumulative Impacts

As defined in Section 15130 of the CEQA Guidelines, cumulative impacts are the incremental effects of an individual project when viewed in connection with the effects of past, current, and probable future projects within the cumulative impact area for recreation. The cumulative impact area for recreation and open space for this Project is the area within 6 miles of the EHOF. The population and associated demand for parks, trails, and open space that could increase as a result of the Project is expected to be low. The Project does not include residential development or other component with the potential to substantially increase population or demand for recreational facilities.

Therefore the Project's contribution to cumulative impacts on park and recreational facilities, in combination with other reasonable foreseeable projects within the project area, would be less than significant.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

The proposed Project would have less than significant cumulative impacts.

4.15 TRANSPORTATION AND TRAFFIC

4.15 Transportation and Traffic

4.15.1 Introduction

This section contains information on the existing transportation system present in the Project area and assesses the potential impacts of the proposed Project.

4.15.2 Environmental Setting

Traffic Impact Study Area

Vehicular traffic associated with the proposed Project will originate from numerous regional locations and has the potential to primarily impact the following intersections and roadway segments within the Project vicinity:

Taft Highway (State Route 119 [SR 119]) and North Access Road;

Taft Highway (SR 119) and Tupman Road;

Taft Highway (SR 119) and Elk Hills Road;

Elk Hills Road and Skyline Road;

North Access Road and Tupman Road;

Tupman Road and Grace Avenue;

Tupman Road and Station Road;

Adohr Road and Dairy Road;

Stockdale Highway and Morris Road;

Stockdale Highway and Dairy Road;

Stockdale Highway and Wasco Way;

Wasco Way and Brite Road;

State Route 58 and Wasco Way;

State Route 33/58 and 'E' Street (access to Skyline Road);

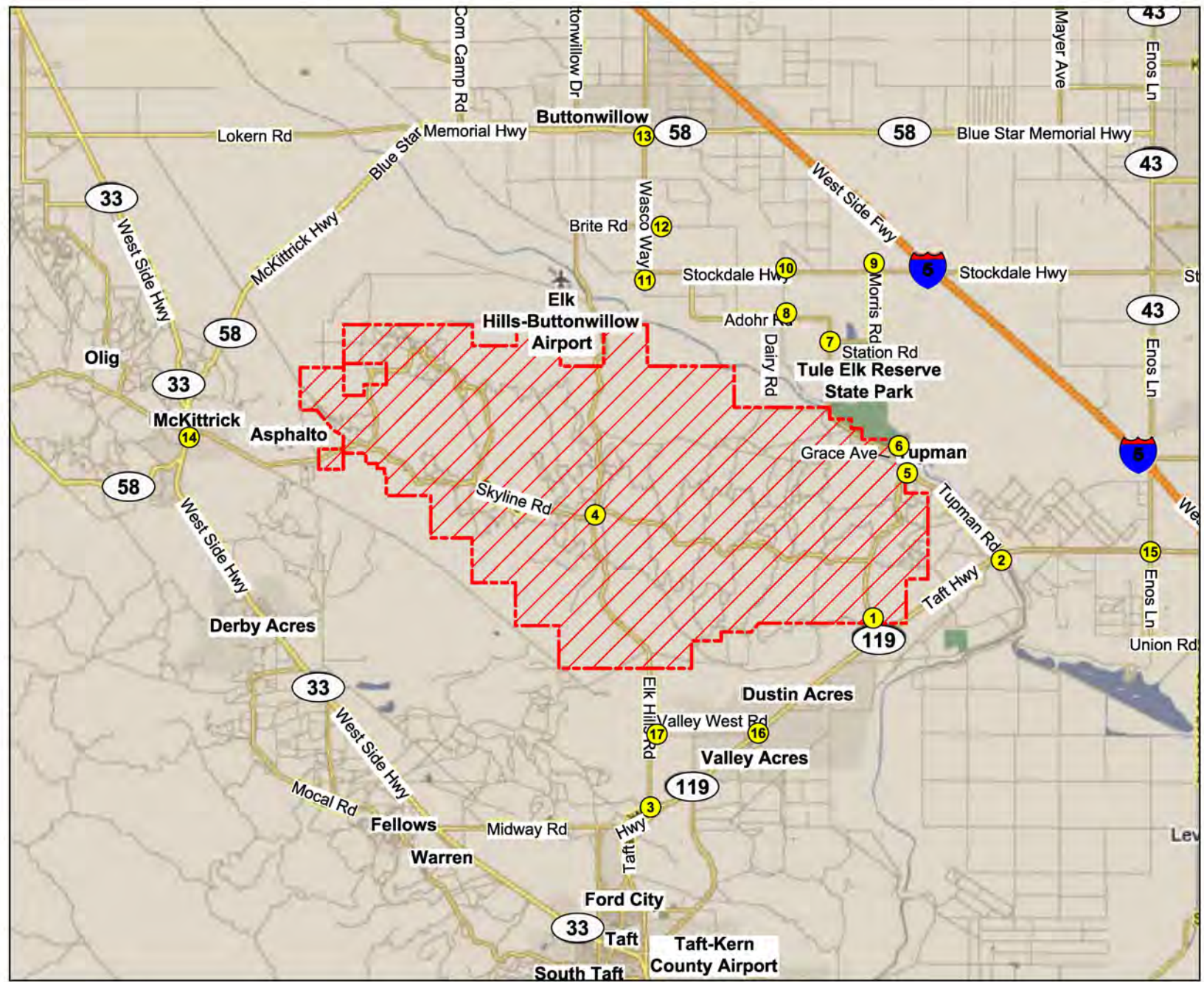
Enos Lane (SR 43) and Taft Highway (SR 119);

Highway 119 and Valley West Road; and

Valley West Road and Elk Hills Road.

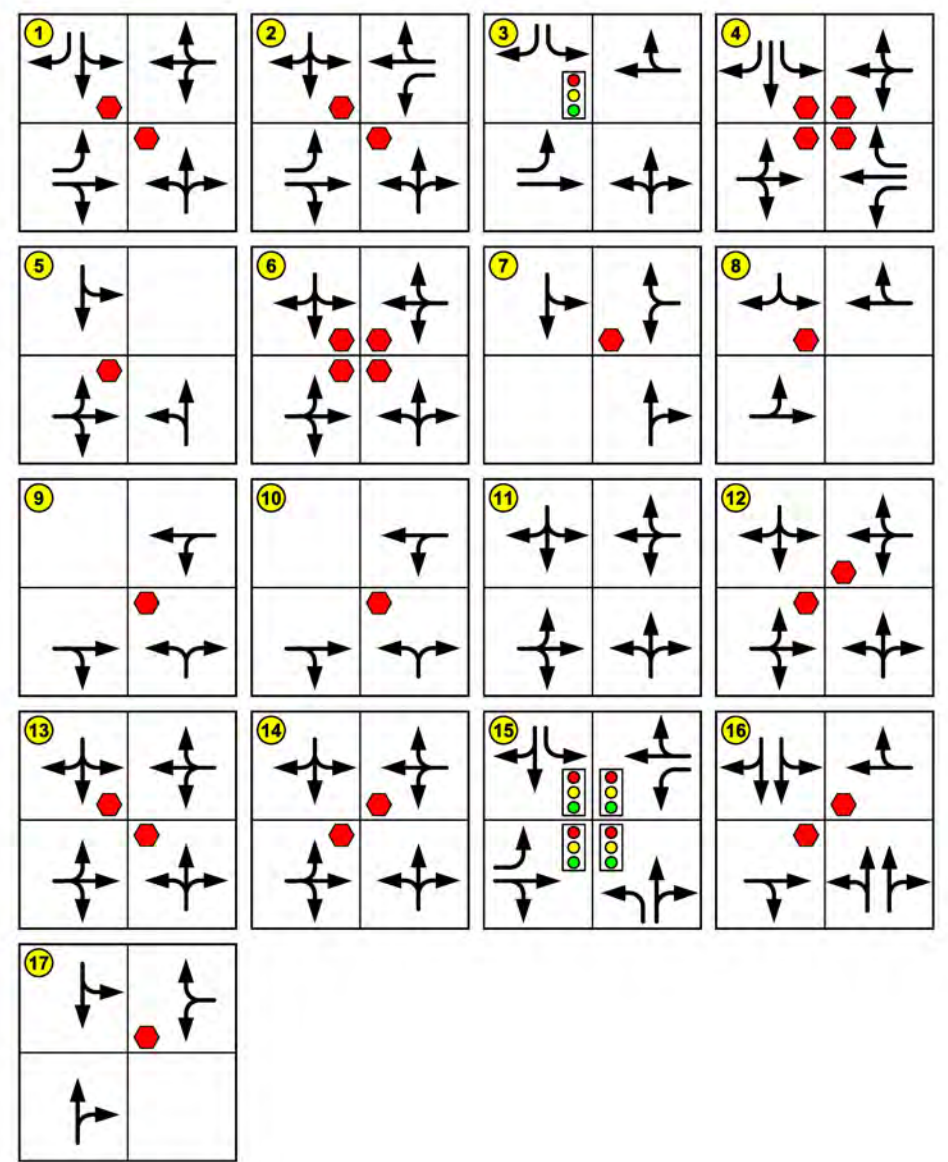
4.15 TRANSPORTATION AND TRAFFIC

Figure 4.15-1 Traffic Study Intersections and Existing Lane Configuration, illustrates the intersections/roadway segments evaluated as part of this analysis. California Department of Transportation (Caltrans) District 6 has jurisdiction over Interstate 5 (I-5), SR 33, SR 43, SR 58, and SR 119. Kern County has jurisdiction over all of the roads identified in Figure 4.15-1, except for Skyline Road, North Access Road, and Tank Farm Road, which are private roadways.



LEGEND

- Approximate Site Boundary
- Lane Configuration
- Stop Light
- Existing Stop Controlled
- Study Intersection



NOTES:

1. Map Source; Google Earth Pro/Map Image, Dated 2010.
2. Site features and locations are approximate.

No warranty is made by Stantec as to the accuracy, reliability, or completeness of these data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed electronically, and may be updated without notification. Any reproduction may result in a loss of scale and/or information.



NOT TO SCALE

FOR:
OEHI CO2 EOR Project
Supplemental Environmental Information
Kern County, CA

Traffic Study Intersections and Existing Lane Configuration

FIGURE:
4.15-1

PROJECT NUMBER: 185802314.200.0004	DRAWN BY: R. Roman	CHECKED BY: S. Edblad	APPROVED BY: M. Weber	DATE: 12/06/10

4.15 TRANSPORTATION AND TRAFFIC

Project Site Access

The Project area is served by an extensive transportation system, including major freeways, highways, and airport and rail facilities. Figure 4.15-2 illustrates the regional transportation setting. The primary transportation corridors in or near the proposed Project Site include I-5 and SR 119, 99, 58, 43, and 33. The closest of these to the proposed Project Site is SR 119, located south of the Project Site and generally runs in a northeast to southwest direction from the community of Taft, intersects I-5, and continues to SR 99. A highway, such as SR 119 is defined by Caltrans as “high-speed, high-capacity, limited-access transportation facility serving regional and county-wide travel.” Interstate 5, located east of the Project Site, generally runs in a northwest to southeast direction from SR 119 to SR 58. State Route 58, located north of the Project Site, generally runs in an east to west direction from I-5 to Lokern Road and then in a northeast to southwest direction from Lokern Road to the community of McKittrick. Within the community of McKittrick (which is located west of the Project Site), SR 58 and SR 33 are joined within the same roadway. South of McKittrick, SR 58 continues west and SR 33 continues south to the community of Taft. State Routes 33 and 119 intersect in the community of Taft, which is located south of the Project Site.

The local transportation network near the proposed Project Site and the interior circulation is illustrated in Figure 4.15-3. The proposed Project Site can be accessed from SR 119 and then along a variety of private roads. The most commonly used access routes are described below.

From Bakersfield: Travel south on SR 99 for 6.2 miles. Exit and travel west on SR 119 for 19.4 miles. Turn right onto North Access Road and proceed to Gate 2 for Project Site access. Continue on North Access Road for 1.5 miles and turn left onto Skyline Road.

From Taft [including surrounding communities Ford City, Valley Acres, and Dustin Acres]: Travel north/east on SR 119 for 7.8 miles. Turn left onto North Access Road and proceed to Gate 2 Project Site access. Continue on North Access Road for 1.5 miles and turn left onto Skyline Road.

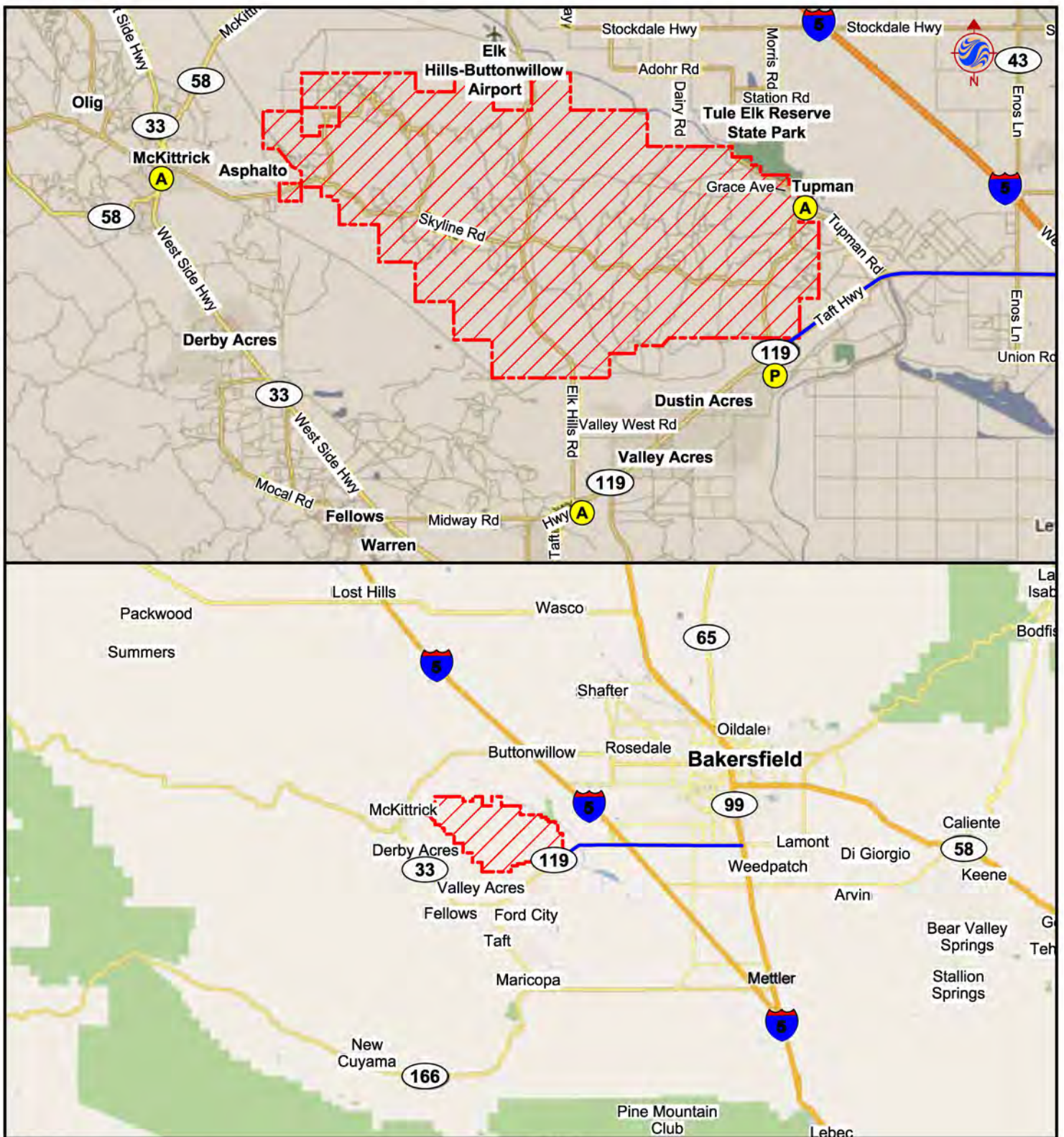
The Project Site may be accessed from personnel residing in the surrounding communities accessed by SR 58 (Buttonwillow), SR 33 (McKittrick or Derby Acres), and I-5 (other communities to the north and south). The mobilization of specific construction equipment or delivery of large equipment and supplies may periodically require alternative security access points on the Project Site. The most likely alternative security access points for the mobilization of construction equipment and supplies (other than from SR 119) are detailed below.

Tupman Road Entrance: North Access Road can be accessed from Tupman Road. North Access Road intersects Tupman Road (Gate 1) approximately 0.3 miles south of Tupman or 2.9 miles north of SR 119.

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Elk Hills Road and Skyline Road: Skyline Road can be accessed from Elk Hills Road (Gates 3 and 4). Skyline Road intersects Elk Hills Road approximately 6.8 miles north of SR 119 or 6.6 miles south of the intersection of Elk Hills Road (Buttonwillow Drive) and Brite Road.

McKittrick Entrance: Skyline Road can be accessed from the community of McKittrick. 'E' Street intersects SR 33/SR 58 in the center of the community and becomes Reserve Road outside of the eastern portion of McKittrick (Gate 5).



LEGEND

-  Approximate Site Boundary
-  Primary Route
-  Primary Entrance
-  Alternative Entrances

NOTES:

1. Map Source; Google Earth Pro/Map Image, Dated 2010.
2. Site features and locations are approximate.

NOT TO SCALE

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FOR: **OEHI CO2 EOR Project**
Supplemental Environmental Information
Kern County, CA

Regional Transportation Setting

FIGURE:

4.15-2

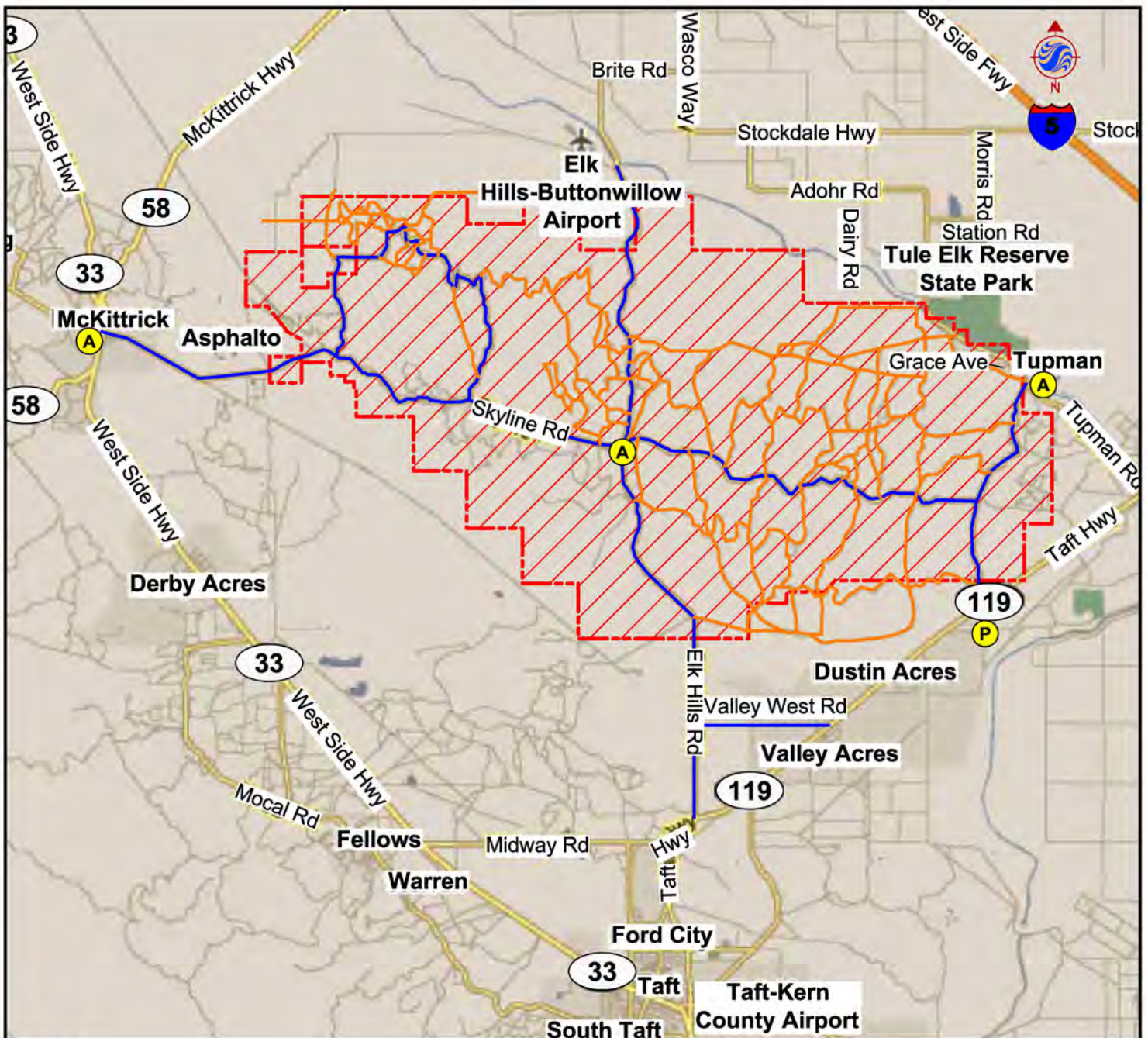
PROJECT NUMBER:
185802314.200.0004

DRAWN BY:

CHECKED BY:

APPROVED BY: M. Weber

DATE: 12/06/10



LEGEND

- Approximate Site Boundary
- Paved Access Roads
- Dirt Access Roads
- P Primary Access Point
- A Alternative Access Point

NOTES:

1. Map Source; Google Earth Pro/Map Image, Dated 2010.
2. Site features and locations are approximate.

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FOR:
OEHI CO2 EOR Project
Supplemental Environmental Information
Kern County, CA

PROJECT NUMBER:
185802314.200.0004

DRAWN BY:
R. Roman

CHECKED BY:
S. Edblad

APPROVED BY:
M. Weber

FIGURE:
4.15-3

DATE:
12/06/10

4.15 TRANSPORTATION AND TRAFFIC

Regional and Local Roadway Characteristics

Kern County contains major transportation corridors representing diverse modes. Passenger vehicles, motor-homes, and trucks cross Kern County in route to out-of-county and interstate destinations. Automobile routes include freeways, highways, and county roads. The proposed Project Site is served directly by SR 119 which provides freeway access to the major north south routes within Kern County. The following provides a description of the regional and local roadways which service the proposed Project Site.

Interstate 5 is the major 1,381-mile north-south freeway through California (796 miles), Oregon (308 miles), and Washington (277 miles). The southern terminus is at the Mexican Border in Tijuana. The northern terminus is at the Canadian Border in White Rock. Interstate 5 connects Kern County to northern and southern California. The *I-5 Transportation Concept Report (District 6)* dated July 2005, divides the District 6 portion of this interstate into segments. Segment 5 contains the interchange with SR 119. The 2005 Annual Average Daily Traffic (AADT) along I-5 in this location is approximately 51,100.

State Route 99 runs parallel to Interstate 5 through Kern County. The southern terminus is at Interstate 5 approximately 20 miles south of Bakersfield. State Route 99 continues north and terminates at Interstate 5 in Red Bluff approximately 130 miles north of Sacramento. The *SR 99 Transportation Concept Report (District 6)* dated November 2003 divides the District 6 portion of this highway into segments. Segment 3 contains the interchange with SR 119. The 2003 AADT along SR 99 in this location is approximately 44,000.

State Route 119 is a 31-mile highway running east to west in Kern County. The western terminus is at the SR 33 junction in Taft and the eastern terminus is at the SR 99. The *SR 119 Transportation Concept Report (District 6)* dated September 2006 divides the highway into segments. Segment 5 contains the intersection of North Access Road and segment 4 contains the intersection of Elk Hills Road. The 2006 AADT along SR 119 in segments 4 and 5 are approximately 11,400.

State Route 58 is a limited access highway. The western terminus is US Highway 101 in San Luis Obispo County west of the town of Santa Margarita and north of the Cuesta Grade. The eastern terminus is Interstate 15 at Barstow in San Bernardino County. The *SR 58 Transportation Concept Report (District 6)* dated December 2004 divides the District 6 portion of this highway into segments. Segments 2 through 6 encompass the area from McKittrick to I-5. The 2004 AADT along SR 58 is approximately 800 (segment 2); 3,500 (segment 3); 4,700 (segment 4); 5,600 (segment 5); and 7,400 (segment 6).

State Route 33 is a limited access highway. The western terminus is US Highway 101 near the City of Ventura in Ventura County. The eastern terminus is Interstate 5 just southeast of the community Tracy in San Joaquin County. The *SR 33 Transportation Concept Report (District 6)* dated March 2007 divides the District 6 portion of this highway into segments. Segments 3 through 8 encompass the area from Taft to McKittrick. Segment 3 contains the intersection of SR 119, segments 4 and 5

4.15 TRANSPORTATION AND TRAFFIC

are in the City of Taft, segments 6 and 7 are near the communities of Fellows and Derby Acres, and segment 8 is in the community of McKittrick. The 2006 AADT along SR 33 is approximately 8,600 (segment 3); 12,900 (segment 4); 10,600 (segment 5); 10,600 (segment 6); 3,100 (segment 7); and 2,900 (segment 8).

State Route 43 is a limited access highway. The southern terminus is the junction of SR 119 in Kern County. The northern terminus is the junction of SR 99 in the City of Selma in central Fresno County. The *SR 43 Transportation Concept Report (District 6)* dated December 2006 divides the District 6 portion of this highway into segments. Segment 1 contains the junctions of I-5 and SR 119. The 2006 AADT along SR 43 is approximately 4,800.

Tupman Road is a local, two-lane county road, extending from the junction of SR 119 to the south and terminating at Adohr Road to the north. This north/south roadway accesses the community of Tupman. The SR 119 intersection is controlled by stop signs on Tupman Road and left-hand turning lanes on SR 119. The North Access Road junction is an uncontrolled three-way intersection with preferential right of way on Tupman Road. The Grace Avenue four-way intersection is controlled with stop signs on both Grace Avenue and Tupman Road. The Station Road junction is a three-way intersection controlled with a stop sign on Station Road. Tupman Road becomes Adohr Road with a western turn within the road (Figure 4.15-1).

Station Road is a local, two-lane county road, extending from the intersection of Tupman Road to the west and terminating at Morris Road to the east. This east/west roadway defines the northern boundary of the Tule Elk Reserve State Park. The Tupman Road junction is a three-way intersection controlled with a stop sign on Station Road. Station Road becomes Morris Road with a northern turn within the road (Figure 4.15-1).

Morris Road is a local, two-lane county road, extending from the Station Road to the south and terminating at Stockdale Highway to the north. Morris Road becomes Station Road with a western turn within the road. The Stockdale Highway three-way intersection is controlled with a stop sign on Morris Road (Figure 4.15-1).

Adohr Road is a local, two-lane county road, extending from Freeborn Road to the west and Tupman Road to the east. Adohr Road becomes Freeborn Road with a northern turn within the road. Adohr Road becomes Tupman Road with a southern turn within the road. The Dairy Road three-way intersection is controlled with a stop sign on Dairy Road (Figure 4.15-1).

Dairy Road is a local, two-lane county road, extending from Stockdale Highway to the north and Adohr Road to the south. Both the Adohr Road and Stockdale Highway three-way intersections are controlled with stop signs on Dairy Road (Figure 4.15-1).

Stockdale Highway is a local, two-lane county road, extending from Wasco Way to the west and terminating at SR 99 to the east. The I-5 junction is controlled with stop signs on the northern and southern route off-ramps to Stockdale Highway. The Morris Road three-way intersection is controlled

4.15 TRANSPORTATION AND TRAFFIC

with a stop sign on Morris Road. The Dairy Road three-way intersection is controlled with a stop sign on Dairy Road. The Wasco Way junction is an uncontrolled four-way intersection where the western continuation of Stockdale Highway and the southern continuation of Wasco Way both terminate into private property (not through roads) (Figure 4.15-1).

Wasco Way is a local, two-lane county road, extending from Stockdale Highway to the south and 7th Standard Road to the north. The Stockdale Highway junction is an uncontrolled four-way intersection where the western continuation of Stockdale Highway and the southern continuation of Wasco Way both terminate into private property (not through roads). The four-way intersection of Brite Road is controlled by stop signs on Brite Road. The four-way intersection of SR 58 is controlled by stop signs on Wasco Way (Figure 4.15-1).

Brite Road is a local, two-lane county road, extending from Buttonwillow Drive to the west and Wasco Way to the east. The Wasco Way four-way intersection is controlled with stop signs on Brite Road. Brite Road becomes Buttonwillow Drive with a southern turn within the road. Buttonwillow Drive continues south and becomes Elk Hills Road once the road crosses the aqueduct (Figure 4.15-1).

Elk Hills Road is a local, two-lane county road, extending from SR 119 to the south, transitioning to Buttonwillow Drive north of the aqueduct and terminating at Brite Road to the north. Buttonwillow Drive becomes Brite Road with an eastern turn within the road. The Skyline Road four-way intersection is controlled with four-way stop signs on Skyline and Elk Hills Roads. There are right and left-hand turn lanes on Elk Hills Road for both the north and southbound directions. The SR 119 three-way intersection is controlled on Elk Hills Road with a stop sign for left-hand turns and a yield sign for right-hand turns onto SR 119. State Route 119 has a left-hand turn lane and has a wide berth on the shoulder for right-hand turns onto Elk Hills Road (Figure 4.15-1).

Skyline Road is a private, two-lane road, extending from Reserve Road to the west and North Access Road to the east. Skyline Road extends east of North Access Road to SR 119, and consists of a dirt road for most of this section. The North Access Road three-way intersection is controlled by a stop sign on Skyline Road. The Elk Hills Road four-way intersection is controlled with four-way stop signs on Skyline and Elk Hills Roads. There are right and left-hand turn lanes on Elk Hills Road for both the north and southbound directions (Figure 4.15-1).

Valley West Road is a local two lane county road, transitioning east of SR 119 to Walnut Street, extending from SR 119 to the west, and terminating at Elk Hills Road. The Valley West Road and Elk Hills Road intersection is controlled with a stop sign at Valley West Road (Figure 4.15-1).

Traffic Volumes

Traffic volume information was obtained from the Traffic Data Branch of Caltrans for State maintained highways and the Kern County Roads Department and Kern Council of Governments for local roads.

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All traffic volumes are Annual Average Daily Traffic (AADT) and may be thought of as the total number of vehicles in both directions, passing a point during the year, divided by 365 days.

Traffic counts available for the intersections most likely to be impacted by the proposed Project are presented in Table 4.15-1. Traffic counts listed consist of the highest AADT count consisting of the most currently available data for a location nearest the intersection.

TABLE 4.15-1: LOCAL AREA INTERSECTION NETWORK TRAFFIC VOLUMES

Intersection	AADT	Year
SR 119 and North Access Road	11,400	2006
SR 119 and Tupman Road	11,800	2009
SR 119 and Elk Hills Road	11,400	2006
Elk Hills Road and Skyline Road	1,200	2006
Tupman Road and Station Road	230	2007
Stockdale Highway and Morris Road	370	2006
Stockdale Highway and Wasco Way	1,050	2007
SR 58 and Wasco Way	5,000	2009
SR 33/58 and 'E' Street	2,750	2009
SR 43 and SR 119	10,600	2009

Methodology

Operation of signalized and unsignalized intersections is measured in terms of level of service (LOS). LOS is directly related to average control delay per vehicle. LOS for a signalized intersection is defined in terms of the intersection as a whole. The LOS for a two-way stop controlled (TWSC) intersection is defined for both the intersection as a whole and the individual approaches. Table 4.15-2 explains the signalized and unsignalized intersection LOS criteria.

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TABLE 4.15-2: LEVEL OF SERVICE CRITERIA INTERSECTIONS

Level of Service (LOS)	Signalized Intersections		Unsignalized Intersections
	Control Delay Per Vehicle (seconds)	Description	Total Delay Per Vehicle (seconds)
A	≤ 10.0	Very low control delay. Occurs when progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.	≤ 10
B	> 10.0 and ≤ 20.0	Generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with LOS "A," causing higher levels of average delay.	> 10 and ≤ 15
C	> 20.1 and ≤ 35.0	These higher delays may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.	> 15.1 and ≤ 25
D	> 35.1 and ≤ 55.0	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.	> 25.1 and ≤ 35
E	> 55.1 and ≤ 80.0	These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent occurrences.	> 35.1 and ≤ 50
F	> 80.0	This level, considered to be unacceptable to most drivers, often occurs with over-saturation, that is, when arrival flow rates exceed the capacity of the intersection. It may also occur at high v/c ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.	> 50

Source: Highway Capacity Manual (2000)

The *Kern County General Plan* Circulation Element of 2005 identifies objectives for intersection and segment operations. Circulation Element Objective #5 is to "Maintain a minimum LOS D for all roads throughout the County." However, Kern County Roads Department prefers Traffic Engineers to evaluate roadway impacts utilizing an LOS C.

Caltrans *Guide for the Preparation of Traffic Impact Studies*, page 1, states "Caltrans endeavors to maintain a target LOS at the transition between LOS "C" and LOS "D"... ..on State highway

4.15 TRANSPORTATION AND TRAFFIC

facilities; however, Caltrans acknowledges that this may not always be feasible and recommends that the lead agency consult with Caltrans to determine the appropriate target LOS.”

Existing Level of Service

Most major study intersections currently experience unacceptable levels of service (D), during peak hours. Table 4.15-3 presents the existing levels of service that are available for the intersections most likely to be impacted by the proposed Project.

TABLE 4.15-3: EXISTING AND PROJECTED INTERSECTION LOS						
INTERSECTION	2004 OR 2006		2015		2030	
	Peak Hour	LOS	Peak Hour	LOS	Peak Hour	LOS
SR 119 and North Access Road	1,050	D	1,400	E	1,800	E
SR 119 and Tupman Road	1,150	D	1,400	D	2,000	E
SR 119 and Elk Hills Road	1,050	D	1,400	D	1,900	E
SR 58 and Wasco Way	1,110	D	1,630	D	2,390	E
SR 33/58 and 'E' Street	330	C	430	C	560	D
SR 43 and SR 119	1,150	D	1,500	D	2,000	E
Source: Transportation Concept Reports – Caltrans Highways						

4.15.3 Regulatory Setting

4.15.3.1 Local

Kern County General Plan

The policies, goals, and implementation measures in the Kern County General Plan for transportation applicable to the proposed Project are provided below. The Kern County General Plan contains additional policies, goals, and implementation measures that are more general in nature and not specific to development such as the proposed Project. Therefore, they are not listed below, but, as stated in Chapter 2, “Introduction,” all policies, goals, and implementation measures in the Kern County General Plan are incorporated by reference. The design LOS for Kern County is LOS C. The minimum LOS for conformance with the Kern County General Plan is LOS D.

4.15 TRANSPORTATION AND TRAFFIC

2.0 Circulation Element

Goals

Goal 5. Maintain a minimum LOS D.

Future Growth

Policies

Policy 2. The County should monitor development applications as they relate to traffic estimates developed for this plan. Mitigation is required if development causes affected roadways to fall below LOS D. Utilization of the CEQA process would help identify alternatives to or mitigation for such developments. Mitigation could involve amending the Land Use, Open Space, and Conservation Element to establish jobs/housing balance if projected trips in any traffic zone exceed trips identified for this Circulation Element. Mitigation could involve exactions to build off-site transportation facilities. These enhancements would reduce traffic congestion to an acceptable level.

Policy 5. When there is a legal lot of record, improvement of access to county, city or State roads will require funding by sources other than the County. Funding could be by starting a local benefit assessment district or, depending on the size of a project, direct development impact fees.

Airport Land Use Compatibility Plan (ALUCP)

Policies

Policy 1. Review land designations and zoning near public and private airports for compatibility.

Policy 2. To the extent legally allowable prevent encroachment on public airport and military base operations from incompatible, unmitigated land uses.

Implementation Measure

Implementation Measure A. Review discretionary land use development applications within the airports influence area and the military base operating area as shown in the ALUCP for consistency.

Implementation Measure B. Coordinate and cooperate with airport operators, the County Department of Airports, Caltrans, the Division of Aeronautics, affected cities, Edwards Air Force Base, Naval Air Weapons Station (NAWS) China Lake and the Department of Defense on ALUCP, review of land use applications, public education and encroachment issues.

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4.15.3.2 State

California Department of Transportation

Caltrans has jurisdiction over state highways and sets maximum load limits for trucks and safety requirements for oversized vehicles that operate on highways. Caltrans requires that a project-specific traffic analysis be conducted if a project generates:

More than 100 peak-hour trips on a state highway;

Between 50 and 100 peak-hour trips on a state highway with LOS C or D conditions; or

1 to 49 peak-hour trips on a state highway with LOS E or F conditions.

California Streets and Highways Code

Under the California Streets and Highways Code, Division 2, Chapter 5.5, Sections 1460-1470, an encroachment permit is required if there is an opening or excavation for any purpose in any state highway or county roadway.

4.15.4 Impacts and Mitigation Measures

4.15.4.1 Methodology

The proposed Project has construction and operational phases that overlap over the projected 20 year Project life span. As such, average annual vehicle trips were quantified for each year of the Project and collectively evaluated for potential impacts to the intersections and roadway segments most likely to be impacted by the Project. The additional vehicle trips associated with the Project were then compared to existing traffic volumes and LOS. In some cases, the traffic volumes and LOS of potentially affected intersections and roadways are not available. Establishing traffic counts and LOS for these intersections and roadway segments is beyond the scope of this analysis. In these cases, 50 additional vehicle trips through any intersection during peak hours were assumed to be a potentially significant impact requiring mitigation.

4.15.4.2 Thresholds of Significance

Appendix G of the CEQA Guidelines and the Kern County CEQA Implementation Document state that a project would have a significant impact on transportation and traffic if it would:

Conflict with an applicable plan, ordinance, or policy, establishing, measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit;

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Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency. Specifically, would implementation of the project cause the level of service for roadways and/or intersections to decline below the following threshold or further degrade already degraded segments(s);

Kern County General Plan LOS D;

Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks;

Substantially increase hazards as a result of a design feature (such as sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment);

Result in inadequate emergency access; or

Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance of safety of such facilities.

4.15.4.3 Project Impacts

IMPACT TRAF-1 Conflict with an applicable plan, ordinance, or policy, establishing, measures of effectiveness for the performance of the circulation system

Project Generated Traffic

There will be one primary and three alternative access points to the Project Site for construction activities: the SR 119 and North Access Road (Gate 2) entrance (primary), the Tupman Road and North Access Road (Gate 1) entrance (alternative), Elk Hills Road and Skyline Road (Gates 3 and 4) entrance (alternative), and McKittrick (Gate 5) entrance (alternative). All access points are currently paved and specific project locations can be access from dirt roads once personnel are on the property. Secured gates will control access into the Project Site. Vehicular traffic into and out of the proposed Project Site will be limited as much as practical to daylight hours. Lay down of materials during the construction period will take place on site.

Construction of the proposed Project will take place over a projected 20-year execution schedule. A large number of personnel required during the construction phase will be employees already involved in existing facility operations (75 percent for piping/well installations and 25 percent for facility installations). Supplemental personnel mobilized to the Site during construction events are expected to largely be comprised of local contractors.

The Project will also generate vehicle trips as a result of Project operation. Operation of the Project is anticipated to create 25 full-time positions over the 20 year life of the Project which is assumed to add 25 vehicle trips to EHOFF each day. It is expected that a majority of these positions will be filled by individuals already residing in the Project region.

4.15 TRANSPORTATION AND TRAFFIC

The annual average vehicle trips estimated for the Project are presented below in Table 4.15-4.

TABLE 4.15-4: PROJECT ANNUAL AVERAGE VEHICLE TRIPS

Year	Construction Annual Average Daily Trips (one way)	Operational Annual Average Daily Trips (one way)
2014	140	–
2015	241	15
2016	25	25
2017	149	25
2018	161	25
2019	243	25
2020	21	25
2021	27	25
2022	2	25
2023	6	25
2024	48	25
2025	56	25
2026	3	25
2027	27	25
2028	64	25
2029	22	25
2030	3	25
2031	21	25
2032	3	25
2033	19	25

Note: Construction annual average daily trips were calculated based on total personnel requirements for each year of construction. Assumes 75 percent of personnel required for piping/well installations and 25 percent of personnel requirements for facility installations are already present at EHO for existing operations.

As shown above, the amount of construction worker vehicle trips is higher in the earlier years and then declines over the remaining years. As shown in Table 4.15-3, the existing LOS on potentially affected intersections and roadway segments is currently at a C or D and are projected to degrade to a D or E by 2030. Potentially affected intersections and roadway segments where an LOS has not been established have been assumed to operate at a similar LOS. As this assumption classifies these intersections and roadway segments as below the County standard of LOS D, this provides a conservative analysis to transportation impacts. This increase in traffic is substantial enough to result in further declines of the LOS of potentially affected intersections and roadways and conflict with established measures of effectiveness for the performance of the circulation system. This increase is

4.15 TRANSPORTATION AND TRAFFIC

considered a potentially significant impact. Mitigation Measure TRAF-1 has been incorporated into the proposed Project design to reduce transportation and traffic impacts.

Transportation Concept Report Improvements

The Transportation Concept Report for SR 119 contains a listing of planned and programmed improvements which will be funded from the Metropolitan Bakersfield Transportation Impact Fee Program. Improvements include widening SR 119 from the two-lane conventional highway to a four-lane expressway. The widening of the roadway is projected to begin in 2010 for segment 4 (contains the intersection of Elk Hills Road) and segment 5 (contains the intersection of North Access Road). All other segments are projected to be widened in the year 2025.

Implementation of these planned improvements along SR 119 with Project mitigation measures will further reduce the Project's transportation impacts.

Mitigation Measures

Mitigation Measure TRAF-1 OEHI will schedule construction activities to occur between the hours of 6:30AM and 3:30PM to minimize Project related traffic during the AM peak hours of 7:00 – 9:00AM and PM peak hours of 4:00 – 6:00PM.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT TRAF-2 Exceed Level of Service Standards on County Roads or State Highways

The proposed Project has the potential to exceed LOS standards on County roads and State highways. This increase is considered a significant impact. Mitigation Measure TRAF-1 has been incorporated into the Project design to reduce transportation and traffic impacts.

Mitigation Measures

Implementation of mitigation measure TRAF-1.

Level of Significance after Mitigation

Increased project-related traffic would not cause a significant increase in congestion or affect the existing LOS on County roads or State Highways. As such, impacts after incorporation of the above mitigation measure will be less than significant.

4.15 TRANSPORTATION AND TRAFFIC

IMPACT TRAF-3 Result in a Change in Air Traffic Patterns, Including Either an Increase in Traffic Levels or a Change in Location that Results in Substantial Safety Risks

The proposed Project is limited to utilizing CO2 EOR at an active oil field. The Project does not include any component that would result in a change in air traffic patterns, increase air traffic, or a change in location that would increase air safety risks. No impact will occur.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impact.

IMPACT TRAF-4 Substantially Increase Hazards caused by a Design Feature (such as Sharp Curves or Dangerous Intersections) or Incompatible Uses (such as Agricultural Equipment)

The proposed Project is limited to utilizing CO2 EOR at an active oil field. The Project does not include any public roadway construction component that has the potential to increase public roadway hazards through design features nor does it present an incompatible use of public roadways. However, Project-related equipment and supply deliveries may consist of heavy loads which have the potential to damage roadways or present roadway hazards to the public. Kern County or DOT will permit heavy loads. These permits will have conditions that require evaluating if damage to roadways occurs and performing necessary repairs to minimize roadway hazards to the public. Considering the above, this is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT TRAF-5 Result in Inadequate Emergency Access

The Project would not alter any existing emergency access routes or change existing patterns of emergency access. The Project would not require closures of public roads, which could inhibit access by emergency vehicles. As described above, increased project-related traffic with Mitigation Measure TRAF-1 and improvements recommended would not cause a significant increase in congestion or affect the existing LOS on roads, which could indirectly affect emergency access. Therefore, this impact would be less than significant.

4.15 TRANSPORTATION AND TRAFFIC

Mitigation Measures

No mitigation measures are required.

Level of Impact after Mitigation

Impacts would be less than significant.

IMPACT TRAF-6 Conflict with Adopted Policies, Plans, or Programs Regarding Public Transit, Bicycle, or Pedestrian Facilities, or Otherwise Decrease the Performance or Safety of Such Facilities

The Project is consistent with the goals and policies of the Kern County General Plan. The Project does not include any component that will decrease the performance or safety of public transit, bicycle, or pedestrian facilities. As such, no impact will result.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impact.

4.15.5 Cumulative Impacts

Vehicle trip growth is expected to occur within the Project area from various planned developments, as well as increases in corridor through travel. Table 4.15-3 presents current (2006) traffic volumes, shows the projected baseline (2015) traffic volumes and future (2030) traffic volumes that are expected to occur within the traffic impact study area at build-out of the Kern County General Plan.

Based on the analysis in Section 4.15.4, the contribution of the Project cumulative scenario to this significant cumulative impact will be considerable without mitigation. However, with the Mitigation Measure TRAF-1 presented above, the Project's contribution to cumulative traffic impacts will be substantially reduced. This reduction in combination with planned improvements to SR 119 will result in the Project having a less than significant cumulative traffic impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

The proposed Project would have less than significant cumulative impacts.

4.16 UTILITIES AND SERVICE SYSTEMS

4.16 Utilities and Service Systems

4.16.1 Introduction

This section describes the Project's potential impacts on utilities and service systems (e.g., water, solid waste and wastewater). Existing urban development and services are limited due to the isolated location of the Project.

4.16.2 Environmental Setting

Water Supply

The Project is located within the West Kern Water District (WKWD). According to the WKWD website (<http://wkwd.org/>), the WKWD is located within the southern San Joaquin Valley and provides municipal and industrial water to a variety of consumers encompassing a 300 square mile area with 7,600 metered accounts. These accounts include commercial and domestic customers in western Kern County, oil companies and co-generation facilities. The mission of the WKWD is to provide its customers a reliable supply of excellent quality water in a planned, efficient, cost effective and environmentally responsible manner, while promoting public awareness of water issues.

The WKWD contracts with the Kern County Water Agency (KCWA) to receive water from the State Water Project. WKWD's State Water Project entitlement is 31,500 acre feet per year. Water purchased from the state through KCWA is used to replenish the groundwater basin beneath the vicinity of the WKWD's groundwater banking area, which lies adjacent to the Kern River. As a result of varying annual allocations, predetermined by the state, the WKWD may not receive all of its allotted annual state water supply; however payment of one hundred percent of its cost is required. Purchasing water and utilizing the WKWD's banking program, which is a concept of storing surplus water in wet years into an underground aquifer allows WKWD to compensate for annual shortfalls.

The WKWD's groundwater banking program is the oldest banking program in Kern County. The program began in the early 1960's as a partnership between WKWD and Buena Vista Water Storage District. The water supply is obtained from eight groundwater wells and is treated before it enters the distribution system of more than 250 miles of pipeline. The WKWD's infrastructure also includes 11 pumping plants and 25 water storage tanks. Potable water required for the Project will be provided by WKWD.

Wastewater

Sanitary Sewer and Wastewater Treatment Plant

Wastewater disposal is handled by both public agencies and private individual systems in this region of the County. Disposal of waste by public agencies is through County Service Areas and Public

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Utility Districts. Individual private disposal generally occurs through a septic tank and leach line or cesspool system. Individual private disposal systems are used in this area of Kern County.

Ford City-Taft Heights Sanitation District is the nearest public utility district to the Project Site. According to the Kern County Waste Management Department website (http://www.co.kern.ca.us/wmd/Services/Sewers-Who_We_Are/sewers-who_we_are.html) Ford City-Taft Heights is a Kern County Sanitation District staffed by Waste Management Department employees. The sanitation district manages wastewater from Ford City and Taft Heights (both unincorporated). Sewer collection for the two communities joins the City of Taft system and gravity flows to the Taft Wastewater Treatment Plants. The Taft Wastewater Treatment Plant, located at 1120 East Ash Street, is jointly owned by the City of Taft (52 percent) and the Ford City-Taft Heights Sanitation District (48 percent). The City of Taft operates the sewer plant via a contractor, Eco Resources, Incorporated. EHOE is not connected to this wastewater treatment plant.

Septic Tank Disposal Systems

Many domestic, industrial and commercial units in unincorporated Kern County are not served by a community (private or public) sewage entity. Disposal of liquid sewage is achieved using individual sewage disposal systems consisting of a septic tank and disposal field.

A septic tank is generally designed to provide a place for solids to settle out of the liquids, for bacterial action to decompose or “digest” the major portion of the solids, and to store residual solids. Liquids flow out of the septic tank into a leach field or into a seepage pit where it percolates into the soil. When septic tanks reach a designated capacity, solid wastes are removed to an approved field or sewage disposal facility.

Solid Waste

Solid Waste collection services in unincorporated Kern County are provided by private companies under contract to the Kern County Waste Management Department. The Kern County Waste Management Department (KCWMD) provides environmentally safe management of both liquid and solid waste. As such, the Department is responsible for operating seven Class III sanitary landfills, five transfer stations, and four transfer bin sites. In addition, the Department also operates two special waste facilities and provides information to residents of Kern County regarding recycling and ways to reduce waste. In the greater Taft region, Westside Waste Management provides garbage pickup services. The company also provides pickup service for recyclable materials. The Project Site is within the service area of Westside Waste Management.

Once collected, solid waste is transported to a local landfill. According to the State of California’s Solid Waste Information System (<http://www.calrecycle.ca.gov/SWFacilities/Directory/>), the permitted capacity for the Taft Landfill (the closest landfill to the Project Site) is 8,787,547 cubic yards, the remaining capacity is approximately 4,308,676 cubic yards, the landfill will reach

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permitted capacity in 2123, and the maximum permitted solid waste that may be accepted is 419 tons per day. The Taft Landfill is currently proposing to expand the landfill which will increase future capacities. In addition to the Taft Landfill, there are other County landfills (such as Shafter) that are available for use if needed.

Electricity, Natural Gas, and Telephone Services

Some utilities that would serve the Project Site would be provided by private companies. The Project Site is within the service area of Pacific Gas & Electric Company (PG&E). PG&E generates, transmits, and distributes electricity and natural gas to 15 million people throughout a 70,000-square-mile service area in northern and central California, including Western Kern County.

Southern California Gas Company provides natural gas only service to Kern County. It is the nation's largest natural gas distribution utility, serving a population of 19.8 million customers in more than 500 communities. Headquartered in Los Angeles, the company buys natural gas on the open market for approximately 5.6 million residential and small commercial and industrial customers which compose its "Core" service group.

Telecommunications services are provided to the Project Site by AT&T. Several companies offer long distance telephone, wireless communication, and internet services region wide.

Cable services are provided by Comcast Cable. Founded in 1963, the Comcast Corporation is the nation's leading provider of cable, entertainment, and communications products and services, with 24.2 million cable customers.

4.16.3 Regulatory Setting

4.16.3.1 Local

Kern County General Plan

The goals, policies, and implementation measures in the *Kern County General Plan* for utilities and service systems that are applicable to the Project are provided below. In addition, the *Kern County General Plan* does contain other goals and policies that are more general in nature and are not specific to development such as the Project. Therefore, these goals and policies are not listed below.

Policies

Policy 1. New discretionary development will be required to pay for its proportional share of the local costs of infrastructure improvements required to service such development.

Policy 3. Individual projects will provide availability of public utility service as per approved guidelines of the serving utility.

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Policy 13. The County shall ensure landfill capacity for the residents and industry of Kern County.

4.16.3.2 State

Urban Water Management Planning Act

In 1983, the State Legislature enacted the Urban Water Management Planning Act (California Water Code Sections 10610-10656). The Act states that every urban water supplier that provides water to 3,000 or more customers, or that provides over 3,000 acre-feet of water annually, should make every effort to ensure the appropriate level of reliability in its water service sufficient to meet the needs of its various categories of customers during normal, dry, and multiple dry years. The Act describes the contents of Urban Water Management Plans to be prepared by the affected entities, as well as how urban water suppliers should adopt and implement the plans.

California Integrated Waste Management Act

To minimize the amount of solid waste that must be disposed of in landfills, the State Legislature passed the California Integrated Waste Management Act of 1989 (AB 939), effective January 1990. According to AB 939, all cities and counties are required to divert 25 percent of all solid waste from landfill facilities by January 1, 1995 and 50 percent by January 1, 2000. Solid waste plans are required to explain how each city's AB 939 plan will be integrated with the County plan. In order of priority, the plans must promote source reduction, recycling and composting, and environmentally safe transformation and land disposal.

California Energy Commission

The California Energy Commission (CEC) regulates the provision of natural gas and electricity within the state. The CEC is the state's primary energy policy and planning agency. Created in 1974, the CEC has five major responsibilities: forecasting future energy needs and keeping historical energy data, licensing thermal power plants 50 megawatts or larger, promoting energy efficiency through appliance and building standards, developing energy technologies and supporting renewable energy, and planning for and directing the state response to energy emergencies.

Wastewater

Wastewater is regulated by the following agencies:

State Water Resources Control Board;

Lahontan Regional Water Quality Control Board;

California Department of Health Services;

California Department of Pesticide Regulation;

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California Department of Toxic Substances; and

California Department of Water Resources.

4.16.4 Impacts and Mitigation Measures

4.16.4.1 Methodology

The analysis contained in the following section addresses the proposed Project's potential impacts on public utilities and service systems. This analysis is based on information and analysis contained in applicable General Plans, Community Plans, and respective EIRs.

4.16.4.2 Thresholds of Significance

Appendix G of the CEQA Guidelines and the Kern County CEQA Implementation Document state that a project would have a significant impact on utilities and service systems if it results in the following:

Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board;

Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects;

Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects;

Have insufficient water supplies available to serve the Project from existing entitlements and resources, or are new expanded entitlements required;

Result in a determination by the wastewater treatment provider which serves or may serve the Project that it has inadequate capacity to serve the Project's projected demand in addition to the provider's existing commitments;

Be served by a landfill with insufficient permitted capacity to accommodate the Project's solid waste disposal needs; or

Conflict with federal, state, and local statutes and regulations related to solid waste.

4.16.4.3 Project Impacts

IMPACT UTIL-1 Exceeds Wastewater Treatment Requirements of the Regional Water Quality Control Board

No services from a wastewater treatment provider would be required. There would be no impact.

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Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impact.

IMPACT UTIL 2 Require or Result in the Construction of New Water or Wastewater Treatment Facilities or Expansion of Existing Facilities, the Construction of Which Could Cause Significant Environmental Effects

No services from a water or wastewater treatment facility would be required. No such facility would be constructed or expanded as a result of the proposed Project. No impact would occur.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impact.

IMPACT UTIL-3 Have Insufficient Water Supplies Available to Serve the Project from Existing Entitlements and Resources or Require Expanded Entitlements

On February 1, 2007, a California State Supreme Court case (Vineyard Area Citizens for Responsible Growth, Inc. et al., v. City of Rancho Cordova and Sunrise Douglas Property Owners Assn. et al.) was handed down that found that CEQA documents must not only identify potential water sources according to SB 610, but must also, to the extent feasible, identify the environmental impacts from utilizing the various supply sources and how those impacts would be mitigated.

With regard to potable water, the Project will periodically increase the number of construction personnel working on-Site over the 20 year construction phase. Construction workers are expected to utilize portable sanitary facilities provided by an established portable sanitary facility service provider. To comply with San Joaquin Valley Air Pollution Control District (SJVAPCD) fugitive dust prohibitions, construction activities will require the use of water for dust suppression activities. OEHI expects to continue to utilize potable water for dust suppression. Use of potable water for dust suppression during grading activities is not expected to increase demand for potable water beyond that which occurs during existing oil field operations and is not expected to substantially increase demand for potable water beyond existing supply capacities.

The addition of up to 25 full-time employment positions at the EHOF to support operation of the Project facilities will slightly increase demand for potable water supply at the site. However, this increase is expected to be limited to an increase in use of existing sanitary facilities located on-site for

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employees. The incremental increase in demand (during construction and operation) will not require new or expanded water entitlements. This is a less than significant impact.

Implementation of the Project will require the use of water for EOR. However, the source of this water will be produced water or non-potable water obtained from existing Tulare aquifer wells located within the EHO. The use of non-potable water for EOR will have no effect on existing potable water service providers or systems. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT UTIL-4 Require or Result in the Construction of New Storm Water Drainage Facilities or Expansion of Existing Facilities, the Construction of which Could Cause Significant Environmental Effects

As discussed in Section 4.8 (Hydrology and Water Quality), storm water runoff does not have the potential to enter public storm water drainage systems or Waters of the United States. No impact to public storm water drainage systems will result from Project implementation.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impact.

IMPACT UTIL-5 Result in a Determination by the Wastewater Treatment Provider which Serves or may Serve the Project that it has Inadequate Capacity to Serve the Project's Projected Demand in Addition to the Provider's Existing Commitments

No services from a wastewater treatment provider would be required. There would be no impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impact.

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IMPACT UTL-6 Served by a Landfill with Insufficient Permitted Capacity to Accommodate the Project's Solid Waste Disposal Needs

Activities at the EHOFF generate many types of solid waste, most of which are non-hazardous waste streams. A total of approximately 4,000 tons/year (equivalent to one truck trip every three days) of non-hazardous solid waste, such as construction debris and domestic-type wastes and trash, are removed from the EHOFF. The amount of solid waste generated as a result of the Project will not be significantly greater than that generated during existing construction and operations at the EHOFF without CO2 EOR. Therefore, no substantial increase in the generation of solid wastes above existing baseline conditions are anticipated as a result of project implementation. As such, the Project is not expected to be served by a landfill with insufficient permitted capacity to accommodate the Project's solid waste disposal needs. Considering the above, the project would have a less than significant impact on landfill capacities and facilities.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT UTL-7 Conflict with Federal, State, and Local Statutes Related to Solid Waste

The proposed Project will utilize non-hazardous and hazardous solid waste landfills with capacity to serve the demand for the Project. OEHI will adhere to all applicable regulations pertaining to solid waste storage, transport, and disposal. The proposed Project will not conflict with any statutes. No impact will occur.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No Impact.

4.16.5 Cumulative Impacts

The Project is limited to utilizing CO2 EOR at an active oil field. The Project does not include any residential development or other component that will substantially impact utilities and service systems beyond existing baseline conditions. As such, the proposed Project is expected to have a less than significant contribution to cumulative utilities and service systems impacts.

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Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

The proposed Project would have less than significant cumulative impacts.

4.17 ENVIRONMENTAL JUSTICE

4.17 Environmental Justice

4.17.1 Introduction

This section discusses the relevant demographic data for the vicinity of the proposed Project and assesses potential environmental justice impacts that could result from Project implementation.

Environmental justice considerations are not required to be addressed within a CEQA analysis, but must be specifically evaluated in NEPA documents pursuant to a Federal Executive Order. Per State law, environmental justice is defined as “the fair treatment of people of all races, cultures, and incomes with respect to development, adoption, implementation, and enforcement of environmental laws, regulations, and policies.

4.17 ENVIRONMENTAL JUSTICE

4.17.2 Environmental Setting

Regional Population and Demographics

County of Kern

Kern County is the third largest county (in acreage) in California with a population of more than 785,000 residents (U.S. Census Bureau, 2008). Kern County is in the heart of Central California with an economic base of agriculture and oil. The area ranges from scenic desert to snow-covered mountain landscapes. The County seat is Bakersfield which is about 115 miles north of Los Angeles and approximately 18 miles east of the Project Site.

The County's racial makeup consists of the following:

TABLE 4.17-1: KERN COUNTY RACIAL MAKEUP

White	63.2%
Black or African American	5.7%
Native American	1.0%
Asian	3.8%
Pacific Islander	0.1%
From other races	22.5%
From two or more races	3.7%

Source: U.S. Census Bureau 2006-2008 3-year estimate

"From other race" was included in Census 2000 for respondents who were unable to identify with the five Office of Management and Budget race categories. Respondents who provided write-in entries such as Moroccan, South African, Belizean, or a Hispanic origin (for example, Mexican, Puerto-Rican, or Cuban) are included in the From other race category.

Source: <http://www.census.gov/prod/2001pubs/c2kbr01-1.pdf>

The median income breakdown for the County of Kern is as follows:

TABLE 4.17-2: KERN COUNTY MEDIAN INCOME

Household	\$46,442
Family	\$50,819
Full-time working Male	\$41,718
Full-time working Female	\$31,303

Source: U.S. Census Bureau 2006-2008 3-year estimate

The per capita income for the County is \$20,410. Of the total population, 19.9 percent of individuals and 16.6 percent of families are below the poverty line.

4.17 ENVIRONMENTAL JUSTICE

Local Population and Demographics

Buttonwillow

The community of Buttonwillow (a Census Designated Place) is located approximately 5 miles north of the Project Site. As of 2000, there were 1,266 (Male: 655 / Female: 611) people, 328 occupied housing units, and 277 families within the community of Buttonwillow.

Buttonwillow's racial makeup consists of the following:

TABLE 4.17-3: BUTTONWILLOW RACIAL MAKEUP	
White	34.3%
Black or African American	3.8%
Native American	1.7%
Asian	0.1%
Pacific Islander	0.0%
From other races	55.1%
From two or more races	5.1%
Source: U.S. Census Bureau 2000	
<i>"From other race" was included in Census 2000 for respondents who were unable to identify with the five Office of Management and Budget race categories. Respondents who provided write-in entries such as Moroccan, South African, Belizean, or a Hispanic origin (for example, Mexican, Puerto-Rican, or Cuban) are included in the From other race category.</i>	
Source: http://www.census.gov/prod/2001pubs/c2kbr01-1.pdf	

The median income breakdown for Buttonwillow is as follows:

TABLE 4.17-4: BUTTONWILLOW MEDIAN INCOME	
Household	\$28,370
Family	\$29,716
Full-time working Male	\$19,514
Full-time working Female	\$16,974
Source: U.S. Census Bureau 2000	

The per capita income for Buttonwillow is \$9,424. Of the total population, 28.7 percent of individuals and 23.1 percent of families are below the poverty line.

4.17 ENVIRONMENTAL JUSTICE

Derby Acres

The community of Derby Acres (a Census Designated Place) is located approximately 6 miles southwest of the Project Site. As of 2000, there were 376 (Male: 188 / Female: 188) people, 125 occupied housing units, and 111 families within Derby Acres.

Derby Acres' racial makeup consists of the following:

TABLE 4.17-5: DERBY ACRES RACIAL MAKEUP	
White	93.1%
Black or African American	0.0%
Native American	1.1%
Asian	0.0%
Pacific Islander	0.5%
From other races	4.5%
From two or more races	0.8%
Source: U.S. Census Bureau 2000	
<i>"From other race" was included in Census 2000 for respondents who were unable to identify with the five Office of Management and Budget race categories. Respondents who provided write-in entries such as Moroccan, South African, Belizean, or a Hispanic origin (for example, Mexican, Puerto-Rican, or Cuban) are included in the From other race category.</i>	
Source: http://www.census.gov/prod/2001pubs/c2kbr01-1.pdf	

The median income breakdown for Derby Acres is as follows:

TABLE 4.17-6: DERBY ACRES MEDIAN INCOME	
Household	\$44,688
Family	\$50,179
Full-time working Male	\$45,521
Full-time working Female	\$22,917
Source: U.S. Census Bureau 2000	

The per capita income for Derby Acres is \$19,925. Of the total population, 14.6 percent of individuals and 15.3 percent of families are below the poverty line.

4.17 ENVIRONMENTAL JUSTICE

Dustin Acres

The community of Dustin Acres (a Census Designated Place) is located approximately 5 miles southwest of the Project Site. As of 2000 there were 585 (Male: 303 / Female: 282) people, 199 occupied housing units, and 172 families within Dustin Acres.

Dustin Acres' racial makeup consists of the following:

TABLE 4.17-7: DUSTIN ACRES RACIAL MAKEUP	
White	85.1%
Black or African American	0.2%
Native American	3.4%
Asian	0.0%
Pacific Islander	0.0%
From other races	8.2%
From two or more races	3.1%
Source: U.S. Census Bureau 2000	
<i>"From other race" was included in Census 2000 for respondents who were unable to identify with the five Office of Management and Budget race categories. Respondents who provided write-in entries such as Moroccan, South African, Belizean, or a Hispanic origin (for example, Mexican, Puerto-Rican, or Cuban) are included in the From other race category.</i>	
Source: http://www.census.gov/prod/2001pubs/c2kbr01-1.pdf	

The median income breakdown for Dustin Acres is as follows:

TABLE 4.17-8: DUSTIN ACRES MEDIAN INCOME	
Household	\$50,203
Family	\$51,689
Full-time working Male	\$51,149
Full-time working Female	\$30,795
Source: U.S. Census Bureau 2000	

The per capita income for Dustin Acres is \$23,929. Of the total population, 7.0 percent of individuals and 4.7 percent of families are below the poverty line.

4.17 ENVIRONMENTAL JUSTICE

Fellows

The community of Fellows (a Census Designated Place) is located approximately 5.5 miles southwest of the Project Site. As of 2000, there were 153 (Male: 77 / Female: 76) people, 56 occupied housing units, and 40 families within Fellows.

Fellows' racial makeup consists of the following:

TABLE 4.17-9: FELLOWS RACIAL MAKEUP	
White	88.9%
Black or African American	0.0%
Native American	2.0%
Asian	1.3%
Pacific Islander	0.7%
From other races	6.5%
From two or more races	0.7%
Source: U.S. Census Bureau 2000	
<i>"From other race" was included in Census 2000 for respondents who were unable to identify with the five Office of Management and Budget race categories. Respondents who provided write-in entries such as Moroccan, South African, Belizean, or a Hispanic origin (for example, Mexican, Puerto-Rican, or Cuban) are included in the From other race category.</i>	
Source: http://www.census.gov/prod/2001pubs/c2kbr01-1.pdf	

The median income breakdown for Fellows is as follows:

TABLE 4.17-10: FELLOWS MEDIAN INCOME	
Household	\$30,417
Family	\$30,000
Full-time working Male	\$36,250
Full-time working Female	\$20,781
Source: U.S. Census Bureau 2000	
<i>"From other race" was included in Census 2000 for respondents who were unable to identify with the five Office of Management and Budget race categories. Respondents who provided write-in entries such as Moroccan, South African, Belizean, or a Hispanic origin (for example, Mexican, Puerto-Rican, or Cuban) are included in the From other race category.</i>	
Source: http://www.census.gov/prod/2001pubs/c2kbr01-1.pdf	

The per capita income for Fellows is \$15,636. Of the total population, 17.4 percent of individuals and 17.5 percent of families are below the poverty line.

4.17 ENVIRONMENTAL JUSTICE

Ford City

The community of Ford City (a Census Designated Place) is located approximately 5 miles south of the Project Site. As of 2000, there were 3,512 (Male: 1,732 / Female: 1,780) people, 1,241 occupied housing units, and 905 families within Ford City.

Ford City's racial makeup consists of the following:

TABLE 4.17-11: FORD CITY RACIAL MAKEUP	
White	80.5%
Black or African American	0.6%
Native American	1.8%
Asian	1.3%
Pacific Islander	0.6%
From other races	11.6%
From two or more races	3.5%
Source: U.S. Census Bureau 2000	
<i>"From other race" was included in Census 2000 for respondents who were unable to identify with the five Office of Management and Budget race categories. Respondents who provided write-in entries such as Moroccan, South African, Belizean, or a Hispanic origin (for example, Mexican, Puerto-Rican, or Cuban) are included in the From other race category.</i>	
Source: http://www.census.gov/prod/2001pubs/c2kbr01-1.pdf	

The median income breakdown for Ford City is as follows:

TABLE 4.17-12: FORD CITY MEDIAN INCOME	
Household	\$25,192
Family	\$30,256
Full-time working Male	\$34,474
Full-time working Female	\$20,625
Source: U.S. Census Bureau 2000	

The per capita income for Ford City is \$11,581. Of the total population, 31.3percent of individuals and 30.5 percent of families are below the poverty line.

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McKittrick

The community of McKittrick (a Census Designated Place) is located approximately 5 miles west of the Project Site. As of 2000, there were 160 (Male: 81 / Female: 79) people, 54 occupied housing units, and 34 families within McKittrick.

McKittrick's racial makeup consists of the following:

TABLE 4.17-13: MCKITTRICK RACIAL MAKEUP	
White	96.9%
Black or African American	0.0%
Native American	0.0%
Asian	0.0%
Pacific Islander	0.0%
From other races	0.0%
From two or more races	3.1%
Source: U.S. Census Bureau 2000	
<i>"From other race" was included in Census 2000 for respondents who were unable to identify with the five Office of Management and Budget race categories. Respondents who provided write-in entries such as Moroccan, South African, Belizean, or a Hispanic origin (for example, Mexican, Puerto-Rican, or Cuban) are included in the From other race category.</i>	
Source: http://www.census.gov/prod/2001pubs/c2kbr01-1.pdf	

The median income breakdown for McKittrick is as follows:

TABLE 4.17-14: MCKITTRICK MEDIAN INCOME	
Household	\$43,333
Family	\$42,917
Full-time working Male	\$30,625
Full-time working Female	\$28,750
Source: U.S. Census Bureau 2000	

The per capita income for McKittrick is \$14,174. Of the total population, 15.0 percent of individuals and 11.8 percent of families are below the poverty line.

4.17 ENVIRONMENTAL JUSTICE

South Taft

The community of South Taft (a Census Designated Place) is located approximately 6.5 miles south of the Project Site. Because South Taft is located in excess of 6-miles from the Project Site, it has not been considered further within this analysis.

Taft Heights

The community of Taft Heights (a Census Designated Place) is located approximately 6.5 miles south of the Project Site. As of 2000, there were 1,865 (Male: 935 / Female: 930) people, 676 occupied housing units, and 465 families within Taft Heights.

Taft Heights' racial makeup consists of the following:

TABLE 4.17-15: TAFT HEIGHTS RACIAL MAKEUP	
White	88.2%
Black or African American	0.5%
Native American	1.4%
Asian	0.9%
Pacific Islander	1.0%
From other races	5.6%
From two or more races	2.3%
Source: U.S. Census Bureau 2000	
<i>"From other race" was included in Census 2000 for respondents who were unable to identify with the five Office of Management and Budget race categories. Respondents who provided write-in entries such as Moroccan, South African, Belizean, or a Hispanic origin (for example, Mexican, Puerto-Rican, or Cuban) are included in the From other race category.</i>	
Source: http://www.census.gov/prod/2001pubs/c2kbr01-1.pdf	

The median income breakdown for Taft Heights is as follows:

TABLE 4.17-16: TAFT HEIGHTS MEDIAN INCOME	
Household	\$37,684
Family	\$37,944
Full-time working Male	\$36,098
Full-time working Female	\$21,765
Source: U.S. Census Bureau 2000	

The per capita income for Taft Heights is \$14,485. Of the total population, 18.0 percent of individuals and 17.2 percent of families are below the poverty line.

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Tupman

The community of Tupman (a Census Designated Place) is located approximately 1.5 miles east of the Project Site. As of 2000, there were 277 (Male: 112 / Female: 115) people, 66 occupied housing units, and 48 families within Tupman.

Tupman's racial makeup consists of the following:

TABLE 4.17-17: TUPMAN RACIAL MAKEUP	
White	93.0%
Black or African American	0.4%
Native American	0.9%
Asian	0.0%
Pacific Islander	0.0%
From other races	2.6%
From two or more races	3.1%
Source: U.S. Census Bureau 2000	
<i>"From other race" was included in Census 2000 for respondents who were unable to identify with the five Office of Management and Budget race categories. Respondents who provided write-in entries such as Moroccan, South African, Belizean, or a Hispanic origin (for example, Mexican, Puerto-Rican, or Cuban) are included in the From other race category.</i>	
Source: http://www.census.gov/prod/2001pubs/c2kbr01-1.pdf	

The median income breakdown for Tupman is as follows:

TABLE 4.17-18: TUPMAN MEDIAN INCOME	
Household	\$27,500
Family	\$43,125
Full-time working Male	\$38,125
Full-time working Female	\$28,750
Source: U.S. Census Bureau 2000	

The per capita income for Tupman is \$8,482. Of the total population, 20.1 percent of individuals and 12.5 percent of families are below the poverty line.

4.17 ENVIRONMENTAL JUSTICE

Valley Acres

The community of Valley Acres (a Census Designated Place) is located approximately 2 miles south of the Project Site. As of 2000, there were 512 (Male: 267 / Female: 245) people, 183 occupied housing units, and 197 families within Valley Acres.

Valley Acres' racial makeup consists of the following:

TABLE 4.17-19: VALLEY ACRES RACIAL MAKEUP	
White	89.6%
Black or African American	0.6%
Native American	1.8%
Asian	0.2%
Pacific Islander	0.6%
From other races	4.7%
From two or more races	2.3%
Source: U.S. Census Bureau 2000	
<i>"From other race" was included in Census 2000 for respondents who were unable to identify with the five Office of Management and Budget race categories. Respondents who provided write-in entries such as Moroccan, South African, Belizean, or a Hispanic origin (for example, Mexican, Puerto-Rican, or Cuban) are included in the From other race category.</i>	
Source: http://www.census.gov/prod/2001pubs/c2kbr01-1.pdf	

The median income breakdown for Valley Acres is as follows:

TABLE 4.17-20: VALLEY ACRES MEDIAN INCOME	
Household	\$41,477
Family	\$48,958
Full-time working Male	\$36,513
Full-time working Female	\$45,357
Source: U.S. Census Bureau 2000	

The per capita income for Valley Acres is \$18,013. Of the total population, 8.2 percent of individuals and 5.1 percent of families are below the poverty line.

Regional Employment

Primary components of the Kern County economy are farm products, petroleum, logistics/warehousing, and national defense and space activities, such as Edwards Air Force Base, China Lake Naval Weapons Center, the National Aeronautics and Space Administration (NASA)-Dryden Flight Research Center, and the East Kern (Mojave) Airport District. Edwards Air Force Base and China Lake Naval Weapons Center are two of Kern County's major employers, joined in that category by Kern County public schools and the Kern County government. Kern County is the largest oil-producing county in California, containing approximately 71 percent of California's oil reserves.

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Kern County is also the third leading producer of agricultural products in the United States (Kern County final budget 2007-2008).

In September 2008, the Kern County civilian labor force of 369,500 represented 2.0 percent of the California civilian labor force. The Kern County civilian labor force increased by 2.8 percent, annually, between 2000 and 2007, and 1.3 percent, annually, between 1990 and 2000. From 2000 to 2007, the Kern County civilian labor force grew faster than the civilian labor force in California by 1.7 percentage points (Table 4.17-23, Kern County Labor force, Employment, and Industry).

TABLE 4.17-21: KERN COUNTY LABOR FORCE, EMPLOYMENT, AND INDUSTRY			
Industry	1990	2000	2007
Civilian Labor Force	257,000	293,500	351,900
Employment	228,900	269,300	322,800
Civilian Unemployment Rate (%)	10.90	8.20	8.30
Percent of Employment, by Industry			
Farm	15	20	16
Natural Resources and Mining	6	3	3
Construction	6	5	7
Manufacturing	5	4	5
Trade, Transportation, and Utilities	17	15	16
Information	2	1	1
Financial Activities	3	3	3
Professional and Business Services	8	9	11
Education and Health Services	6	8	9
Leisure and Hospitality	7	7	8
Other Services	3	3	2
Government	22	21	21
<i>Source: CEDD, 2008a</i>			

4.17.3 Regulatory Setting

Federal Regulation

Federal laws, guidelines and policies:

- EPA's 1998 Environmental Justice Guidance (provides details and guidance for implementing the federal Environmental Justice program);
- Executive Order #12898 of 1994 (established the federal Environmental Justice program); and
- US Constitution (equal protection) Title VI of the 1964 Civil Rights Act.

Executive Order 12898: An Executive Order on Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations was issued by President Clinton on February 11,

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1994. The executive order was designed to focus attention on environmental and human health conditions in areas of high minority populations and low-income communities, and promote non-discrimination in programs and projects substantially affecting human health and environment (Federal Register, 1994). Executive Order 12898 required the USEPA, all other federal agencies, as well as state Federal funded agencies to develop strategies to address the issue. Each agency was required to identify and address any disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and/or low-income populations.

In 1997, the U.S. Environmental Protection Agency (USEPA) Office of Environmental Justice released the *Environmental Justice Implementation Plan* (USEPA, 1997), supplementing the USEPA environmental justice strategy and providing a framework for developing specific plans and guidance for implementing Executive Order 12898. Federal agencies received a framework for the assessment of environmental justice in the USEPA's *Guidance for Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analysis*, in 1998 (USEPA, 1998). This approach emphasized the importance of selecting an analytical process appropriate to the unique circumstances of the potentially affected community.

State Regulations

California was one of the first states in the Nation to pass legislation to codify environmental justice in state statute. Environmental Justice is defined in statute as, "The fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations and policies." (Government Code Section 65040.12).

California laws, guidelines and policies:

- Government Code Section 65040.12 (defines Environmental Justice and designates the Office of Planning and Research (OPR) as coordinator for state Environmental Justice program); and
- Government Code Section 65040.2 (requires the OPR to develop Environmental Justice guidelines for local General Plans).

California Energy Commission: The California Resources Agency developed an Environmental Justice Policy that applies to all of its Departments, Boards, Commissions, Conservancies and Special Programs. The California Energy Commission has been integrating environmental justice into its siting process since 1995, as part of its thorough CEQA analysis of applications for siting power plants and related facilities. The cornerstone of the Energy Commission approach is based on wide-reaching public outreach efforts by the Siting, Transmission & Environmental Protection Division, the Hearing Office, Media and Public Communications Office, in addition to the Public Adviser's Office, to notify, inform and involve community members, including non-English speaking people (CEC, 2010).

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4.17.4 Impacts and Mitigation Measures

4.17.4.1 Methodology

In recent environmental justice analyses, the CEC has used consistent methodology under USEPA guidelines. Under current USEPA methodology and CEC practice, for potential environmental justice impacts to exist, an environmental justice population must be present within 6 miles of the Project Site and the Project must result in “high and adverse” environmental impacts that affect the environmental justice populations disproportionately.

Potential environmental justice populations are defined as areas where the minority or low income population percentage is meaningfully greater than the minority or low-income population percentage in the general population, according to CEC guidance. For the purposes of this analysis, “meaningfully greater” is defined as approximately 10 percentage points greater than the county-wide average. This threshold figure with respect to the Project Site would be any minority population greater than 46.8 percent, which would be 10 percentage points greater than the Kern County minority population of 36.8 percent, and a low-income population of 29.9 percent, which would be 10 percentage points greater than the Kern County low-income population of 19.9 percent. The above Kern County minority and low-income population data was derived from 3 year data between 2006-2008. Table 4.17-24 below lists the communities located within 6 miles of the proposed Project Site, percent racial minorities, percent of individuals living below the poverty level, and whether the community is considered an environmental justice population based on the above criteria.

TABLE 4.17-22: ENVIRONMENTAL JUSTICE COMMUNITIES			
Geographic Area	% Racial Minority	% Individuals Living Below Poverty Level	Environmental Justice Community?
EJ Community Threshold (Kern County Average + 10%)	46.8	29.9	Threshold Value
Buttonwillow	65.8	28.7	YES
Derby Acres	11.9	14.6	NO
Dustin Acres	14.9	7.0	NO
Fellows	11.2	17.4	NO
Ford City	19.4	31.3	YES
McKittrick	3.1	15.0	NO
Taft Heights	11.7	18.0	NO
Tupman	7.0	20.1	NO
Valley Acres	10.2	8.2	NO
<i>% Racial Minority: Total sum of Black or African American, Native American, Asian, Pacific Islander, From Other Races, and From Two or More Races.</i>			

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Based on the above data, there are two environmental justice communities located in proximity to the Project Site; Buttonwillow and Ford City. Potential environmental justice impacts that could result to the communities of Buttonwillow and Ford City from Project implementation are analyzed below.

4.17.4.2 Significance Criteria

There are currently no established CEQA or NEPA thresholds for environmental justice issues. The Federal Executive Order on Environmental Justice and other sources were considered to derive a significance threshold for this analysis. A project would result in a significant environmental justice impact if it would:

- Cause a disproportionately high and adverse impact on low-income or minority communities adjacent to or in the affected vicinity of the project area;
- Substantially increase project air emissions that disproportionately impact low-income or minority communities in proximity to the project site;
- Degrade the health and safety of low-income or minority communities disproportionately; or
- Fail to provide for or encourage effective participation of low-income or minority communities adjacent to, or in the affected vicinity of, the project area in the environmental review and decision-making process for this project.

4.17.4.3 Project Impacts

IMPACT EJ 1 Cause a disproportionately high and adverse impact on low-income or minority communities adjacent to or in the affected vicinity of the project area

The following discussion includes an analysis of impacts that could result from Project implementation for the issue areas commonly evaluated for potential environmental justice impacts.

Aesthetics

The proposed Project will be constructed in phases over a 20 year period. This construction activity will temporarily introduce additional construction equipment at various locations within the Project Site. Given existing utilization of the Project vicinity primarily by oil and gas operations that commonly utilize heavy equipment, the short-term introduction of construction equipment at various locations would not contribute to a negative aesthetic impact to low-income or minority populations within the environmental justice communities.

The Project consists of utilizing CO2 enhanced oil recovery at an active oil field which will not substantially alter the visual character of the Project Site. Considering the distance away from the Project and topography of Elk Hills, it is not anticipated that any Project components will substantially alter or degrade the viewshed from Buttonwillow or Ford City. As discussed in Section 4.1, while the proposed EOR Processing Facility located in Section 27 has the potential to result in significant

4.17 ENVIRONMENTAL JUSTICE

impacts to aesthetics, it will not have a disproportionately high and adverse impact on low-income or minority communities adjacent to or in the affected vicinity of the project area.

Air Quality

See Impact EJ 2 below.

Hazards and Hazardous Materials

See Impact EJ 3 below.

Hydrology and Water Quality

The proposed Project does not have the potential to result in significant water quality impacts during construction and operation (see Section 4.8). As water quality impacts resulting from the proposed Project will be less than significant, the proposed Project will have less than significant water quality impacts to low-income or minority populations within environmental justice communities.

Noise

As discussed within Section 4.11, the proposed Project would generate short-term construction-related noise during facility installation. Operation of the Project would also generate equipment noise from the EOR Processing Facility located in Section 27S. However, the proposed Project will have less than significant noise impacts and will not have a disproportionately high and adverse impact on low-income or minority communities adjacent to or in the affected vicinity of the project area.

Population and Housing

The proposed Project is limited to utilizing CO2 EOR and the installation of supporting facilities at an active oil field. The proposed Project does not include a growth inducing element that would substantially increase population. As population and housing impacts resulting from the proposed Project will be less than significant (see Section 4.12), the proposed Project will have less than significant population and housing impacts to low-income or minority populations within environmental justice communities.

Public Services

The project is limited to CO2 enhanced oil recovery and the installation of supporting facilities at an active oil field. As discussed in Section 4.13, the proposed Project does not include an element that will substantially impact public services. As public services impacts resulting from the proposed Project will be less than significant, the proposed Project will have less than significant public services impacts to low-income or minority populations within environmental justice communities.

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Recreation

The project is limited to CO2 enhanced oil recovery and the installation of supporting facilities at an active oil field. As discussed in Section 4.14, the proposed Project does not include an element that will substantially impact recreation resources. As recreation impacts resulting from the proposed Project will be less than significant, the proposed Project will have less than significant recreation impacts to low-income or minority populations within environmental justice communities.

Transportation and Traffic

The proposed Project has the potential to result in significant transportation and traffic impacts during the construction phase of the Project. However, the significance of potential transportation and traffic impacts has been mitigated to a less than significant level (see Section 4.15). As transportation and traffic impacts resulting from the proposed Project will be less than significant, the proposed Project will have less than significant transportation and traffic impacts to low-income or minority populations within environmental justice communities.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT EJ 2 Substantially increase project air emissions that disproportionately impact low-income or minority communities in proximity to the project site

The proposed Project has the potential to result in significant air quality impacts. However, the significance of potential air quality impacts has been mitigated to a less than significant level (see Section 4.3). As air quality impacts resulting from the proposed Project will be less than significant, the proposed Project will have less than significant air quality impacts to low-income or minority populations within environmental justice communities.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

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IMPACT EJ 3 Degrade the health and safety of low-income or minority communities disproportionately

Buttonwillow and Ford City are located less than 6 miles from the proposed Project Site. There are no project components that have the potential to result in significant health and safety impacts to low-income or minority populations within Buttonwillow and Ford City. No impact will occur.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impact.

IMPACT EJ 4 Fail to provide for or encourage effective participation of low-income or minority communities adjacent to, or in the affected vicinity of, the project area in the environmental review and decision-making process for this project

The Lead Agency retains the responsibility for coordinating public involvement and review of the Project under the CEQA. This process provides and encourages public participation, including environmental justice communities. However, the timing and location of public involvement opportunities such as public scoping meetings, workshops, and hearings can substantially influence attendance and possibly exclude involvement of low-income or minority populations. This is potentially a significant environmental justice impact. Although the Lead Agency will be responsible for coordinating public review under CEQA, mitigation measure EJ-1 below is recommended to encourage effective participation of environmental justice communities in the environmental review and decision-making process for the Project.

Mitigation Measures

Mitigation Measure EJ-1 Conduct at least two public scoping meetings at different times within 5 miles of each environmental justice community with the potential to be affected by the proposed Project (e.g., 6 miles); Buttonwillow and Ford City. A notice of each public scoping meeting must be posted in at least one local newspaper 3-7 days prior to each meeting. A notice of each pending meeting should also be posted at each meeting location at least 7 days in advance of each meeting.

Level of Significance after Mitigation

Impacts would be less than significant.

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4.17.5 Cumulative Impacts

As discussed above in Section 4.17.4, the proposed Project will result in less than significant adverse environmental justice impacts. Cumulative impacts of the proposed Project would be minimized through implementation of Mitigation Measure EJ-1. The proposed Project does not include any component with the potential to significantly contribute to a cumulative environmental justice impact. The proposed Project will therefore have a less than significant environmental justice cumulative impact.

Mitigation Measures

Mitigation Measure EJ-1 detailed above is expected to reduce environmental justice impacts to a less than significant level, and thus ensure the proposed Project will not contribute to an overall cumulative impact.

Level of Significance after Mitigation

The proposed Project would have less than significant cumulative impacts.

4.18 GREENHOUSE GAS EMISSIONS

4.18 Greenhouse Gas Emissions

4.18.1 Introduction

This section considers the greenhouse gas impacts of the proposed Project.

4.18.2 Environmental Setting

Greenhouse gases, which are transparent to solar radiation, absorb infrared radiation, resulting in heat trapping. This phenomenon is known as the greenhouse effect. Among the prominent greenhouse gases contributing to the greenhouse effect are carbon dioxide (CO₂), methane (CH₄), ozone (O₃), water vapor, nitrous oxide (N₂O), and chlorofluorocarbons (CFCs).

Consumption of fossil fuels in the transportation sector was the single largest source of California's greenhouse gas emissions in 2004, accounting for 40.7 percent of total greenhouse gas emissions in the state (CEC, 2006a). This category was followed by the electric power sector (including both in- and out-of-state sources) (22.2 percent) and the industrial sector (20.5 percent) (CEC 2006a).

As compared to criteria air pollutants and toxic air contaminants, which can produce localized effects on air quality, emissions of greenhouse gases do not create localized impacts.

4.18.3 Regulatory Setting

This section describes local, State, and Federal Legislation and regulations that specifically address greenhouse gas emissions.

Local

San Joaquin Valley Air Pollution Control District

The SJVAPCD staff utilizes an approach intended to streamline the CEQA process to determine if project-specific greenhouse gas emissions could have a significant effect on the environment. The methodology relies on the use of performance based standards to determine significance of project specific greenhouse gas emission impacts. These are known as Best Performance Standards (BPS). Establishing BPS helps project proponents, lead agencies, and the public by proactively identifying effective, feasible greenhouse gas emission reduction measures. Emission reductions achieved through implementation of BPS are pre-quantified, thus negating the need for project specific quantification of greenhouse gas emissions (SJVAPCD 2009).

BPS' are defined as the most effective achieved-in-practice means of reducing or limiting greenhouse gas emissions from a specified greenhouse gas emissions source. For traditional stationary source projects, such as pollutant-emitting equipment requiring an air permit, BPS includes equipment type, equipment design, and operational and maintenance practices for the identified service, operation, or emission unit class and category. For development projects, such as new commercial or residential

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development, BPS focuses on measures that improve energy efficiency and those that reduce vehicle miles travelled. SJVAPCD staff establishes BPS for specific classes and categories of stationary sources and development projects and maintains a listing of the established BPS ("BPS Guidance") on the Climate Change page of the SJVAPCD's webpage www.valleyair.org (SJVAPCD 2009). Projects implementing BPS in accordance with this Guidance will be judged as having a less than significant individual and cumulative impact on global climate change and would not require project specific quantification of greenhouse gas emissions.

The BPS Guidance employs a tiered approach to review a project's greenhouse gas emissions. Projects exempt from the requirements of CEQA, and projects complying with an approved greenhouse gas emission reduction plan or mitigation program (such as AB 32) will also be judged to have a less than significant individual or cumulative impact. Such plans or programs must be specified in law or adopted by the public agency with jurisdiction over the affected resources and have a certified final CEQA document. Projects not implementing BPS would require quantification of project specific greenhouse gas emissions. To be judged as having a less than significant individual and cumulative impact, such projects must have reduced or mitigated greenhouse gas emissions by 29 percent as measured against "business as usual" (BAU), consistent with greenhouse gas emission reduction targets established by CARB's AB 32 Scoping Plan. For all projects for which the lead agency has determined that an EIR is required, quantification of greenhouse gas emissions is recommended regardless of whether the project incorporates BPS (SJVAPCD 2009).

The Guidance also notes that "nothing...shall be construed as limiting a lead agency's authority to adopt a statement of overriding consideration for projects with significant greenhouse gas impacts" (SJVAPCD 2009).

Process for Evaluating Significance of Greenhouse Gas Emissions under the SJVAPCD Policy

Under the Guidance, greenhouse gas emissions are analyzed as follows:

- Projects determined to be exempt from the requirements of CEQA are characterized as having a less than significant individual and cumulative impact for greenhouse gas emissions and do not require further environmental review, including analysis of project specific greenhouse gas emissions. Projects exempt under CEQA are evaluated consistent with established rules and regulations governing project approval without consideration of BPS.
- Projects complying with an approved greenhouse gas emissions reduction plan or greenhouse gas mitigation program which avoids or substantially reduces greenhouse gas emissions within the geographic area in which the project is located will be judged to have a less than significant individual and cumulative impact for greenhouse gas emissions. Such plans or programs must be specified in law or approved by the lead agency with jurisdiction over the affected resource and supported by a CEQA compliant environmental

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review document adopted by the lead agency.

- Projects implementing BPS are not required to quantify project specific greenhouse gas emissions. Consistent with CEQA Guideline, such projects will be judged to have a less than significant individual and cumulative impact for greenhouse gas emissions.
- Projects not implementing BPS, and not otherwise exempt from CEQA or deemed to have an insignificant impact are required to quantify project-specific greenhouse gas emissions and demonstrate that such emissions would be reduced or mitigated by at least 29 percent, compared to BAU (including greenhouse gas emission reductions achieved since the 2002-2004 baseline period) and to be determined to have a less than significant individual and cumulative greenhouse gas impact.
- Notwithstanding any of the above provisions, projects requiring preparation of an EIR for any other reason require quantification of project specific greenhouse gas emissions. Where such projects implement BPS or achieve at least 29 percent greenhouse gas emission reduction compared to BAU, they will be judged as having a less than significant individual and cumulative impact for greenhouse gas.

Application of BPS to Stationary Source Equipment

Greenhouse gas emissions can be directly emitted from stationary sources of air pollution requiring operating permits from the SJVAPD, or they may be emitted indirectly, as a result of electrical power consumption. In many cases, a land-use agency will act as the lead agency under CEQA for projects that will eventually require Permits to Operate from the SJVAPCD. The SJVAPCD recommends that the lead agency apply the SJVAPCD's policy for assessing significance of greenhouse gas emission impacts from stationary source projects, under CEQA.

For greenhouse gas emissions increases, the land-use agency should consult the Climate Change Action Plan (CCAP) to ascertain the appropriate BPS for the class and category of source of greenhouse gas emissions, and require the source to apply the BPS contained in the listing at the time the application for discretionary approval was deemed complete by the lead agency. If such BPS is proposed and required, or the project achieves a 29 percent reduction in greenhouse gas emissions relative to the BAU baseline, the greenhouse gas impacts from the stationary source equipment shall be judged as having a less than individually and cumulatively significant impact on global climate change for CEQA purpose.

State

Assembly Bill 32, the California Global Warming Solutions Act of 2006

In September 2006, the Global Warming Solutions Act of 2006 (AB 32) was signed into law by former Governor Arnold Schwarzenegger. AB 32 requires that statewide greenhouse gas emissions be reduced to 1990 levels by the year 2020, which results in a roughly 25 percent reduction under

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BAU estimates. The law requires this reduction to be accomplished through a variety of measures, including an enforceable statewide cap on greenhouse gas emissions that will be phased-in starting in 2012. AB 32 directs CARB to develop and implement regulations to reduce statewide greenhouse gas emissions from stationary sources.

The AB 32 Scoping Plan

CARB adopted the AB 32 Scoping Plan on December 12, 2008. The Scoping Plan provides the outline for future actions to reduce California's greenhouse gas emissions and establishes a schedule for CARB and other state agencies to adopt implementing regulations and other initiatives to reduce greenhouse gas emissions.

CARB has adopted a number of measures required by the Scoping Plan and the Scoping Plan calls for the remaining measures to be adopted by the start of 2011 and in effect on or before 2012. One of the most significant measures called for in the Scoping Plan is the statewide cap on emissions from the largest sources of greenhouse gas emissions. The cap-and-trade regulation was approved by CARB on December 16, 2010 following public review and comment. It calls for a phased program starting in 2012 that includes electricity producers, including electricity imports, and large industrial facilities (those with greater than 25,000 tonnes carbon dioxide per year). Starting in 2015, distributors of transportation fuels, natural gas, and other fuels will be included in the cap-and-trade program.

Facilities covered in the cap-and-trade program are not given a specific limit on their greenhouse gas emissions but must supply a sufficient number of allowances (each covering the equivalent of one tonne of carbon dioxide equivalent) to cover their annual emissions. Each year, the total number of allowances issued in the state drops, requiring covered facilities to find the most cost-effective and efficient approaches to reducing their emissions. Facilities without sufficient allowances to cover their annual emissions must acquire additional allowances or offsets. By the end of the program in 2020 there will be a reduction in greenhouse gas emissions sufficient to reach the same level of emissions as the state experienced in 1990, as required under AB 32.

On October 20, 2011, CARB submitted Final Rules for California's cap-and-trade program to the California Office of Administrative Law. With Office of Administrative Law's approval of the rules on December 13, 2011, Article 5: "California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms" was formally added to Subchapter 10 of Title 17 of the California Code of Regulations. The cap-and-trade final rules cover the following areas:

- Annual Cap and Allowance Budgets;
- Determining Reporting Obligations;
- Allowance Distribution;
- Market Operations;

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- Market Oversight; and
- Offsets.

California Climate Action Registry

The California Climate Action Registry (CCAR) was created by the California legislature in 2000, as a non-profit public/private partnership that helps companies and organizations throughout the United States to track, publicly report and reduce their greenhouse gas emissions. The results are certified by independent third-parties to ensure compliance with CCAR protocols and standardization across participants and sectors. The CCAR has been widely recognized as a gold standard for public reporting of greenhouse gases.

Federal

Code of Federal Regulations (40 CFR Part 98)

In response to the FY2008 Consolidated Appropriations Act (H.R. 2764; Public Law 110–161), EPA issued the Mandatory Reporting of Greenhouse Gases Rule (74 FR 5620) which requires reporting of greenhouse gas data and other relevant information from large sources and suppliers in the United States. The purpose of the rule is to collect accurate and timely greenhouse gas data to inform future policy decisions. The Rule is codified in 40 CFR Part 98 and is referred to as the Greenhouse Gas Reporting Program (GHGRP).

Suppliers of certain products that would result in greenhouse gas emissions if released, combusted or oxidized; direct emitting source categories; and facilities that inject CO₂ underground for geologic sequestration or any purpose other than geologic sequestration, are covered in the Rule. Specifically, facilities that emit 25,000 tonnes or more per year of greenhouse gases are required to submit annual reports to the U.S. EPA.

Subpart C of the 40 CFR 98 specifically addresses reporting requirements for stationary fuel combustion sources. The reporting requirements specify calculation methodologies based on unit heat input capacity and fuel type. Subpart NN addresses requirements for reporting greenhouse gas emissions from suppliers of natural gas and natural gas liquids that would result from complete combustion or oxidation of the products that are placed into commerce. Subpart UU addresses the underground injection of CO₂ for the purposes of enhanced oil and gas recovery. Subpart W addresses requirements for leak detection, calculation and reporting of fugitive and process emissions from oil and natural gas systems.

Prevention of Significant Deterioration

In 2009, EPA issued an affirmative finding on the issue of whether greenhouse gas emissions contribute to air pollution that endangers public health or welfare. Shortly thereafter, it proposed to apply Prevention of Significant Deterioration (“PSD”) requirements to facilities whose carbon dioxide

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equivalent emissions exceed 25,000 tonnes per year. On May 13, 2010, EPA announced a final rule “tailoring” greenhouse gas emissions to PSD requirements and raised the emission threshold for rule applicability to 75,000 tonnes per year where a source was required to obtain a PSD permit for other pollutants and 100,000 tonnes per year for sources that would not otherwise be regulated. In 2011, EPA will consider whether the threshold should become carbon dioxide equivalent emissions of more than 50,000 tonnes per year.

4.18.4 Impacts and Mitigation Measures

4.18.4.1 Methodology

Greenhouse gas emissions associated with the proposed Project were estimated using CO₂ emissions as a proxy for all greenhouse gas emissions. This is done by expressing the emissions of each greenhouse gas in terms of CO₂ equivalents (CO₂e), a well-accepted mathematical conversion based on the global warming potential of each gas. This is consistent with the current reporting requirements of the CARB.

The primary sources of the Project greenhouse gas emissions are anticipated to be vehicle emissions and construction equipment used during the construction phase and various stationary, mobile, and indirect sources during operation of the Project. Indirect sources refer to emissions of CO₂e produced as a result of generating electrical power consumed by the Project.

Vehicle emissions were calculated using emissions factors for “Light Duty Autos” (LDA) and “Heavy-Duty Trucks” (HDT) obtained from CARB’s EMFAC 2007 and are specific to each construction year and vehicles within the Kern County inventory. The Emissions factors associated with construction equipment were obtained from CARB’s OFFROAD 2007 model. These emissions factors were then applied to the anticipated number of internal combustion engines, coupled with brake-horsepower, engine load factor, daily operating hours, and operational days per year. The greenhouse gas emissions from combustion equipment were calculated from the annual heat input rate to the equipment (MMBtu/Year, HHV) and the greenhouse gas emission factors (Kg/MMBtu) contained in Appendix-A of the California Air Resources Board (CARB) “*Regulations for the Mandatory Reporting of Greenhouse Gas Emissions*”. Fugitive greenhouse gas emissions (CO₂ and methane) from leaking piping components were calculated from component counts and component leak factors. Leak rate factors (Lb/Day per component) were estimated using “Average Leak Rate Equations” (ALR) published by the EPA in the document titled “*Protocol for Equipment Leak Emission Estimate*”, EPA-453/R-95-017, 1995. Detailed emissions estimates and assumptions used in the calculations are included in Appendix A.

4.18.4.2 Threshold of Significance

CEQA Guidelines Appendix G and the Kern County CEQA Implementation Document states that a project has a significant impact on greenhouse gas emissions and climate change if it would:

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- Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment; or
- Conflict with any applicable plan, policy or regulation of an agency adopted for the purpose of reducing the emissions of greenhouse gases.

Pursuant to SJVAPCD guidance, projects implementing BPS or achieving at least a 29% greenhouse gas emission reduction compared to BAU are judged as having a less than significant individual and cumulative greenhouse gas emissions impact.

4.18.4.3 Project Impacts

IMPACT GHG-1: Generates Greenhouse Gas Emissions, Either Directly or Indirectly, that may have a Significant Impact on the Environment

Tables 4.18-1 (Estimated Project Construction CO₂e Emissions) and 4.18-2 (Estimated Project Operation CO₂e Emissions) below present the estimated annual CO₂e emissions that could result from Project implementation. Detailed calculations for all Project emission sources as well as assumptions used in the calculations are provided in Appendix A.

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TABLE 4.18-1 ESTIMATED PROJECT CONSTRUCTION CO ₂ e EMISSIONS	
Year	CO ₂ e (tonnes)
2014	1,838.46
2015	2,867.58
2016	2,461.04
2017	2,573.19
2018	2,150.89
2019	2,751.93
2020	1,413.83
2021	1,532.98
2022	1,105.61
2023	2,159.48
2024	1,625.36
2025	2,193.59
2026	1,379.83
2027	1,631.71
2028	1,821.30
2029	2,153.27
2030	1,302.29
2031	1,820.08
2032	903.43
2033	2,425.90
Project Construction Total:	38,112
Project Sequestration Total:	44,000,000
Net Reduction:	43,961,888

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TABLE 4.18-2 ESTIMATED PROJECT OPERATION CO₂e EMISSIONS

Source	CO ₂ e (tonnes)
Stationary	46,281
Indirect (Electric Power)	180,177
Mobile Source	340
Annual Total	226,798
Project Operation Total (2016-2033):	4,082,364
Project Net Sequestration After Subtraction of Construction Emissions:	43,961,888
Net Reduction:	39,879,524

As shown above, construction and operation of the proposed EOR facilities could result in an estimated total of 38,112 and 4,082,364 tonnes of CO₂e emissions respectively, for a combined total of approximately 4.12 million tonnes of CO₂e emissions over a 20-year Project lifespan. The above estimates of CO₂e emissions do not consider CO₂e emissions from the HECA project. For purposes of this analysis, operational CO₂e emissions for the entire Project were assumed to begin in 2016 and occur throughout the Project lifespan. Of the total estimated Project CO₂e emissions, Table 4.18-2 shows that approximately 79 percent would be from indirect sources (e.g., consumption of electric power not generated as part of the Project).

The proposed Project involves the use of CO₂ (produced by the gasification process at the proposed HECA facility). Through CO₂ EOR it is estimated that the Project will ultimately sequester approximately 44 million tonnes of CO₂e (over 2 million tonnes of CO₂ each year) delivered by HECA. As a result, compared to the case in which CO₂ generated through the HECA gasification process is vented to the atmosphere, over the life of the combined HECA and CO₂ EOR projects, a net reduction of approximately 39.88 million tonnes of CO₂e emissions will be achieved.

Based upon the foregoing, the Project will not result in emissions that trigger PSD permitting requirements or exceed applicable state or local significance thresholds. The Project will achieve more than a 29% reduction in greenhouse gas emissions from BAU and will have a less than significant impact on greenhouse gas emissions.

4.18 GREENHOUSE GAS EMISSIONS

Mitigation Measures

No mitigation measures are necessary.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT GHG-2 Conflicts with any Applicable Plan, Policy or Regulation of an Agency Adopted for the Purpose of Reducing the Emissions of Greenhouse Gases

SJVAPCD has adopted a Climate Change Action Plan and associated implementation guidance including requiring BPS for new projects in the air basin. There are no other plans, policies or regulations applicable to the Project. As mentioned in IMPACT GHG-1, under the SJVAPCD plan and guidance, the Project will result in a net reduction of approximately 39.88 million tonnes of CO₂e. This reduction exceeds the 29% reduction from BAU set forth in the SJVAPCD guidance. In addition, the EHOE will be subject to the provisions of AB 32, including any applicable regulations from the Scoping Plan and the CARB cap-and-trade regulation that will require greenhouse gas emissions to be reduced beginning in 2012. Therefore the proposed Project will have a less than significant impact on green house gas emissions.

Mitigation Measures

No mitigation measures are necessary.

Level of Significance after Mitigation

Impacts would be less than significant.

4.18.5 Cumulative Impacts

The Project is estimated to generate approximately 4.12 million tonnes of CO₂e emissions over a 20 year period, but will involve the sequestration of approximately 44 million tonnes of greenhouse gases in the form of CO₂e. There will be a net reduction of approximately 39.88 million tonnes of CO₂ from what would otherwise be emitted. This is considered a less than significant impact and therefore, the Project is not expected to result in cumulatively significant emissions of greenhouse gases or impacts to global climate change.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

5.0 CONSEQUENCES OF PROJECT IMPLEMENTATION

5.0 Consequences of Project Implementation

5.0.1 Environmental Effects found to be Less Than Significant

Upon assessment and environmental review in this SEI, impacts in the following areas would be less than significant or could be reduced to less than significant levels with mitigation measures:

Aesthetics;

Agricultural resources;

Air quality;

Biological resources;

Cultural and paleontological resources;

Geology and soils;

Hazards and hazardous materials;

Hydrology and water quality;

Land use and planning;

Mineral resources;

Noise;

Population and housing;

Public services;

Recreation;

Transportation and traffic;

Utilities and service systems;

Environmental justice; and

Greenhouse gas emissions.

5.0 CONSEQUENCES OF PROJECT IMPLEMENTATION

5.0.2 Significant Environmental Effects

Impacts in the following areas would be significant, even with the incorporation of feasible mitigation measures that attempt to reduce impacts to less than significant levels:

None.

5.1 Significant Cumulative Impacts

This SEI has considered the potential cumulative effects of the proposed Project. Impacts for the following have been found to be cumulatively considerable:

None.

5.2 Growth Inducement

This subsection has been prepared to address whether or not construction of the proposed Project is likely to foster additional growth, either directly or indirectly. This information can be an important factor in a decision to approve a project because such approval can, in turn, lead to additional projects that may have environmental consequences.

The fact that a project may result in additional growth does not imply that such growth is either detrimental or beneficial. For example, a project that furthers growth consistent with the adopted goals and policies of a County's General Plan would likely be considered beneficial. Conversely, a project that fosters growth that would conflict with such goals and policies would likely be considered detrimental.

The Kern County General Plan recognizes that certain forms of growth are beneficial, both economically and socially. Section 15126.2 [d] of the State CEQA Guidelines provides the following guidance on growth-inducing impacts: a project is identified as growth inducing if it "could foster economic or population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment."

In general, a project may foster spatial, economic, or population growth in a geographic area if it meets any one of the criteria identified below:

The project removes an impediment to growth (e.g., the establishment of an essential public service, or the provision of new access to an area)

Project Evaluation. The Project is limited to utilizing CO₂ for enhanced oil recovery and will not remove an impediment to growth, nor will it establish an essential public service or provide new access to an area that has the potential to induce growth. This is a less than significant impact.

The project results in the urbanization of land in a remote location (leapfrog development)

5.0 CONSEQUENCES OF PROJECT IMPLEMENTATION

Project Evaluation. The Project is limited to utilizing CO2 for enhanced oil recovery and does not include urbanization of land. This is a less than significant impact.

The project establishes a precedent-setting action (e.g., a change in zoning or general plan amendment approval)

Project Evaluation. The Project is limited to utilizing CO2 for enhanced oil recovery and does not include a component that requires a change in zoning or general plan amendment. This is a less than significant impact.

Economic expansion or growth occurs in an area in response to the project (e.g., changes in revenue base, employment expansion, etc.)

Project Evaluation. The Project is limited to utilizing CO2 for enhanced oil recovery at an active oil field. Although the Project will result in economic benefits, these benefits will not result in economic expansion or growth which has the potential to induce growth which could result in significant environmental impacts. This is a less than significant impact.

5.3 Precedent-Setting Action

Changes from a project that could be precedent-setting include (among others) a change in zoning, General Plan amendments, or approval of exceptions to regulations that could have implications for other properties or that could make it easier for other properties to develop.

The Project does not include a component that requires a change in zoning or General Plan amendment. The project will comply with all applicable rules and regulations and will not require approval or exceptions to regulations. The proposed Project is consistent with the goals and policies of the Kern County General Plan.

CO2 EOR and sequestration is a proven technology that can have both economic and environmental benefits. It has been demonstrated through study that the EHOF and specifically the Stevens Reservoirs, are extremely suitable for utilizing CO2 EOR and sequestering CO2. Implementation of the Project is not expected to result in a precedent setting action that would make it easier to develop other properties which could induce growth, conflict with established policies and plans, or lead to exceptions to regulations. As such, the Project will not result in a precedent setting action.

6.0 ALTERNATIVES TO THE PROJECT

6.0 Alternatives to the Project

6.1 Introduction

The California Environmental Quality Act (Public Resources Code, Section 21000 *et seq.*) (CEQA) and the State CEQA Guidelines (California Code of Regulations, Title 14, Section 15000 *et seq.*) require that an environmental impact report (EIR) “describe a range of reasonable alternatives to the proposed Project, or to the location of the proposed Project, which would feasibly attain most of the basic objectives of the proposed Project, but would avoid or substantially lessen any of the significant effects of the proposed Project, and evaluate the comparative merits of the alternatives” (CEQA Guidelines Section 15126.6(a)). If a project alternative would substantially lessen the significant environmental effects of a proposed Project, the decision maker should not approve the proposed Project unless it determines that specific technological, economic, social, or other considerations make the project alternatives infeasible (PRC Section 21002, CEQA Guidelines Section 15091(a)(3)). The EIR must also identify alternatives that were considered by the lead agency but were rejected as infeasible during the scoping process and should briefly explain the reasons underlying the lead agency’s determination (CEQA Guidelines Section 15126.6(c)).

One of the alternatives analyzed must be the “No Project” alternative. The “No Project” analysis must discuss the existing conditions, as well as what would be reasonably expected to occur in the foreseeable future if the Project were not approved and development continued to occur in accordance with existing plans and consistent with available infrastructure and community services (CEQA Guidelines Section 15126.6(e)(2)). As oil recovery operations would continue to occur within the EHOF but without utilizing CO₂ from the HECA Project, the “No Project” alternative evaluates continuation of the existing oil recovery operations.

6.2 Alternatives Considered but Determined to be Infeasible

During the Pre-FEED stage of the Project, OEHI developed a range of alternatives that were considered, but were determined to be infeasible and therefore were not considered further in this alternatives evaluation. Each of these alternatives with a brief discussion on why they were eliminated from further consideration is presented below.

6.2.1 Reduced Project Scale

OEHI considered a reduced Project scale that would minimize CO₂ EOR processing facilities (including satellite stations), injection and production wells, and pipeline linears. A reduced Project scale does have the potential to reduce potential environmental impacts. However, the proposed Project has been designed to utilize and mitigate for the total volume of CO₂ generated by the HECA Project. Reducing the Project scale would not allow OEHI to utilize and mitigate for the total volume

6.0 ALTERNATIVES TO THE PROJECT

of CO2 generated by the HECA Project. A reduced Project scale would not meet the critical Project objectives and has therefore not been considered further within this SEI.

6.2.2 Alternative Project Locations

Alternative Oil Field

Alternative oil field locations for CO2 EOR and sequestration were evaluated in HECA's Application for Certification with the CEC. HECA evaluated CO2 EOR and sequestration in oil fields in the well-studied Ventura Basin and southern end of the San Joaquin Basin due to their sequestration and EOR potential. The study evaluated capacity, containment, and other specific criteria generally deemed important by current industry and scientific standards in sequestration (depth, pressure, lithology, porosity & permeability, structural integrity, and storage capacity) and deemed necessary to satisfy HECA Project objectives. This study identified the EHOF and Ventura Oil Field as meeting these key factors. The EHOF was determined to be the preferred field due to its closer proximity to the HECA Project Site, shorter CO2 supply line length, results of previous CO2 pilot studies, and decreased construction time and requirements (URS, 2009). As implementation of the Project within the EHOF can reasonably be expected to result in less environmental impacts compared to Project implementation at another oil field, alternative oil field locations were not considered further within this SEI.

Alternative Reservoir within Elk Hills Oil Field

Alternative reservoirs within the EHOF for CO2 EOR and sequestration were evaluated in HECA's Application for Certification with the CEC. Characteristics of the Stevens reservoirs indicate they are ideal candidates for miscible-CO2 EOR. CO2 EOR in the targeted CO2 injection zones of the Stevens reservoirs has the potential to significantly increase oil reserves and extend the productive life of the EHOF. There is adequate capacity within the Stevens reservoirs to support the volume of CO2 that will be generated by the HECA Project (URS, 2009). Use of another reservoir within the EHOF will not meet the Project objectives and is not expected to reduce potential environmental impacts compared to the proposed Project. Considering the above, alternative reservoirs within the EHOF were not considered further within this SEI.

Alternative Project Layout within the Stevens Reservoirs

OEHI evaluated a range of Project component siting options within the Stevens reservoirs during the Pre-FEED stage of the Project. The proposed Project layout has been designed to reduce potential environmental impacts to the maximum extent possible. This includes the following measures incorporated into the Project design to minimize disturbances:

- Use of existing wells and well pads (approximately 80% of required Project wells are anticipated to use existing wells);
- Siting of facilities to reduce length of necessary supporting pipelines;

6.0 ALTERNATIVES TO THE PROJECT

- Pipelines installed in previously disturbed corridors to the extent feasible;
- Typical with current operations, pipelines with lower hazards installed above-ground (reduces surface disturbance); and
- Buried pipelines installed within multi-line right of ways when possible (reduces land disturbance).

Alternative site layouts within the Stevens reservoirs would likely result in increased disturbances and potential environmental impacts compared to the proposed layout. Considering the above, alternative Project layouts within the Stevens reservoirs were not considered further within this SEI.

6.3 Alternatives Analyzed within SEI

As discussed in Section 6.2, OEHI considered a range of Project alternatives during the Pre-FEED stage of the proposed Project. None of the alternatives considered were determined to be feasible or would not decrease potential significant environmental impacts and have therefore not been analyzed further within this SEI. As such, this alternatives evaluation focuses on an analysis of the potential environmental impacts of the “No Project” alternative.

6.4 Comparison of Proposed Project to No Project

Table 6-1 below provides a comparative summary of the potential environmental impacts that could result from the Proposed Project and the No Project alternative. A discussion to support the determination for each impact determination for the No Project alternative is provided in Section 6.5.

6.0 ALTERNATIVES TO THE PROJECT

TABLE 6-1: SUMMARY COMPARISON OF ENVIRONMENTAL IMPACTS OF PROJECT AND PROJECT ALTERNATIVES

	Proposed Project (CO2 EOR and Sequestration)	No-Project Alternative (Continued Oil Field Production and Use)
Extent to Which Project Objectives Satisfied	Total	None
<i>Aesthetics Impacts</i>	Significant but Mitigable	Less than Significant
<i>Agriculture Impacts</i>	No Impact	No Impact
<i>Air Quality Impacts</i>	Significant but Mitigable	Significant but Mitigable
<i>Biological Resources Impacts</i>	Significant but Mitigable	Significant but Mitigable
<i>Cultural and Paleontological Resources Impacts</i>	Significant but Mitigable	Significant but Mitigable
<i>Geology / Soils Impacts</i>	Significant but Mitigable	Significant but Mitigable
<i>Greenhouse Gases Impacts</i>	Less than Significant	Significant but Mitigable
<i>Hazards / Hazardous Materials Impacts</i>	Less than Significant	Less than Significant
<i>Hydrogeology and Water Quality Impacts</i>	Less than Significant	Less than Significant
<i>Land Use / Planning Impacts</i>	Less than Significant	Less than Significant
<i>Mineral Resources Impacts</i>	Less than Significant	Less than Significant
<i>Noise Impacts</i>	Less than Significant	Less than Significant
<i>Population and Housing Impacts</i>	Less than Significant	Less than Significant
<i>Public Services Impacts</i>	Less than Significant	Less than Significant
<i>Environmental Justice Impacts</i>	Significant but Mitigable	Less than Significant
<i>Recreation Impacts</i>	Less than Significant	Less than Significant
<i>Transportation / Traffic Impacts</i>	Significant but Mitigable	Less than Significant
<i>Utilities and Service Systems Impacts</i>	Less than Significant	Less than Significant

6.5 No Project Alternative:

CEQA, through case law and statutory language, requires that a “No Project” alternative be evaluated. Under State CEQA Guidelines Section 15126.6(e)(2), “the No Project alternative shall discuss the existing conditions at the time the notice of preparation is published . . . as well as what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services” [14 CCR 15126.6(e)(2)].

The purpose of the No Project alternative is to allow comparison of the impacts of the proposed Project with the impacts of a continuation of baseline conditions. The No Project alternative assumes that existing oil recovery operations occur without the use of CO2 EOR for a 20 year period (the proposed lifespan of the CO2 EOR Project). Ongoing operations include installation of wells,

6.0 ALTERNATIVES TO THE PROJECT

pipelines, access roads and other infrastructure within and outside the current area of operation. As discussed in section 3.2 Project Description Addendum, over the life of the proposed Project approximately 150 new wells would be needed for CO2 EOR. Under the No Project alternative over the same period of time, approximately 137 new wells would be required. The impacts of the No Project alternative were evaluated in the Supplemental Environmental Impact Statement/Program Environmental Impact Report (SEIS/PEIR) prepared for the sale of Naval Petroleum Reserve-1 (NPR-1)(Department of Energy [DOE], 1997).

6.5.1 Environmental Impact of the No Project Alternative

Aesthetics

NPR-1 (also referred to as the “Elk Hills”), was created by an Executive Order issued by President William Howard Taft in 1912. Development of Elk Hills began in 1973, with full production beginning in 1976. Considering that the No Project alternative is limited to oil recovery within an active oil field, visual impacts are anticipated to be less than significant.

Agriculture

The EHOE is primarily zoned for agricultural use (A and A-1). However the A and A-1 zoning designations allow for oil exploration and production. The EHOE does not contain any lands under Williamson Act Contract or other important farmland designations. The No Project alternative would not impact or impede agriculture production in the area. No impact to agricultural resources would result.

Air Quality

The continuation of existing oil recovery operations within the EHOE will result in both construction-related and operation-related emissions of criteria air pollutants which have the potential to result in significant air quality impacts. This is a potentially significant impact. However, it is expected that the significance of these emissions can be mitigated to a less than significant level through compliance with applicable San Joaquin Valley Air Pollution Control District (SJVAPCD) rules and regulations, emissions reduction requirements imposed by the SJVAPCD through permitting requirements for stationary sources, and utilization of emissions reduction credits to offset emissions.

Biological Resources

The EHOE contains important and some critical habitat for federally and State of California threatened and/or endangered species. Continuation of existing oil recovery operations has the potential to impact these special status species, especially as a result of new ground disturbances that are common to sustain production in a maturing oil field. This is a potentially significant impact. However, it is expected that the significance of these impacts can be mitigated to a less than significant level through implementation of OEHI’s Habitat Conservation Plan (HCP) and associated mitigation measures.

6.0 ALTERNATIVES TO THE PROJECT

Cultural and Paleontological Resources

The EHOFF contains important cultural and paleontological areas. Continuation of existing oil recovery operations has the potential to impact these special status areas. This is a potentially significant impact. However, it is expected that the significance of these impacts can be mitigated to a less than significant level by avoiding known cultural/paleontological resource areas to the maximum extent possible and incorporating best management practices (BMPs) for minimizing potential impacts to such resources.

Geology and Soils

Continuation of existing oil recovery operations within the EHOFF will require the installation of new oil producing wells, pipelines, and other oil field support equipment that will cause ground disturbances. These disturbances have the potential to result in significant soil erosion-related impacts due to wind. However, it is anticipated that these impacts can be mitigated to a less than significant level by incorporating BMPs into the design, construction, and operation of oil recovery operations.

Greenhouse Gases

As discussed in Section 4.3 (Air Quality), as part of its CEQA review of new projects, the SJVAPCD evaluates the potential significance of a project's greenhouse gas emissions based on the implementation of Best Performance Standards (BPS) or whether the project's stationary source greenhouse gas emissions have been reduced by 29 percent from a business as usual baseline, consistent with projected emission reductions in the CARB AB32 Scoping Plan. Projects that implement either the applicable BPS or can otherwise demonstrate at least a 29 percent reduction in greenhouse gas emissions for stationary sources are determined to have a less than significant individual and cumulative greenhouse gas emissions impact. Although potentially significant, it is expected that this impact could be mitigated to a less than significant level.

Hazards and Hazardous Materials

Oil recovery operations within the EHOFF involve the use of hazardous materials and the generation of hazardous waste. These materials are generally limited to use away from public areas and present a less than significant hazard to the public. Spills and releases of hazardous materials do however have the potential to significantly impact health and the environment. Adherence to OEHI's hazardous materials handling practices that comply with applicable regulations is expected to reduce the potential for releases to occur. Implementation of OEHI's spill response plan is expected to minimize and remediate impacts from potential releases of hazardous materials to a less than significant level.

6.0 ALTERNATIVES TO THE PROJECT

Hydrology and Water Quality

Potential water quality impacts from existing oil recovery operations are generally limited to polluted storm water runoff or the introduction of hazardous materials into waterways. The project area is located within an unnamed basin where several ephemeral washes flow across alluvial sediments and terminate at various points north of the OEHI operations. Per the Occidental of Elk Hills Construction General Permit Compliance Plan (Compliance Plan), this area has no common water conveyance connections that can be defined between various channels. The Compliance Plan finds that the ephemeral washes are non-jurisdictional according to the analysis method provided by the US Environmental Protection Agency and the US Army Corps of Engineers. Considering the above, potential impacts of the No Project alternative to hydrology and water quality are less than significant.

Land Use and Planning

The EHOE is primarily zoned for agricultural use that allows for oil exploration and production activities. The continuation of oil field recovery operations will not require any zoning change or conflict with any applicable plan. Therefore, the No Project alternative will have less than significant impacts on land use and planning.

Mineral Resources

As noted above in Land Use and Planning, the EHOE is primarily zoned for agricultural use that allows for oil exploration and production. There are no active mines or other known economically important mineral deposits near the EHOE. The No Project alternative would have a less than significant impact on mineral resources.

Noise

Oil recovery operations within the EHOE create noise from a variety of point sources. However, noises generated from standard oil field procedures are not located in close proximity and are buffered from sensitive receptors such as the town of Tupman. The No Project alternative is expected to have a less than significant noise impact.

Population and Housing

Continuation of existing oil recovery operations is not expected to result in substantial population growth, divide a community, or displace residents. Therefore, the No Project alternative is expected to have a less than significant population and housing impact.

Public Services

Continuation of existing oil recovery operations is not expected to result in a substantial increase in demand for public services that would exceed service capacities or require the construction of new

6.0 ALTERNATIVES TO THE PROJECT

public service facilities which could cause significant impacts. Therefore, the No Project alternative is expected to have a less than significant impact on public services.

Environmental Justice

Existing oil field recovery operations do not disproportionately impact environmental justice communities. Continuation of these operations is not expected to modify the racial makeup or income level demographics in the neighboring areas or result in substantially higher magnitude environmental impacts than which occur under current baseline conditions. Therefore, the No Project alternative is expected to have a less than significant environmental justice impact.

Recreation

Continued oil recovery operations within the EHOF does not include the construction of recreational facilities nor is it expected to substantially increase demand for use of recreational facilities. Therefore, the No Project alternative is expected to have a less than significant recreation impact.

Transportation and Traffic

Continuation of existing oil recovery operations is not expected to result in a substantial increase in vehicle trips compared to those that occur under current baseline conditions. Therefore, the No Project alternative is expected to have a less than significant transportation and traffic impact.

Utilities and Service Systems

Continuation of existing oil recovery operations is not expected to result in a substantial increase in demand for utilities and service systems beyond typical use associated with current baseline conditions. An increase in demand that would require the construction of new utility service systems which could cause significant impacts is also not anticipated. Therefore, the No Project alternative is expected to have a less than significant impact on utilities and service systems.

Comparison to Project Objectives

Implementation of the No Project alternative will result in the continuation of existing oil recovery operations within the EHOF. As discussed in section 3.2 Project Description Addendum, over the life of the proposed Project approximately 150 new wells would be needed for CO2 EOR. Under the No Project alternative over the same period of time, approximately 137 new wells would be required resulting in a similar, but slightly reduced area of disturbance. However, under either the proposed Project or the No Project alternative, impacts to biological, cultural, and paleontological resources would be mitigated to a less than significant level by compliance with the OEHI's HCP and BMPs. Ongoing operations are not subject to analysis pursuant to SJVAPCD CEQA guidance and so there would be no requirement to reduce greenhouse gas emissions by implementation of BPS or by 29 percent. Also, without the HECA Project, electricity would continue to be generated at power plants that are not required to capture their greenhouse gas emissions and there would be no demonstration

6.0 ALTERNATIVES TO THE PROJECT

of carbon capture and sequestration as a method of reducing greenhouse gas emissions. Accordingly, the No Project alternative would not result in the appreciable reduction in identified impacts compared to the Proposed Project.

The No Project alternative would not meet any of the Project objectives (Section 1.5) to enhance and maximize oil production of the Elk Hills Unit while providing a mechanism to mitigate CO2 emission impacts from the nearby HECA Project.

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APPENDICES

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APPENDIX A AIR EMISSIONS DATA

APPENDICES

OPERATIONAL PHASE CRITERIA POLLUTANT EMISSIONS

Total Operational Emissions from
The Occidental of Elk Hills, Inc. CO2 EOR Project

Annual Emissions (Lb/Year)

Process Equipment	NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	PM2.5 Lb/Year	SOx Lb/Year
Stationary Source Activities	14,399.57	45,265.98	63,958.45	5,805.67	5,753.07	2,107.99
Mobile Source Activities	234.55	67.01	1,954.77	42.61	42.61	4.38
Total Operational Emissions	14,634.12	45,332.99	65,913.22	5,848.28	5,795.68	2,112.37

Permitted Emissions of
Criteria Pollutants From Stationary Source Equipment

Criteria Pollutant Emissions From Combustion Equipment (Lb/Year)						
Process Equipment	NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	PM2.5 Lb/Year	SOx Lb/Year
Injection Heater	4,465.46	2,862.33	19,415.03	3,994.56	3,994.56	1,472.27
Mol-Sieve Heater	744.24	480.75	3,235.84	665.76	665.76	245.38
TEG Heater	1,594.81	240.38	6,471.68	332.88	332.88	122.69
NRU Heater	212.64	92.45	1,294.34	66.58	66.58	24.53
CTB - Emergency Engine	11.46	0.29	5.52	0.51	0.51	0.02
RCF - Emergency Engine	11.46	0.29	5.52	0.51	0.51	0.02
CTB - Emergency Flare	-----	-----	-----	-----	-----	-----
RCF - Emergency Flare	-----	-----	-----	-----	-----	-----
Total Combustion Emissions	7,040.06	3,676.49	30,427.92	5,060.80	5,060.80	1,864.91
Fugitive VOC Emissions From CO2 EOR Process Equipment						
Emissions From Process Components	VOC Lb/Year	Calculated using EPA Average Leak Rate Equations				
Central Tank Battery	1,966.11	Fugitive VOC for a 500 ppmv leak, with 0.0010 Leak Fraction				
Reinjection Compression Facility	4,478.48	Fugitive VOC for a 500 ppmv leak, with 0.0010 Leak Fraction				
Carbon Dioxide Recovery Plant	13,039.04	Fugitive VOC for a 500 ppmv leak, with 0.0010 Leak Fraction				
Total Fugitive VOC Emissions	19,483.64	Fugitive VOC for a 500 ppmv leak, with 0.0010 Leak Fraction				
VOC Emissions From Uncontrolled Fixed Roof Tanks						
Emissions From Fixed Roof Tanks	VOC Lb/Year	Calculated using EPA AP42 Tanks 4.09d				
CTB - Open Drain Sump Tank	64.60	1,500 Gallon, TVP < 1.5 psia, one turnover per week				
RCF - Open Drain Sump Tank	64.60	1,500 Gallon, TVP < 1.5 psia, one turnover per week				
CRP - Open Drain Sump Tank	64.60	1,500 Gallon, TVP < 1.5 psia, one turnover per week				
Common Open Drain Sump Tank	193.34	3,100 Gallon, TVP < 1.5 psia, three turnovers per week				
Miscellaneous Organic Liquid Storage Tank	1,009.27	500 Bbl, TVP < 1.5 psia, one turnover per week				
Miscellaneous Organic Liquid Storage Tank	1,009.27	500 Bbl, TVP < 1.5 psia, one turnover per week				
Miscellaneous Organic Liquid Storage Tank	1,009.27	500 Bbl, TVP < 1.5 psia, one turnover per week				
Total VOC Emissions from Tanks	3,414.95	Total Emission from Organic Liquid Storage Tanks				

Operational Emissions of Criteria Pollutants From Stationary Source
Activities Not Accounted For in Permitted Emissions, and Emissions From Mobile Sources

Annual Emissions (Lb/Year)

Process Equipment	NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	PM2.5 Lb/Year	SOx Lb/Year
Stationary Source Activities	5,816.05	18,290.40	31,646.18	684.24	684.24	239.48
Employee Travel To Plants	140.78	57.27	1,863.79	36.85	36.85	3.70
Max. Well Maintenance	1,543.45	400.50	1,884.35	60.62	8.02	3.593
Max. Travel to Well Sites	93.77	9.74	90.99	5.76	5.76	0.676
Total Emissions	7,594.06	18,757.92	35,485.30	787.48	734.88	247.46

1. Operational emissions not included in the "permitted emissions" include emission from emergency flaring due to power outages (7.47 hours per year). It also includes fugitive VOC emissions from production activities on new wells, and gas injection systems and gathering systems that are not otherwise subject to SJVAPCD permit requirements
2. Fugitive dust emissions are not included as operational emissions because travel on unpaved roads is not required and fugitive dust from travel on paved roads will not increase as a result of the project. Such travel already occurs and is required the operation of existing equipment. Windblown dust from the facility and satellite settings will be eliminated by paving or
3. Mobile source emissions were calculated using EMFAC2007 and include employee travel (25 full time employees) to and from the facility. The emissions were calculated using 50 one way trips per day with a travel distance of 30 miles per vehicle trip (i.e. 1500 VMT per day). The travel distance used in the calculations is the approximate distance from the Elk Hill Facility to Bakersfield, Ca.
4. Emissions from well maintenance activities were calculated from fuel use and emission factors from CARB OFFROAD2007. The reported emissions are the maximum annual emissions expected to occur in year 2034. The calculations are based on the assumption that each well will undergo maintenance annually.
5. Emission from mobile well workover rig and employee travel to and from the well sites was calculated using EMFAC2007. The emissions are estimated assuming 4 vehicle trips per well maintenance event. A trip length of 30 miles was used in The travel distance used in the calculations is the approximate distance from the Elk Hill Oilfield to Bakersfield, Ca. The reported emissions are the maximum annual emissions expected to occur in year 2034.

Permitted Emissions of
Criteria Pollutants From Stationary Source Equipment

Maximum Daily Emissions (Lb/Day)

Process Equipment	NOx Lb/Day	VOC Lb/Day	CO Lb/Day	PM10 Lb/Day	PM2.5 Lb/MMBtu	SOx Lb/Day
Injection Heater	12.23	7.84	53.19	10.94	10.94	4.03
Mol-Sieve Heater	2.04	1.32	8.87	1.82	1.82	0.67
TEG Heater	4.37	0.66	17.73	0.91	0.91	0.34
NRU Heater	0.58	0.25	3.55	0.18	0.18	0.07
CTB - Emergency Engine	22.92	0.57	11.05	1.03	1.03	0.05
RCF - Emergency Engine	22.92	0.57	11.05	1.03	1.03	0.05
CTB - Emergency Flare	4,662.00	4,315.50	25,345.00	548.00	548.00	191.80
RCF - Emergency Flare	4,662.00	4,319.20	25,366.74	548.47	548.47	191.96
Fugitive Emissions (VOC)	-----	53.38	-----	-----	-----	-----
Tank Emissions (VOC)	-----	9.36	-----	-----	-----	-----
Total Maximum Emissions	9,389.05	8,708.66	50,817.16	1,112.39	1,112.39	388.97

Annual Permitted Emissions (Lb/Year)

Process Equipment	NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	PM2.5 Lb/Year	SOx Lb/Year
Injection Heater	4,465.46	2,862.33	19,415.03	3,994.56	3,994.56	1,472.27
Mol-Sieve Heater	744.24	480.75	3,235.84	665.76	665.76	245.38
TEG Heater	1,594.81	240.38	6,471.68	332.88	332.88	122.69
NRU Heater	212.64	92.45	1,294.34	66.58	66.58	24.53
CTB - Emergency Engine	11.46	0.29	5.52	0.51	0.51	0.02
RCF - Emergency Engine	11.46	0.29	5.52	0.51	0.51	0.02
CTB - Emergency Flare	-----	-----	-----	-----	-----	-----
RCF - Emergency Flare	-----	-----	-----	-----	-----	-----
Fugitive Emissions (VOC)	-----	19,483.64	-----	-----	-----	-----
Tank Emissions (VOC)	-----	3,414.95	-----	-----	-----	-----
Total Maximum Emissions	7,040.06	26,575.07	30,427.92	5,060.80	5,060.80	1,864.91

Annual Emissions (Ton/Year)

Process Equipment	NOx Ton/Year	VOC Ton/Year	CO Ton/Year	PM10 Ton/Year	PM2.5 Ton/Year	SOx Ton/Year
Annual Emissions	3.52	13.29	15.21	2.53	2.53	0.93
Worst Case Offset	1.50	1.50	1.50	1.50	-----	1.50
ERC Required	5.28	19.93	22.82	3.80	-----	1.40
ERC Value \$/Ton	65,000.00	35,000.00	15,000.00	40,000.00	-----	40,000.00
ERC Cost	343,203.05	697,595.66	342,314.14	151,824.11	-----	55,947.31

Total Cost	1,590,884.27

1. Flare emissions are calculated for purge gas and pilot gas only. Emergency use only equipment is exempt from offsets.
2. Fugitive VOC emissions have been estimated using EPA Average leak Rate Equations. All TOG is assumed to be VOC
3. The emissions from fixed roof tanks have been calculated using EPA AP42 Tanks 4.09d. All TOG is assumed to be VOC
4. It is assumed that the facility would include a two emergency use only diesel engine (Tier-3, 175 Bhp, 12 hour/year each).
- 5.. ERC are calculated using a worst case distance offset ratio. It is also assumed that PM emissions will be offset using SOx.

Emissions From a 60 MMBtu/Hr CO2 Injection Heater With Ultra Low NOx Burner

Process Emission Factors for Heater or Boiler
Natural Gas As Fuel (Total Sulfur Content 1 grain per 100 SDCF)

CO2 Injection Heater MMBtu/Hr Rating	Emission Factors	NOx	VOC	CO	PM10	PM2.5	SOx
60.0000	Conc. (ppm 3% O2)	7	13	50	-----	-----	1.7
	Lb/MMBtu	0.0085	0.0054	0.0369	0.0076	0.0076	0.0028

Maximum Daily Emissions
(100% of Rated Heat Input, Full Time Operation)

Process Heater or Boiler	Operating Hr/Day	NOx Lb/Day	VOC Lb/Day	CO Lb/Day	PM10 Lb/Day	PM2.5 Lb/MMBtu	SOx Lb/Day
	24.00	12.23	7.84	53.19	10.94	10.94	4.03

Annual Emissions
(100% of Rated Heat Input, Full Time Operation)

Process Heater or Boiler	Operating Hr/Year	NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	PM2.5 Lb/Year	SOx Lb/Year
	8,760.00	4,465.46	2,862.33	19,415.03	3,994.56	3,994.56	1,472.27

Calculation Assumptions and Notes

Note:

1. Emissions from the process heater have been calculated using the listed process emission factors (Lb/MMBtu). The concentrations are calculated using EPA F-Factors (8710, 68F, Dry) corrected for temperature (60F) and excess oxygen (3% O2).
2. The concentration of VOC has been calculated from the EPA AP42 default value using a molecular weight of 16 (i.e. as methane).
3. The SOx concentration is equivalent to 1 grain of total sulfur / 100 SDCF of fuel (HHV 1020) or about 17 ppmv total S in the fuel gas.

Emissions From a 10 MMBtu/Hr Mol-Sieve Heater With Ultra Low NOx Burner

Process Emission Factors for Heater or Boiler
Natural Gas As Fuel (Total Sulfur Content 1 grain per 100 SDCF)

Mol Sieve Heater MMBtu/Hr Rating	Emission Factors	NOx	VOC	CO	PM10	PM2.5	SOx
	Conc. (ppm 3% O2)						
10.0000	Lb/MMBtu	0.0085	0.0055	0.0369	0.0076	0.0076	0.0028

Maximum Daily Emissions
(100% of Rated Heat Input, Full Time Operation)

Process Heater or Boiler	Operating Hr/Day	NOx Lb/Day	VOC Lb/Day	CO Lb/Day	PM10 Lb/Day	PM2.5 Lb/MMBtu	SOx Lb/Day
	24.00	2.04	1.32	8.87	1.82	1.82	0.67

Annual Emissions
(100% of Rated Heat Input, Full Time Operation)

Process Heater or Boiler	Operating Hr/Year	NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	PM2.5 Lb/Year	SOx Lb/Year
	8,760.00	744.24	480.75	3,235.84	665.76	665.76	245.38

Calculation Assumptions and Notes

Note:

- Emissions from the process heater have been calculated using the listed process emission factors (Lb/MMBtu). The concentrations are calculated using EPA F-Factors (8710, 68F, Dry) corrected for temperature (60F) and excess oxygen (3% O2).
- The concentration of VOC has been calculated from the EPA AP42 default value using a molecular weight of 16 (i.e. as methane).
- The SOx concentration is equivalent to 1 grain of total sulfur / 100 SDCF of fuel (HHV 1020) or about 17 ppmv total S in the fuel gas.

Emissions 5 MMBtu/Hr Glycol Reboiler With Low NOx Burner

Process Emission Factors for O2 Heater
Natural Gas As Fuel (Total Sulfur Content 1 grain per 100 SDCF)

TEG Reboiler MMBtu/Hr Rating	Emission Factors	NOx	VOC	CO	PM10	PM2.5	SOx
5.0000	Conc. (ppm 3% O2)	30	13	200	-----	-----	1.7
	Lb/MMBtu	0.0364	0.0055	0.1478	0.0076	0.0076	0.0028

Maximum Daily Emissions
(100% of Rated Heat Input, Full Time Operation)

O2 Heater	Operating Hr/Day	NOx Lb/Day	VOC Lb/Day	CO Lb/Day	PM10 Lb/Day	PM2.5 Lb/MMBtu	SOx Lb/Day
	24.00	4.37	0.66	17.73	0.91	0.91	0.34

Annual Emissions
(100% of Rated Heat Input, Full Time Operation)

O2 Heater	Operating Hr/Year	NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	PM2.5 Lb/Year	SOx Lb/Year
	8,760.00	1,594.81	240.38	6,471.68	332.88	332.88	122.69

Calculation Assumptions and Notes

Note:

1. Emissions from the process heater have been calculated using the listed process emission factors (Lb/MMBtu). The concentrations are calculated using EPA F-Factors (8710, 68F, Dry) corrected for temperature (60F) and excess oxygen (3% O2).
2. The concentration of VOC has been calculated from the EPA AP42 default value using a molecular weight of 16 (i.e. as methane).
3. The SOx concentration is equivalent to 1 grain of total sulfur / 100 SDCF of fuel (HHV 1020) or about 17 ppmv total S in the fuel gas.

Emissions 2 MMBtu/Hr NRU Heater With Standard Burner

Process Emission Factors for O2 Heater
Natural Gas As Fuel (Total Sulfur Content 1 grain per 100 SDCF)

NRU Heater MMBtu/Hr Rating	Emission Factors	NOx	VOC	CO	PM10	PM2.5	SOx
	Conc. (ppm 3% O2)						
1.0000	Lb/MMBtu	0.0243	0.0106	0.1478	0.0076	0.0076	0.0028

Maximum Daily Emissions
(100% of Rated Heat Input, Full Time Operation)

O2 Heater	Operating Hr/Day	NOx Lb/Day	VOC Lb/Day	CO Lb/Day	PM10 Lb/Day	PM2.5 Lb/MMBtu	SOx Lb/Day
	24.00	0.58	0.25	3.55	0.18	0.18	0.07

Annual Emissions
(100% of Rated Heat Input, Full Time Operation)

O2 Heater	Operating Hr/Year	NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	PM2.5 Lb/Year	SOx Lb/Year
	8,760.00	212.64	92.45	1,294.34	66.58	66.58	24.53

Calculation Assumptions and Notes

Note:

- Emissions from the process heater have been calculated using the listed process emission factors (Lb/MMBtu). The concentrations are calculated using EPA F-Factors (8710, 68F, Dry) corrected for temperature (60F) and excess oxygen (3% O2).
- The concentration of VOC has been calculated from the EPA AP42 default value using a molecular weight of 16 (i.e. as methane).
- The SOx concentration is equivalent to 1 grain of total sulfur / 100 SDCF of fuel (HHV 1020) or about 17 ppmv total S in the fuel gas.

EPA Certified Tier-3 Engine (175 Bhp)

Emission Factors for Emergency Use Only Engine
(Ultra Low Sulfur Diesel Fuel 15 ppmw S)

Emergency Use Only	Max Rating BHP	NOx g/Bhp*Hr	VOC g/Bhp*Hr	CO g/Bhp*Hr	PM10 g/Bhp*Hr	PM2.5 g/Bhp*Hr	SOx g/Bhp*Hr
CTB - Emergency Engine	175.00	2.4750	0.0620	1.1930	0.1110	0.1110	0.0050
RCF - Emergency Engine	175.00	2.4750	0.0620	1.1930	0.1110	0.1110	0.0050

Note: BSFC = 7065.26 Btu/Bhp*hr or 9.0 Gallons per hour of ultra low sulfur diesel fuel (Sulfur <= 15 ppmw);
Density = 7.079 Lb/Gal; HHV = 137,380 Btu/Gallon or 19,673 Btu/Lb

Diesel Fueled Engine (175 Bhp)
Emergency Use Only - Maximum Daily Emissions

Emergency Use Only	Operating Hr/Day	NOx Lb/Day	VOC Lb/Day	CO Lb/Day	PM10 Lb/Day	PM2.5 Lb/MMBtu	SOx Lb/Day
CTB - Emergency Engine	24	22.9167	0.5741	11.0463	1.0278	1.0278	0.0463
RCF - Emergency Engine	24	22.9167	0.5741	11.0463	1.0278	1.0278	0.0463

Diesel Fueled Engine (175 Bhp)
(Emergency Use Only - Allowable Annual Emissions - 12 Hour of Operation Each Engine)

Emergency Use Only	Operating Hr/Year	NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	PM2.5 Lb/Year	SOx Lb/Year
CTB - Emergency Engine	12	11.4583	0.2870	5.5231	0.5139	0.5139	0.0231
RCF - Emergency Engine	12	11.4583	0.2870	5.5231	0.5139	0.5139	0.0231

Emergency Use Only Flare - Tank Battery

Process Emission Factors
(For Pilot Gas, Purge Gas and Emergency Flare Event)

Emergency Use Flare	Process Rate MMBtu/Hr	NOx Lb/MMBtu	VOC Lb/MMBtu	CO Lb/MMBtu	PM10 Lb/MMBtu	PM2.5 Lb/MMBtu	SOx Lb/MMBtu
274 MMSCFD							
Pilot Gas (4 x 50 Sdcfh)	0.20	0.0680	0.0630	0.3700	0.0080	0.0080	0.0028
Purge Gas (2200 Sdcfh)	2.24	0.0680	0.0630	0.3700	0.0080	0.0080	0.0028
Emergency (274 MMSCfd)	2,854.17	0.0680	0.0630	0.3700	0.0080	0.0080	0.0028
Total Heat or Average EF	2,856.61	0.0680	0.0630	0.3700	0.0080	0.0080	0.0028

Maximum Daily Emissions
(Assumes Flaring at Rated Capacity During an Emergency Event)

Emergency Use Flare	Operating Hr/Day	NOx Lb/Day	VOC Lb/Day	CO Lb/Day	PM10 Lb/Day	PM2.5 Lb/MMBtu	SOx Lb/Day
274 MMSCFD							
Pilot Gas	24.00	0.33	0.31	1.81	0.04	0.04	0.01
Purge Gas	24.00	3.66	3.39	19.93	0.43	0.43	0.15
Emergency Event	24.00	4,658.00	4,315.50	25,345.00	548.00	548.00	191.80
Max. Daily Emissions (With Emergency Event)		4,662.00	4,319.20	25,366.74	548.47	548.47	191.96

Annual Operational Emissions
From the Emergency Use Only Flare

Emergency Use Flare	Operating Hr/Year	NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	PM2.5 Lb/Year	SOx Lb/Year
250 MMSCFD							
Pilot Gas	8760.00	121.52	112.58	661.20	14.30	14.30	5.00
Purge Gas	8760.00	1,336.71	1,238.42	7,273.25	157.26	157.26	55.04
Emergency Event	7.47	1,449.80	1,343.20	7,888.63	170.57	170.57	59.70
Total Allowable Annual Emissions		2,908.03	2,694.20	15,823.09	342.12	342.12	119.74

Calculation Assumptions and Notes

Note:

- The flare will be permitted for emergency use only. Daily emission estimates are equal to the total emissions that could occur on a day with an emergency event. Annual emissions are equal to the sum of the emissions from pilot gas and purge gas and 7.47 hours of reasonable foreseeable emergency use for power outages. Additional use is allowed but is not foreseeable and is therefore not quantified

Emergency Use Only Flare - CO2 Recompression Facility

Process Emission Factors (For Pilot Gas, Purge Gas and Emergency Flare Event)

Emergency Use Flare	Process Rate	NOx	VOC	CO	PM10	PM2.5	SOx
274 MMSCFD	MMBtu/Hr	Lb/MMBtu	Lb/MMBtu	Lb/MMBtu	Lb/MMBtu	Lb/MMBtu	Lb/MMBtu
Pilot Gas (4 x 50 Sdcfh)	0.20	0.0680	0.0630	0.3700	0.0080	0.0080	0.0028
Purge Gas (2200 Sdcfh)	2.24	0.0680	0.0630	0.3700	0.0080	0.0080	0.0028
Emergency (274 MMScfd)	2,854.17	0.0680	0.0630	0.3700	0.0080	0.0080	0.0028
Total Heat or Average EF	2,856.61	0.0680	0.0630	0.3700	0.0080	0.0080	0.0028

Maximum Daily Emissions (Assumes Flaring at Rated Capacity During an Emergency Event)

Emergency Use Flare	Operating	NOx	VOC	CO	PM10	PM2.5	SOx
274 MMSCFD	Hr/Day	Lb/Day	Lb/Day	Lb/Day	Lb/Day	Lb/MMBtu	Lb/Day
Pilot Gas	24.00	0.33	0.31	1.81	0.04	0.04	0.01
Purge Gas	24.00	3.66	3.39	19.93	0.43	0.43	0.15
Emergency Event	24.00	4,658.00	4,315.50	25,345.00	548.00	548.00	191.80
Max. Daily Emissions (With Emergency Event)		4,662.00	4,319.20	25,366.74	548.47	548.47	191.96

Annual Operational Emissions From the Emergency Use Only Flare

Emergency Use Flare	Operating	NOx	VOC	CO	PM10	PM2.5	SOx
274 MMSCFD	Hr/Year	Lb/Year	Lb/Year	Lb/Year	Lb/Year	Lb/Year	Lb/Year
Pilot Gas	8760.00	121.52	112.58	661.20	14.30	14.30	5.00
Purge Gas	8760.00	1,336.71	1,238.42	7,273.25	157.26	157.26	55.04
Emergency Event	7.47	1,449.80	1,343.20	7,888.63	170.57	170.57	59.70
Total Allowable Annual Emissions		2,908.03	2,694.20	15,823.09	342.12	342.12	119.74

Calculation Assumptions and Notes

Note:

- The flare will be permitted for emergency use only. Daily emission estimates are equal to the total emissions that could occur on a day with an emergency event. Annual emissions are equal to the sum of the emissions from pilot gas and purge gas assuming full time operation (8760 hour per year).

Emissions From Organic Liquid Storage Tanks

Daily Emissions From Fixed Roof Tanks (Breathing and Working Loss - Uncontrolled Tanks)

Breathing and Working Loss From Uncontrolled Tanks	Tank Emissions (Lb/Day)			Total CO2e Lb/Day
	Tank Vapor	VOC	CO2	
CTB - 1,500 Gallon Open Drain Tank	0.18	0.18	0.15	0.40
RCF - 1,500 Gallon Open Drain Tank	0.18	0.18	0.15	0.40
CRP - 1,500 Gallon Open Drain Tank	0.18	0.18	0.15	0.40
Shared 3,100 - Gallon Open Drain Tank	0.53	0.53	0.45	1.21
500 BBL Miscellaneous Organic Liquid Tank	2.77	2.77	2.37	6.31
500 BBL Miscellaneous Organic Liquid Tank	2.77	2.77	2.37	6.31
500 BBL Miscellaneous Organic Liquid Tank	2.77	2.77	2.37	6.31
Total Maximum Emissions	9.36	9.36	8.01	21.34

Annual Emissions From Fixed Roof Tanks (Breathing and Working Loss - Uncontrolled Tanks)

Breathing and Working Loss From Uncontrolled Tanks	Tank Emissions (Lb/Year)			Total CO2e Lb/Year
	Tank Vapor	VOC	CO2	
CTB - 1,500 Gallon Open Drain Tank	64.60	64.60	55.31	147.37
RCF - 1,500 Gallon Open Drain Tank	64.60	64.60	55.31	147.37
CRP - 1,500 Gallon Open Drain Tank	64.60	64.60	55.31	147.37
Shared 3,100 - Gallon Open Drain Tank	193.34	193.34	165.53	441.06
500 BBL Miscellaneous Organic Liquid Tank	1,009.27	1,009.27	864.08	2,302.43
500 BBL Miscellaneous Organic Liquid Tank	1,009.27	1,009.27	864.08	2,302.43
500 BBL Miscellaneous Organic Liquid Tank	1,009.27	1,009.27	864.08	2,302.43
Total Maximum Emissions	3,414.95	3,414.95	2,923.69	7,790.47

Stream Composition Versus
CO2-EOR Project Gas Composition Versus Project Year

Stream Constituents	Molecular		2015		2017		2019		2025	
	Formula	Weight	Mol. Fraction		Mol. Fraction		Mol. Fraction		Mol. Fraction	
Water Vapor	H2O	18.02	0.040		0.0400		0.0400		0.0400	
Nitrogen	N2	28.01	0.010		0.0210		0.0210		0.0150	
Oxygen	O2	32.00	0.000		0.0000		0.0000		0.0000	
Carbon Dioxide	CO2	44.01	0.433		0.8150		0.9100		0.9410	
Hydrogen Sulfide	H2S	34.08	0.000		0.0000		0.0000		0.0000	
Methane	C1	16.04	0.467		0.1200		0.0580		0.0290	
Ethane	C2	30.07	0.032		0.0140		0.0060		0.0040	
Propane	C3	44.10	0.024		0.0110		0.0040		0.0030	
iso-Butane	i-C4	58.12	0.006		0.0030		0.0010		0.0010	
Butane	n-C4	58.12	0.014		0.0070		0.0030		0.0020	
iso-Pentane	i-C5	72.15	0.005		0.0030		0.0010		0.0010	
Pentane	n-C5	72.15	0.006		0.0040		0.0020		0.0010	
Hexanes	C6	86.18	0.000		0.0000		0.0000		0.0000	
Heptanes+	C7+	100.20	0.000		0.0000		0.0000		0.0000	
Molecular Weight of Gas Stream			31.52		41.09		43.09		43.59	

GHG By Year CO2e (Tonne/Year)	8.67	2.88	2.14	1.82

Tank - Calculation Assumptions and Notes

Notes:

1. Tank emissions were calculated using EPA AP42 Tanks 4.09d. For permitting purposes all of the emissions predicted by Tanks 4.09d are assumed to be VOC.
2. The emissions of GHG were calculate by speciating the mass of the tank vapors using the average MW, average mole fraction for methane and the average mole fraction for CO2 for the period 2015 through 2025

Criteria Pollutant (Exhaust)
Emissions From Well Maintenance Activities

Exhaust Emissions From
Diesel Engines Used in Mobile 425 Hp Workover Rig

Project Year	Number Of Well Drilled	Wells Undergoing Maintenance	Annual Fuel Use Gal/Year	Annual Emission From Well Maintenance (Mobile Workover Rig)				
				NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	SOx Lb/Year
2016	18	0	0.000	0.000	0.000	0.000	0.000	0.000
2017	4	18	3073.291	579.866	74.803	328.784	24.354	0.661
2018		22	3720.816	665.495	87.173	377.043	27.711	0.808
2019		22	3720.816	622.262	82.921	354.363	25.727	0.808
2020	8	22	3720.816	581.156	79.377	333.810	23.884	0.808
2021		30	5073.840	739.331	103.410	429.102	30.250	1.102
2022	9	30	5073.840	688.109	98.577	406.874	28.027	1.102
2023	27	39	6595.992	832.980	122.371	503.808	33.671	1.432
2024		66	11162.448	1309.727	197.947	814.327	52.729	2.424
2025	20	66	11162.448	1218.301	189.655	780.308	48.690	2.424
2026		86	14545.008	1473.894	236.876	983.520	58.734	3.158
2027		86	14545.008	1365.846	227.456	950.274	54.024	3.158
2028		86	14545.008	1263.338	218.591	919.799	49.869	3.158
2029	20	86	14545.008	1169.142	210.556	894.864	45.990	3.158
2030		106	17927.568	1331.762	250.303	1072.239	52.246	3.893
2031	21	106	17927.568	1229.319	242.108	1048.336	48.490	3.893
2032		127	21479.256	1362.399	280.662	1227.386	53.596	4.664
2033	23	127	21479.256	1260.116	272.480	1202.838	49.505	4.664
2034	0	150	25335.180	1370.513	312.709	1394.641	54.048	5.501
Average	-----	-----	11349.114	1003.345	173.051	738.017	40.081	2.464

Exhaust Emissions From
Diesel Engines Used in Mobile 375 Hp Workover Rig

Project Year	Number Of Well Drilled	Wells Undergoing Maintenance	Annual Fuel Use Gal/Year	Annual Emission From Well Maintenance (Mobile Workover Rig)				
				NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	SOx Lb/Year
2016	18	0	0.000	0.000	0.000	0.000	0.000	0.000
2017	4	18	1397.650	155.118	20.435	64.059	5.559	0.303
2018		22	1705.004	169.530	23.812	76.353	6.134	0.370
2019		22	1705.004	150.765	22.647	75.059	5.494	0.370
2020	8	22	1705.004	133.294	21.482	74.412	4.872	0.370
2021		30	2325.006	159.706	27.794	100.588	5.841	0.505
2022	9	30	2325.006	141.177	26.294	99.706	5.100	0.505
2023	27	39	3022.508	161.736	32.347	128.471	5.724	0.656
2024		66	5115.013	238.765	51.830	215.471	8.231	1.110
2025	20	66	5115.013	205.765	49.112	215.471	6.911	1.110
2026		86	6665.017	231.442	60.706	280.765	7.512	1.447
2027		86	6665.017	200.836	58.430	280.765	6.602	1.447
2028		86	6665.017	175.036	56.406	280.765	6.020	1.447
2029	20	86	6665.017	152.524	54.382	280.765	5.489	1.447
2030		106	8215.021	168.353	65.783	346.060	6.235	1.783
2031	21	106	8215.021	153.389	64.535	346.060	5.736	1.783
2032		127	9842.525	169.209	76.200	414.619	6.350	2.137
2033	23	127	9842.525	156.883	75.080	414.619	5.939	2.137
2034	0	150	11625.030	172.942	87.794	489.707	6.574	2.524
Average	-----	-----	5200.811	162.972	46.056	220.196	5.806	1.129

Total Exhaust Emissions From Diesel Engines
Used in Mobile 425 Hp Workover Rig and 375 Hp Workover Pump

Project Year	Number Of Well Drilled	Wells Undergoing Maintenance	Annual Fuel Use Gal/Year	Annual Emission From Well Maintenance (Mobile Workover Rig)				
				NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	SOx Lb/Year
2016	18	0	0.000	0.000	0.000	0.000	0.000	0.000
2017	4	18	4470.941	734.984	95.238	392.843	29.913	0.964
2018		22	5425.820	835.024	110.985	453.396	33.845	1.178
2019		22	5425.820	773.027	105.568	429.422	31.220	1.178
2020	8	22	5425.820	714.450	100.860	408.222	28.756	1.178
2021		30	7398.846	899.037	131.204	529.690	36.091	1.606
2022	9	30	7398.846	829.286	124.872	506.580	33.127	1.606
2023	27	39	9618.500	994.715	154.718	632.279	39.395	2.088
2024		66	16277.461	1548.493	249.777	1029.798	60.960	3.534
2025	20	66	16277.461	1424.067	238.767	995.779	55.600	3.534
2026		86	21210.025	1705.336	297.582	1264.285	66.246	4.605
2027		86	21210.025	1566.681	285.886	1231.039	60.626	4.605
2028		86	21210.025	1438.374	274.997	1200.564	55.889	4.605
2029	20	86	21210.025	1321.666	264.939	1175.630	51.479	4.605
2030		106	26142.589	1500.116	316.086	1418.299	58.481	5.676
2031	21	106	26142.589	1382.708	306.643	1394.396	54.226	5.676
2032		127	31321.781	1531.608	356.862	1642.005	59.946	6.801
2033	23	127	31321.781	1416.999	347.559	1617.457	55.444	6.801
2034	0	150	36960.210	1543.454	400.503	1884.348	60.622	8.025
Average	-----	-----	16549.925	1166.317	219.108	958.212	45.888	3.593

**Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors**

Total Fugitive Emissions (Occidental of Elk Hills CO2 Enhanced Oil Recovery Project)

Type of Component	Component Service	Total Component Counts	Weighted Average Leak (ppmv)	Weighted Average Leak Fraction	Weighted Leak Rate lb/day*component	Fugitive VOC Emissions (lb/day)	Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	14,191	1,820	0.0010	7.895E-04	11.204	173.383
	Light Crude Oil	7,205	1,369	0.0010	4.241E-03	30.558	229.791
	Heavy Crude Oil	248	500	0.0010	8.854E-05	0.022	0.028
Pump Seals	Gas/Light Liquid	720	2,000	0.0010	1.489E-02	10.721	165.899
	Light Crude Oil	59	500	0.0010	7.920E-03	0.469	3.526
	Heavy Crude Oil	12	500	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	1,251	1,625	0.0010	5.360E-03	6.706	103.778
	Light Crude Oil	1,638	1,489	0.0010	6.126E-03	10.032	75.435
	Heavy Crude Oil	44	500	0.0010	1.167E-03	0.052	0.066
Connectors	Gas/Light Liquid	44,531	1,613	0.0010	1.439E-03	64.100	991.939
	Light Crude Oil	33,772	1,421	0.0010	1.426E-04	4.817	36.225
	Heavy Crude Oil	406	500	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	13,249	1,495	0.0010	2.941E-03	38.971	603.070
	Light Crude Oil	11,422	1,501	0.0010	2.661E-03	30.393	228.551
	Heavy Crude Oil	299	500	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	0	0.0000	0.000E+00	0.000	0.000
	Light Crude Oil	0	0	0.0000	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	0	0.0000	0.000E+00	0.000	0.000
Total Fugitive VOC Emissions From Associated Components						208.044	2611.691
Weight percentage of VOC in the total organic compounds in gas ?							
						-----	-----
Weight percentage of VOC in the total organic compounds in oil ?						-----	-----

**Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors**

Fugitive Emissions From The Reinjection Compression Facility (RCF)

Type of Component	Component Service	Component Counts For RCF	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	319	500	0.0010	5.505E-04	0.176	2.719
	Light Crude Oil	384	500	0.0010	3.612E-03	1.387	10.429
	Heavy Crude Oil	12	500	0.0010	4.805E-04	0.006	0.007
Pump Seals	Gas/Light Liquid	0	500	0.0010	7.234E-03	0.000	0.000
	Light Crude Oil	0	500	0.0010	7.920E-03	0.000	0.000
	Heavy Crude Oil	2	500	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	43	500	0.0010	3.854E-03	0.167	2.577
	Light Crude Oil	61	500	0.0010	4.594E-03	0.281	2.114
	Heavy Crude Oil	1	500	0.0010	1.167E-03	0.001	0.002
Connectors	Gas/Light Liquid	1,496	500	0.0010	1.251E-03	1.873	28.977
	Light Crude Oil	3,850	500	0.0010	1.251E-03	4.817	36.225
	Heavy Crude Oil	7	500	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	1,050	500	0.0010	2.328E-03	2.445	37.835
	Light Crude Oil	558	500	0.0010	2.003E-03	1.118	8.406
	Heavy Crude Oil	26	500	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	500	0.0010	2.170E-03	0.000	0.000
	Light Crude Oil	0	500	0.0010	1.785E-03	0.000	0.000
	Heavy Crude Oil	0	500	0.0010	8.606E-04	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						12.270	129.290
Weight percentage of VOC in the total organic compounds in gas ?							
						100.0	-----
Weight percentage of VOC in the total organic compounds in oil ?						100.0	-----

**Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors**

Fugitive Emissions From The Carbon Dioxide Recovery Plant (CRP)

Type of Component	Component Service	Component Counts For CRP	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	1,289	500	0.0010	5.505E-04	0.709	10.979
	Light Crude Oil	1,961	500	0.0010	3.612E-03	7.081	53.251
	Heavy Crude Oil	236	500	0.0010	6.864E-05	0.016	0.021
Pump Seals	Gas/Light Liquid	0	500	0.0010	7.234E-03	0.000	0.000
	Light Crude Oil	43	500	0.0010	7.920E-03	0.342	2.573
	Heavy Crude Oil	10	500	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	247	500	0.0010	3.854E-03	0.953	14.745
	Light Crude Oil	416	500	0.0010	4.594E-03	1.913	14.384
	Heavy Crude Oil	43	500	0.0010	1.167E-03	0.050	0.064
Connectors	Gas/Light Liquid	9,662	500	0.0010	1.251E-03	12.091	187.110
	Light Crude Oil	8,204	500	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	398	500	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	3,310	500	0.0010	2.328E-03	7.706	119.255
	Light Crude Oil	2,426	500	0.0010	2.003E-03	4.861	36.551
	Heavy Crude Oil	272	500	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	500	0.0010	2.170E-03	0.000	0.000
	Light Crude Oil	0	500	0.0010	1.785E-03	0.000	0.000
	Heavy Crude Oil	0	500	0.0010	8.606E-04	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						35.723	438.931
Weight percentage of VOC in the total organic compounds in gas?						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

**Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors**

Fugitive Emissions From The Central Tank Battery (CTB)

Type of Component	Component Service	Component Counts For CTB	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	98	500	0.0010	5.505E-04	0.054	0.835
	Light Crude Oil	688	500	0.0010	3.612E-03	2.485	18.685
	Heavy Crude Oil	0	500	0.0010	6.864E-05	0.000	0.000
Pump Seals	Gas/Light Liquid	0	500	0.0010	7.234E-03	0.000	0.000
	Light Crude Oil	16	500	0.0010	7.920E-03	0.127	0.953
	Heavy Crude Oil	0	500	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	22	500	0.0010	3.854E-03	0.085	1.312
	Light Crude Oil	80	500	0.0010	4.594E-03	0.367	2.763
	Heavy Crude Oil	0	500	0.0010	1.167E-03	0.000	0.000
Connectors	Gas/Light Liquid	324	500	0.0010	1.251E-03	0.405	6.274
	Light Crude Oil	982	500	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	500	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	100	500	0.0010	2.328E-03	0.233	3.603
	Light Crude Oil	814	500	0.0010	2.003E-03	1.631	12.262
	Heavy Crude Oil	0	500	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	500	0.0010	2.170E-03	0.000	0.000
	Light Crude Oil	0	500	0.0010	1.785E-03	0.000	0.000
	Heavy Crude Oil	0	500	0.0010	8.606E-04	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						5.387	46.688
Weight percentage of VOC in the total organic compounds in gas?							
						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors

Fugitive Emissions From Production Satellite Settings

Type of Component	Component Service	Component Counts Per Setting	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	0	2,000	0.0010	8.222E-04	0.000	0.000
	Light Crude Oil	572	2,000	0.0010	4.699E-03	2.688	20.213
	Heavy Crude Oil	0	2,000	0.0010	4.805E-04	0.000	0.000
Pump Seals	Gas/Light Liquid	0	2,000	0.0010	1.489E-02	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.436E-02	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	208	2,000	0.0010	5.861E-03	1.219	18.865
	Light Crude Oil	0	2,000	0.0010	6.917E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.690E-03	0.000	0.000
Connectors	Gas/Light Liquid	2,106	2,000	0.0010	1.505E-03	3.169	49.042
	Light Crude Oil	936	2,000	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	286	2,000	0.0010	3.252E-03	0.930	14.395
	Light Crude Oil	1,144	2,000	0.0010	2.988E-03	3.419	25.709
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	2,000	0.0010	2.772E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.936E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.373E-03	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						11,425	128,223
Weight percentage of VOC in the total organic compounds in gas?						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

**Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors**

Fugitive Emissions From Crude Oil and Natural Gas Production Wells

Type of Component	Component Service	Component Counts Per Well	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	10,260	2,000	0.0010	8.222E-04	8.436	130.543
	Light Crude Oil	3,600	2,000	0.0010	4.699E-03	16.917	127.214
	Heavy Crude Oil	0	2,000	0.0010	4.805E-04	0.000	0.000
Pump Seals	Gas/Light Liquid	720	2,000	0.0010	1.489E-02	10.721	165.899
	Light Crude Oil	0	2,000	0.0010	1.436E-02	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	360	2,000	0.0010	5.861E-03	2.110	32.650
	Light Crude Oil	1,080	2,000	0.0010	6.917E-03	7.470	56.174
	Heavy Crude Oil	0	2,000	0.0010	1.690E-03	0.000	0.000
Connectors	Gas/Light Liquid	25,380	2,000	0.0010	1.505E-03	38.192	591.016
	Light Crude Oil	19,800	2,000	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	7,020	2,000	0.0010	3.252E-03	22.832	353.330
	Light Crude Oil	6,480	2,000	0.0010	2.988E-03	19.365	145.624
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	2,000	0.0010	2.772E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.936E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.373E-03	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						126.043	1602.449
Weight percentage of VOC in the total organic compounds in gas?						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

**Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors**

Fugitive Emissions From CO2 Injection Wells

Type of Component	Component Service	Component Counts	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	2,225	2,000	0.0010	8.222E-04	1.829	28.307
	Light Crude Oil	0	2,000	0.0010	4.699E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	4.805E-04	0.000	0.000
Pump Seals	Gas/Light Liquid	0	2,000	0.0010	1.489E-02	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.436E-02	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	371	2,000	0.0010	5.861E-03	2.173	33.630
	Light Crude Oil	0	2,000	0.0010	6.917E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.690E-03	0.000	0.000
Connectors	Gas/Light Liquid	5,562	2,000	0.0010	1.505E-03	8.370	129.520
	Light Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	1,483	2,000	0.0010	3.252E-03	4.824	74.652
	Light Crude Oil	0	2,000	0.0010	2.988E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	2,000	0.0010	2.772E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.936E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.373E-03	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						17,196	266,110
Weight percentage of VOC in the total organic compounds in gas?						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

**Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors**

Gathering System for Crude oil and Natural Gas Production

Type of Component	Component Service	Component Counts	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	0	2,000	0.0010	8.222E-04	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	4.699E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	4.805E-04	0.000	0.000
Pump Seals	Gas/Light Liquid	0	2,000	0.0010	1.489E-02	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.436E-02	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	0	2,000	0.0010	5.861E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	6.917E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.690E-03	0.000	0.000
Connectors	Gas/Light Liquid	0	2,000	0.0010	1.505E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	0	2,000	0.0010	3.252E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	2.988E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	2,000	0.0010	2.772E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.936E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.373E-03	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						0.000	0.000
Weight percentage of VOC in the total organic compounds in gas?						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

**Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors**

CO2 Intake and CO2 Distribution System for Injection

Type of Component	Component Service	Component Counts	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	0	2,000	0.0010	8.222E-04	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	4.699E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	4.805E-04	0.000	0.000
Pump Seals	Gas/Light Liquid	0	2,000	0.0010	1.489E-02	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.436E-02	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	0	2,000	0.0010	5.861E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	6.917E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.690E-03	0.000	0.000
Connectors	Gas/Light Liquid	0	2,000	0.0010	1.505E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	0	2,000	0.0010	3.252E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	2.988E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	2,000	0.0010	2.772E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.936E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.373E-03	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						0.000	0.000
Weight percentage of VOC in the total organic compounds in gas?						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

**Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors**

Reserved

Type of Component	Component Service	Component Counts	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid		2,000	0.0200	2.399E-03	0.000	0.000
	Light Crude Oil		2,000	0.0200	7.994E-02	0.000	0.000
	Heavy Crude Oil		2,000	0.0200	1.785E-03	0.000	0.000
Pump Seals	Gas/Light Liquid		2,000	0.0200	6.706E-02	0.000	0.000
	Light Crude Oil		2,000	0.0200	9.662E-02	0.000	0.000
	Heavy Crude Oil		2,000	0.0200	0.000E+00	0.000	0.000
Others	Gas/Light Liquid		2,000	0.0200	7.207E-02	0.000	0.000
	Light Crude Oil		2,000	0.0200	7.413E-02	0.000	0.000
	Heavy Crude Oil		2,000	0.0200	1.690E-03	0.000	0.000
Connectors	Gas/Light Liquid		2,000	0.0200	2.157E-02	0.000	0.000
	Light Crude Oil		2,000	0.0200	0.000E+00	0.000	0.000
	Heavy Crude Oil		2,000	0.0200	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid		2,000	0.0200	6.244E-02	0.000	0.000
	Light Crude Oil		2,000	0.0200	5.816E-02	0.000	0.000
	Heavy Crude Oil		2,000	0.0200	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid		2,000	0.0200	4.792E-02	0.000	0.000
	Light Crude Oil		2,000	0.0200	3.805E-02	0.000	0.000
	Heavy Crude Oil		2,000	0.0200	2.144E-02	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						0.000	0.000
Weight percentage of VOC in the total organic compounds in gas?						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

EPA Protocol For Equipment Leak Emission Estimates (November 1995) **Average Leak Rates For Components At Oil and Natural Gas Processing Facilities**

ALR - Fugitive Emissions Factors For A 10,000 ppmv Leak Threshold

Component Type	Component Service Type	Proposed Leak Fraction	EPA Table 5-7 ALR Equations For Proposed Leak Threshold (10,000 ppmv) And Specified leak fraction (LKFRAC)	ALR Factor lb/day per component
Valves	Gas/Light Liquid	0.0000	ALR = [(0.098 x LKFRAC) + 2.5E-5]*2.2*24	1.320E-03
	Light Crude Oil	0.0000	ALR = [(0.087 x LKFRAC) + 1.9E-5]*2.2*24	1.003E-03
	Heavy Crude Oil	0.0000	ALR = (8.4 E-6)*2.2*24	4.435E-04
Pump Seals	Gas/Light Liquid	0.0000	ALR = [(0.074 x LKFRAC) + 3.5E-4]*2.2*24	1.848E-02
	Light Crude Oil	0.0000	ALR = [(0.100 x LKFRAC) + 5.1E-4]*2.2*24	2.693E-02
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Others	Gas/Light Liquid	0.0000	ALR = [(0.089 x LKFRAC) + 1.2E-4]*2.2*24	6.336E-03
	Light Crude Oil	0.0000	ALR = [(0.083 x LKFRAC) + 1.4E-4]*2.2*24	7.392E-03
	Heavy Crude Oil	0.0000	ALR = (3.2 E-5)*2.2*24	1.848E-03
Connectors	Gas/Light Liquid	0.0000	ALR = [(0.026 x LKFRAC) + 1.0E-5]*2.2*24	5.280E-04
	Light Crude Oil	0.0000	ALR = [(0.026 x LKFRAC) + 9.7E-6]*2.2*24	5.122E-04
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Flanges	Gas/Light Liquid	0.0000	ALR = [(0.082 x LKFRAC) + 5.7E-6]*2.2*24	3.010E-04
	Light Crude Oil	0.0000	ALR = [(0.073 x LKFRAC) + 2.4E-6]*2.2*24	1.267E-04
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Open-ended Lines	Gas/Light Liquid	0.0000	ALR = [(0.055 x LKFRAC) + 1.5E-5]*2.2*24	7.920E-04
	Light Crude Oil	0.0000	ALR = [(0.044 x LKFRAC) + 1.4E-5]*2.2*24	7.392E-04
	Heavy Crude Oil	0.0000	ALR = [(0.030 x LKFRAC) + 7.2E-6]*2.2*24	3.802E-04

EPA Protocol For Equipment Leak Emission Estimates (November 1995) **Average Leak Rates For Components At Oil and Natural Gas Processing Facilities**

ALR - Fugitive Emissions Factors For A 2,000 ppmv Leak Threshold

Component Type	Component Service Type	Proposed Leak Fraction	EPA Table 5-7 ALR Equations For Proposed Leak Threshold (10,000 ppmv) And Specified leak fraction (LKFRAC)	ALR Factor lb/day per component
Valves	Gas/Light Liquid	0.0000	ALR = [(0.083 x LKFRAC) + 1.4E-5]*2.2*24	7.392E-04
	Light Crude Oil	0.0000	ALR = [(0.075 x LKFRAC) + 1.4E-5]*2.2*24	7.392E-04
	Heavy Crude Oil	0.0000	ALR = [(0.0013 x LKFRAC) + 7.8E-6]*2.2*24	4.118E-04
Pump Seals	Gas/Light Liquid	0.0000	ALR = [(0.052 x LKFRAC) + 2.3E-4]*2.2*24	1.214E-02
	Light Crude Oil	0.0000	ALR = [(0.082 x LKFRAC) + 1.9E-4]*2.2*24	1.003E-02
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Others	Gas/Light Liquid	0.0000	ALR = [(0.066 x LKFRAC) + 4.5E-5]*2.2*24	2.376E-03
	Light Crude Oil	0.0000	ALR = [(0.067 x LKFRAC) + 6.4E-5]*2.2*24	3.379E-03
	Heavy Crude Oil	0.0000	ALR = (3.2 E-5)*2.2*24	1.690E-03
Connectors	Gas/Light Liquid	0.0000	ALR = [(0.020 x LKFRAC) + 8.5E-6]*2.2*24	4.488E-04
	Light Crude Oil	0.0000	ALR = [(0.022 x LKFRAC) + 8.6E-6]*2.2*24	4.541E-04
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Flanges	Gas/Light Liquid	0.0000	ALR = [(0.059 x LKFRAC) + 2.6E-6]*2.2*24	1.373E-04
	Light Crude Oil	0.0000	ALR = [(0.055 x LKFRAC) + 1.6E-6]*2.2*24	8.448E-05
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Open-ended Lines	Gas/Light Liquid	0.0000	ALR = [(0.045 x LKFRAC) + 7.5E-6]*2.2*24	3.960E-04
	Light Crude Oil	0.0000	ALR = [(0.036 x LKFRAC) + 6.7E-6]*2.2*24	3.538E-04
	Heavy Crude Oil	0.0000	ALR = [(0.020 x LKFRAC) + 6.0E-6]*2.2*24	3.168E-04

EPA Protocol For Equipment Leak Emission Estimates (November 1995) **Average Leak Rates For Components At Oil and Natural Gas Processing Facilities**

ALR - Fugitive Emissions Factors For A 1,000 ppmv Leak Threshold

Component Type	Component Service Type	Proposed Leak Fraction	EPA Table 5-7 ALR Equations For Proposed Leak Threshold (10,000 ppmv) And Specified leak fraction (LKFRAC)	ALR Factor lb/day per component
Valves	Gas/Light Liquid	0.0000	ALR = [(0.076 x LKFRAC) + 1.1E-5]*2.2*24	5.808E-04
	Light Crude Oil	0.0000	ALR = [(0.069 x LKFRAC) + 1.2E-5]*2.2*24	6.336E-04
	Heavy Crude Oil	0.0000	ALR = (0.0013 x LKFRAC) + 7.8E-6]*2.2*24	4.118E-04
Pump Seals	Gas/Light Liquid	0.0000	ALR = [(0.052 x LKFRAC) + 2.3E-4]*2.2*24	1.214E-02
	Light Crude Oil	0.0000	ALR = [(0.079 x LKFRAC) + 1.5E-4]*2.2*24	7.920E-03
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Others	Gas/Light Liquid	0.0000	ALR = [(0.061 x LKFRAC) + 3.1E-5]*2.2*24	1.637E-03
	Light Crude Oil	0.0000	ALR = [(0.058 x LKFRAC) + 4.4E-5]*2.2*24	2.323E-03
	Heavy Crude Oil	0.0000	ALR = [(0.0011 x LKFRAC) + 2.1E-5]*2.2*24	1.109E-03
Connectors	Gas/Light Liquid	0.0000	ALR = [(0.018 x LKFRAC) + 8.0E-6]*2.2*24	4.224E-04
	Light Crude Oil	0.0000	ALR = [(0.021 x LKFRAC) + 8.3E-6]*2.2*24	4.382E-04
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Flanges	Gas/Light Liquid	0.0000	ALR = [(0.051 x LKFRAC) + 1.8E-6]*2.2*24	9.504E-05
	Light Crude Oil	0.0000	ALR = [(0.046 x LKFRAC) + 1.2E-6]*2.2*24	6.336E-05
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Open-ended Lines	Gas/Light Liquid	0.0000	ALR = [(0.039 x LKFRAC) + 5.0E-6]*2.2*24	2.640E-04
	Light Crude Oil	0.0000	ALR = [(0.032 x LKFRAC) + 4.7E-6]*2.2*24	2.482E-04
	Heavy Crude Oil	0.0000	ALR = [(0.015 x LKFRAC) + 4.9E-6]*2.2*24	2.587E-04

EPA Protocol For Equipment Leak Emission Estimates (November 1995) **Average Leak Rates For Components At Oil and Natural Gas Processing Facilities**

ALR - Fugitive Emissions Factors For A 500 ppmv Leak Threshold

Component Type	Component Service Type	Proposed Leak Fraction	EPA Table 5-7 ALR Equations For Proposed Leak Threshold (10,000 ppmv) And Specified leak fraction (LKFRAC)	ALR Factor lb/day per component
Valves	Gas/Light Liquid	0.0000	ALR = [(0.070 x LKFRAC) + 9.1E-6]*2.2*24	4.805E-04
	Light Crude Oil	0.0000	ALR = [(0.059 x LKFRAC) + 9.4E-6]*2.2*24	4.963E-04
	Heavy Crude Oil	0.0000	ALR = (0.0013 x LKFRAC) + 7.8E-6]*2.2*24	4.118E-04
Pump Seals	Gas/Light Liquid	0.0000	ALR = [(0.027 x LKFRAC) + 1.1E-4]*2.2*24	5.808E-03
	Light Crude Oil	0.0000	ALR = [(0.071 x LKFRAC) + 7.9E-5]*2.2*24	4.171E-03
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Others	Gas/Light Liquid	0.0000	ALR = [(0.055 x LKFRAC) + 1.8E-5]*2.2*24	9.504E-04
	Light Crude Oil	0.0000	ALR = [(0.053 x LKFRAC) + 3.4E-5]*2.2*24	1.795E-03
	Heavy Crude Oil	0.0000	ALR = [(0.0011 x LKFRAC) + 2.1E-5]*2.2*24	1.109E-03
Connectors	Gas/Light Liquid	0.0000	ALR = [(0.016 x LKFRAC) + 7.7E-6]*2.2*24	4.066E-04
	Light Crude Oil	0.0000	ALR = [(0.016 x LKFRAC) + 7.7E-6]*2.2*24	4.066E-04
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Flanges	Gas/Light Liquid	0.0000	ALR = [(0.043 x LKFRAC) + 1.1E-6]*2.2*24	5.808E-05
	Light Crude Oil	0.0000	ALR = [(0.037 x LKFRAC) + 9.4E-7]*2.2*24	4.963E-05
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Open-ended Lines	Gas/Light Liquid	0.0000	ALR = [(0.037 x LKFRAC) + 4.1E-6]*2.2*24	2.165E-04
	Light Crude Oil	0.0000	ALR = [(0.030 x LKFRAC) + 3.8E-6]*2.2*24	2.006E-04
	Heavy Crude Oil	0.0000	ALR = [(0.012 x LKFRAC) + 4.3E-6]*2.2*24	2.270E-04

APPENDICES

OPERATIONAL PHASE HAP/TAC EMISSIONS

CAPCOA Risk Prioritization for The
CO2 Enhanced Oil Recovery (EOR) Project - Operational Activities

(Prioritized using the CAPCOAA Dispersion Adjustment Procedure, DPM included as BAP)

Daily and Annual HAP/TAC Emissions										OEHA Risk Matrix				CAPCOA Risk Score		
Chemical Substance	Chemical CAS No	Status (Y/N)		Max Daily TAC Lb/Day	Annual TAC Lb/Year	Unit Risk ug/M3	Acute REL	Chronic REL	Cancer Score	Acute Score	Chronic Score					
		HAP	TAC													
1,3 Butadiene	106-99-0	Y	Y	6.903781E-04	2.572065E-01	2.70E-06	4.70E+02	1.40E+02	2.3334E-06	9.1806E-08	3.1459E-08					
2-Methylchloroanthrene	56-49-5	Y	Y	3.218824E-06	1.174871E-03											
2-Methylnaphthalene	91-57-6	Y	Y	4.2917765E-05	1.566494E-02											
7,12-Dimethylbenz(a)anthracene	57-96-6	Y	Y	2.861176E-05	1.044329E-02											
Acenaphthene	83-32-9	Y	Y	1.940235E-06	7.696858E-04											
Acenaphthylene	208-96-8	Y	Y	2.092235E-06	5.697830E-02											
Acetaldehyde	75-07-0	Y	Y	5.785374E+00	5.403354E+00	2.7000E-06	4.7000E+02	1.4000E+02	4.9019E-05	1.5387E-03	1.3218E-06					
Acrolein	107-02-8	Y	Y	1.359313E+00	6.319376E+00		2.5000E+00	3.5000E-01		6.7966E-02	6.1833E-04					
Anthracene	120-12-7	Y	Y	4.2917765E-06	1.578123E-03											
Benzene	71-43-2	Y	Y	2.150870E+01	6.237296E+01	2.9000E-05	1.3000E+03	6.0000E+01	6.0776E-03	2.0681E-03	3.5601E-05					
Benzo(a)anthracene	56-55-6	Y	Y	2.7717765E-06	1.039964E-03	1.1000E-04			3.8437E-07							
Benzo(a)pyrene (BAP) + Diesel DPM	50-32-8	Y	Y	2.613967E+00	8.583248E+01	1.1000E-03			3.1724E-01							
Benzo(b)fluoranthene	205-99-2	Y	Y	1.940235E-06	7.113563E-04	1.1000E-04			2.6292E-07							
Benzo(g,h,i)perylene	191-24-2	Y	Y	1.403765E-06	5.147262E-04											
Benzo(k)fluoranthene	207-08-9	Y	Y	1.940235E-06	7.100381E-04	1.1000E-04			2.6243E-07							
Butane	106-07-8	N	N	0.000000E+00	0.000000E+00											
Chlorobenzene	108-90-7	Y	Y	0.000000E+00	4.781150E-06	4.6000E-06		1.00E+03	7.3897E-11		1.6374E-13					
Chrysene	218-01-9	Y	Y	2.619765E-06	9.800999E-04	1.1000E-05			3.6224E-08							
Dibenz(a,h)anthracene	53-70-3	Y	Y	1.403765E-06	5.161061E-04	1.2000E-03			2.0809E-06							
Dibenzochlorine	25321-22-6	Y	Y	2.145882E-03	7.832471E-01											
Ethane	74-84-00	N	N	0.000000E+00	0.000000E+00											
Ethylbenzene	100-41-4	Y	Y	1.941329E+02	1.269673E+02			2.0000E+03			2.1741E-06					
Fluoranthene	206-44-0	Y	Y	3.934118E-06	1.482621E-03											
Fluorene	86-73-7	Y	Y	4.649412E-06	2.008292E-03											
Formaldehyde	50-00-0	Y	Y	1.572212E+02	1.245711E+02	6.0000E-06	5.5000E+01	9.0000E+00	2.5114E-03	3.5732E-01	4.7401E-04					
Hydrogen Chloride	7647-01-0	Y	Y	0.000000E+00	0.000000E+00		2.1000E+03	9.0000E+00		0.0000E+00	0.0000E+00					
Hydrogen Sulfide (H2S)	77-83-06-4	N	Y	3.040000E-01	1.109600E+02											
Hexane	110-54-3	Y	Y	6.416765E+00	9.216108E+02											
Indeno(1,2,3,c,d)pyrene	193-39-5	Y	Y	1.940235E-06	7.100911E-04	1.1000E-04			2.6245E-07							
Naphthalene	91-20-3	Y	Y	1.479370E+00	1.157072E+00	3.4000E-05		9.0000E+00	1.3218E-04		4.4029E-06					
Pentane	109-66-0	N	N	0.000000E+00	0.000000E+00											
Phenanthrene	85-01-8	Y	Y	2.592941E-05	1.052744E-02											
Propane	74-98-6	N	N	0.000000E+00	0.000000E+00											
Propylene	115-07-1	N	Y	1.945877E+02	4.888962E+02											
Pyrene	129-00-0	Y	Y	6.258824E-06	2.345106E-03											
Toluene	108-88-3	Y	Y	7.857979E+00	2.714703E+01		3.7000E+04	3.0000E+02		2.6547E-05	3.0990E-06					
Total xylene	1330-20-7	Y	Y	3.920756E+00	1.034878E+01		2.2000E+04	7.0000E+02		2.2274E-05	5.0630E-07					
Total PAH(W/Naphthalene)	1150/1151	Y	Y	1.882763E+00	1.447833E+00	1.10E-03			5.3512E-03							
Total PAH(W/O Naphthalene)	1150/1151	Y	Y	5.416931E-02	1.797377E-01											

CAPCOA Risk Prioritization for The
CO2 Enhanced Oil Recovery (EOR) Project - Operational Activities

(Prioritized using the CAPCOAA Dispersion Adjustment Procedure, DPM included as BAP)

Daily and Annual HAP/TAC Emissions				OEHHA Risk Matrix				CAPCOA Risk Score			
Chemical Substance	Chemical CAS No	Status (Y/N)		Max Daily TAC Lb/Day	Annual TAC Lb/Year	Unit Risk ug/M3	Acute REL	Chronic REL	Cancer Score	Acute Score	Chronic Score
		HAP	TAC								
Arsenic	7440-38-2	Y	Y	2.724339E-02	1.472634E-01	3.3000E-03	2.0000E-01	1.5000E-02	1.6329E-03	1.7027E-02	3.3622E-04
Barium	7440-39-3	N	Y	5.993545E-01	3.238901E+00						
Beryllium	7440-41-7	Y	Y	1.634603E-03	8.876325E-03	2.4000E-03		7.0000E-03	7.1579E-05		4.3426E-05
Cadmium	7440-43-9	Y	Y	1.498386E-01	8.097518E-01	4.2000E-03		2.0000E-02	1.1427E-02		1.3866E-03
Chromium, VI	18540-29-9	Y	Y	0.000000E+00	1.717867E-05	1.5000E-01		2.0000E-01	8.6580E-06		2.9416E-09
Chromium, total as Cr VI	7440-47-3	Y	Y	1.907037E-01	1.030703E+00						
Cobalt	744048-4	Y	Y	1.144222E-02	6.183357E-02						
Copper	7440-50-8	N	Y	1.157844E-01	6.258127E-01		1.0000E+02			1.4473E-04	
Lead	7439-92-1	Y	Y	0.000000E+00	8.589335E-05	1.2500E-05			3.6075E-09		
Manganese	7439-96-5	Y	Y	5.176244E-02	2.797974E-01			9.0000E-02			1.0647E-04
Mercury	7439-97-6	Y	Y	3.541640E-02	1.914565E-01		6.0000E-01	3.0000E-02		7.3784E-03	2.1856E-04
Molybdenum	7439-98-7	N	Y	1.498386E-01	8.097253E-01						
Nickel	7440-02-0	Y	Y	2.860556E-01	1.545894E+00	2.6000E-04	6.0000E+00	5.0000E-02	1.3505E-03	5.9595E-03	1.0588E-03
Selenium	7782-49-2	Y	Y	3.269207E-03	1.773598E-02			2.0000E+01			3.0370E-08
Vanadium	7440-62-2	N	Y	3.132990E-01	1.693062E+00		3.0000E+01			1.3054E-03	
Zinc	7440-66-6	N	Y	3.950291E+00	2.134762E+01						
Risk Prioritization Score for CO2 EOR Operational Emissions											
									3.4585E-01	4.6076E-01	4.2895E-03

Note:

1. Risk is prioritized using the CAPCO "dispersion adjustment procedure". The stack height used for selecting the dispersion adjustment factors was 0.060 (stack < 20m)
2. The gas plant is located in an existing oilfield. The nearest public (or sensitive) receptors are located more than one mile away. Consequently, the receptor adjustment factor used in the analysis was set equal to 0.002 (1500m < receptor < 2,000 m).

HAP/TAC Emissions from
The CO2 Enhanced Oil Recovery (EOR) Project

Total HAP/TAC Emissions from Operational Activities

Chemical Substance	Chemical CAS No	Status (Y/N)		POM Y/N	Maximum Daily Emissions		Annual Emissions	
		HAP	TAC		HAP Lb/Day	TAC Lb/Day	HAP Lb/Year	TAC Lb/Year
1,3 Butadiene	106-99-0	Y	Y	N	2.362395E-02	2.362395E-02	2.914463E+00	2.914463E+00
2-Methylchloroanthrene	56-49-5	Y	Y	Y	3.218824E-06	3.218824E-06	1.174871E-03	1.174871E-03
2-Methylnaphthalene	91-57-6	Y	Y	Y	4.291765E-05	4.291765E-05	1.566494E-02	1.566494E-02
7,12-Dimethylbenz(a)anthracene	57-96-6	Y	Y	Y	2.861176E-05	2.861176E-05	1.044329E-02	1.044329E-02
Acenaphthene	83-32-9	Y	Y	Y	9.061768E-05	9.061768E-05	4.846312E-03	4.846312E-03
Acenaphthylene	208-96-8	Y	Y	Y	8.105859E-02	8.105859E-02	3.783259E+00	3.783259E+00
Acetaldehyde	75-07-0	Y	Y	N	5.845942E+00	5.845942E+00	1.242125E+01	1.242125E+01
Acrolein	107-02-8	Y	Y	N	1.363004E+00	1.363004E+00	6.747030E+00	6.747030E+00
Anthracene	120-12-7	Y	Y	Y	2.105898E-05	2.105898E-05	2.348935E-03	2.348935E-03
Benzene	71-43-2	Y	Y	N	2.152842E+01	2.152842E+01	6.465725E+01	6.465725E+01
Benzo(a)anthracene	56-55-6	Y	Y	Y	4.353405E-05	4.353405E-05	2.913863E-03	2.913863E-03
Benzo(a)pyrene	50-32-8	Y	Y	Y	3.667506E-05	3.667506E-05	2.158306E-03	2.158306E-03
Benzo(b)fluoranthene	205-99-2	Y	Y	Y	6.511720E-06	6.511720E-06	9.215138E-04	9.215138E-04
Benzo(g,h,i)perylene	191-24-2	Y	Y	Y	4.795213E-06	4.795213E-06	6.706358E-04	6.706358E-04
Benzo(k)fluoranthene	207-08-9	Y	Y	Y	4.610908E-06	4.610908E-06	8.328126E-04	8.328126E-04
Butane	106-07-8	N	N	N	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Chlorobenzene	108-90-7	Y	Y	N	2.101145E-05	2.101145E-05	2.439326E-03	2.439326E-03
Chrysene	218-01-9	Y	Y	Y	3.706088E-05	3.706088E-05	2.563406E-03	2.563406E-03
Dibenzo(a,h)anthracene	53-70-3	Y	Y	Y	6.784929E-06	6.784929E-06	7.634857E-04	7.634857E-04
Dibenzochlorine	25321-22-6	Y	Y	N	2.145882E-03	2.145882E-03	7.832471E-01	7.832471E-01
Ethane	74-84-00	N	N	N	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Ethylbenzene	100-41-4	Y	Y	N	1.941341E+02	1.941341E+02	1.270997E+02	1.270997E+02
Fluoranthene	206-44-0	Y	Y	Y	7.122519E-05	7.122519E-05	4.576085E-03	4.576085E-03
Fluorene	86-73-7	Y	Y	Y	4.534543E-04	4.534543E-04	2.264048E-02	2.264048E-02
Formaldehyde	50-00-0	Y	Y	N	1.573480E+02	1.573480E+02	1.392583E+02	1.392583E+02
Hydrogen Chloride	7647-01-0	Y	Y	N	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Hydrogen Sulfide (H2S)	77-83-06-4	N	Y	N	0.000000E+00	3.040000E-01	0.000000E+00	1.109600E+02
Hexane	110-54-3	Y	Y	N	6.419588E+00	6.419588E+00	9.219379E+02	9.219379E+02
Indeno(1,2,3,c,d)pyrene	193-39-5	Y	Y	Y	4.687332E-06	4.687332E-06	8.363789E-04	8.363789E-04
Naphthalene	91-20-3	Y	Y	Y	1.480683E+00	1.480683E+00	1.217449E+00	1.217449E+00
Pentane	109-66-0	N	N	N	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Phenanthrene	85-01-8	Y	Y	Y	1.558973E-03	1.558973E-03	8.100357E-02	8.100357E-02

Total HAP/TAC

HAP/TAC Emissions from
The CO2 Enhanced Oil Recovery (EOR) Project

Total HAP/TAC Emissions from Operational Activities

Chemical Substance	Chemical CAS No	Status (Y/N)		POM Y/N	Maximum Daily Emissions		Annual Emissions	
		HAP	TAC		HAP Lb/Day	TAC Lb/Day	HAP Lb/Year	TAC Lb/Year
Propane	74-98-6	N	N	N	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Propylene	115-07-1	N	Y	N	0.000000E+00	1.946309E+02	0.000000E+00	4.939023E+02
Pyrene	129-00-0	Y	Y	Y	9.368936E-05	9.368936E-05	6.364410E-03	6.364410E-03
Toluene	108-88-3	Y	Y	N	7.870756E+00	7.870756E+00	2.862748E+01	2.862748E+01
Total xylene	1330-20-7	Y	Y	N	3.924734E+00	3.924734E+00	1.087928E+01	1.087928E+01
Total PAH(W/Napthalene)	1150/1151	Y	Y	Y	1.885933E+00	1.885933E+00	1.593559E+00	1.593559E+00
Total PAH(W/O Napthalene)	1150/1151	Y	Y	Y	5.585525E-02	5.585525E-02	2.572432E-01	2.572432E-01
Arsenic	7440-38-2	Y	Y	N	2.742183E-02	2.742183E-02	1.679387E-01	1.679387E-01
Barium	7440-39-3	N	Y	N	0.000000E+00	5.993545E-01	0.000000E+00	3.238901E+00
Beryllium	7440-41-7	Y	Y	N	1.823391E-03	1.823391E-03	3.075071E-02	3.075071E-02
Cadmium	7440-43-9	Y	Y	N	1.499552E-01	1.499552E-01	8.232544E-01	8.232544E-01
Chromium VI	18540-29-9	Y	Y	N	7.549412E-05	7.549412E-05	8.764497E-03	8.764497E-03
Chromium, total	7440-47-3	Y	Y	N	1.913341E-01	1.913341E-01	1.103739E+00	1.103739E+00
Cobalt	744048-4	Y	Y	N	1.144222E-02	1.144222E-02	6.183357E-02	6.183357E-02
Copper	7440-50-8	N	Y	N	0.000000E+00	1.162936E-01	0.000000E+00	6.848077E-01
Lead	7439-92-1	Y	Y	N	3.774706E-04	3.774706E-04	4.382248E-02	4.382248E-02
Manganese	7439-96-5	Y	Y	N	5.208812E-02	5.208812E-02	3.175328E-01	3.175328E-01
Mercury	7439-97-6	Y	Y	N	3.571020E-02	3.571020E-02	2.254975E-01	2.254975E-01
Molybdenum	7439-98-7	N	Y	N	0.000000E+00	1.498386E-01	0.000000E+00	8.097253E-01
Nickel	7440-02-0	Y	Y	N	2.862982E-01	2.862982E-01	1.574006E+00	1.574006E+00
Selenium	7782-49-2	Y	Y	N	3.573505E-03	3.573505E-03	5.299426E-02	5.299426E-02
Vanadium	7440-62-2	N	Y	N	0.000000E+00	3.132990E-01	0.000000E+00	1.693062E+00
Zinc	7440-66-6	N	Y	N	0.000000E+00	3.951669E+00	0.000000E+00	2.150728E+01

Total EPA HAP and CARB TAC	400.761025	600.826375	1,321.985433	1,954.781552
Total EPA Polycyclic Organic Material (POM)	2.235697	N/A	1.625722	N/A

Maximum Daily Emissions of a Single EPA HAP (Ethyl Benzene)	194.134073	194.630895		
Maximum Annual Emissions of a Single HAP (Hexane)			921.937948	921.937948

HAP/TAC Emissions from Natural Gas Fired Heaters

Increase In HAP/TAC Emission From CO2 Injection Heater (60 MMBtu/HR)

Chemical Substance	Chemical CAS No	Status (Y/N)	POM Y/N	Emission Factors (Lb/MMBtu)				MMBtu/Day =		1,440.00		MMBtu/Year =		525,600.00	
		HAP	TAC	VCAPCD	EPA	SJ/APCD	Average	HAP Lb/Day	TAC Lb/Day	HAP Lb/Day	TAC Lb/Day	HAP Lb/Year	TAC Lb/Year	HAP Lb/Year	TAC Lb/Year
1,3 Butadiene	106-99-0	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	0.000000
2-Methylchloranthrene	56-49-5	Y	Y		1.764706E-09		1.764706E-09	2.541176E-06	2.541176E-06	2.541176E-06	2.541176E-06	0.000928	0.000928	0.000928	0.000928
2-Methylnaphthalene	91-57-6	Y	Y		2.352941E-08		2.352941E-08	3.388235E-05	3.388235E-05	3.388235E-05	3.388235E-05	0.012367	0.012367	0.012367	0.012367
7,12-Dimethylbenz(a)anthracene	57-96-6	Y	Y		1.568627E-08		1.568627E-08	2.258824E-05	2.258824E-05	2.258824E-05	2.258824E-05	0.008245	0.008245	0.008245	0.008245
Acenaphthene	83-32-9	Y	Y		1.764706E-09		1.764706E-09	1.531765E-06	1.531765E-06	1.531765E-06	1.531765E-06	0.000559	0.000559	0.000559	0.000559
Acenaphthylene	208-96-8	Y	Y		1.764706E-09		1.764706E-09	1.651765E-06	1.651765E-06	1.651765E-06	1.651765E-06	0.000603	0.000603	0.000603	0.000603
Acetaldehyde	75-07-0	Y	Y		3.039216E-06		3.039216E-06	3.317647E-03	3.317647E-03	3.317647E-03	3.317647E-03	1.210941	1.210941	1.210941	1.210941
Acrolein	107-02-8	Y	Y		2.647059E-06		2.647059E-06	1.178824E-02	1.178824E-02	1.178824E-02	1.178824E-02	4.302706	4.302706	4.302706	4.302706
Anthracene	120-12-7	Y	Y					3.388235E-06	3.388235E-06	3.388235E-06	3.388235E-06	0.001237	0.001237	0.001237	0.001237
Benene	71-43-2	Y	Y		2.352941E-09		2.352941E-09	3.388235E-06	3.388235E-06	3.388235E-06	3.388235E-06	1.631765	1.631765	1.631765	1.631765
Benzo(a)anthracene	56-55-6	Y	Y		2.058824E-06		1.568627E-06	4.470588E-03	4.470588E-03	4.470588E-03	4.470588E-03	0.000799	0.000799	0.000799	0.000799
Benzo(a)pyrene	50-32-8	Y	Y		1.764706E-09		1.764706E-09	2.188235E-06	2.188235E-06	2.188235E-06	2.188235E-06	0.000405	0.000405	0.000405	0.000405
Benzo(b)fluoranthene	205-99-2	Y	Y		1.176471E-09		3.627451E-10	1.108235E-06	1.108235E-06	1.108235E-06	1.108235E-06	0.000559	0.000559	0.000559	0.000559
Benzo(g,h,i)perylene	191-24-2	Y	Y		1.764706E-09		3.627451E-10	1.108235E-06	1.108235E-06	1.108235E-06	1.108235E-06	0.000405	0.000405	0.000405	0.000405
Benzo(k)fluoranthene	207-08-9	Y	Y		1.764706E-09		3.627451E-10	1.063725E-09	1.063725E-09	1.063725E-09	1.063725E-09	0.000559	0.000559	0.000559	0.000559
Butane	106-07-8	N	N		2.058824E-03			0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	0.000000
Chlorobenzene	108-90-7	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	0.000000
Chrysene	218-01-9	Y	Y		1.764706E-09		1.107843E-09	2.068235E-06	2.068235E-06	2.068235E-06	2.068235E-06	0.000755	0.000755	0.000755	0.000755
Dibenzo(a,h)anthracene	53-70-3	Y	Y		1.176471E-09		3.627451E-10	1.108235E-06	1.108235E-06	1.108235E-06	1.108235E-06	0.000405	0.000405	0.000405	0.000405
Dibenzochlorine	25321-22-6	Y	Y		1.176471E-06			1.694118E-03	1.694118E-03	1.694118E-03	1.694118E-03	0.618353	0.618353	0.618353	0.618353
Ethane	74-84-00	N	N		3.039216E-03			0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	0.000000
Ethylbenzene	100-41-4	Y	Y		1.176471E-06		1.176471E-05	9.264706E-06	1.334118E-02	1.334118E-02	1.334118E-02	4.869529	4.869529	4.869529	4.869529
Fluoranthene	206-44-0	Y	Y		2.941176E-09		1.372549E-09	2.156863E-09	3.105882E-06	3.105882E-06	3.105882E-06	0.001134	0.001134	0.001134	0.001134
Fluorene	86-73-7	Y	Y		2.745098E-09		2.352941E-09	2.549020E-09	3.670588E-06	3.670588E-06	3.670588E-06	0.001340	0.001340	0.001340	0.001340
Formaldehyde	50-00-0	Y	Y		1.205882E-05		7.352941E-05	5.661176E-02	5.661176E-02	5.661176E-02	5.661176E-02	20.663294	20.663294	20.663294	20.663294
Hydrogen Chloride	7647-01-0	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	0.000000
Hydrogen Sulfide (H2S)	77-83-06-4	N	Y		1.666667E-04			0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	0.000000
Hexane	110-54-3	Y	Y		4.509804E-06		1.764706E-03	1.273835E+00	1.273835E+00	1.273835E+00	1.273835E+00	464.949882	464.949882	464.949882	464.949882
Indeno(1,2,3-c,d)pyrene	193-39-5	Y	Y					1.531765E-06	1.531765E-06	1.531765E-06	1.531765E-06	0.000559	0.000559	0.000559	0.000559
Naphthalene	91-20-3	Y	Y		2.941176E-07		5.980392E-07	5.162353E-04	5.162353E-04	5.162353E-04	5.162353E-04	0.188426	0.188426	0.188426	0.188426
Pentane	109-66-0	N	N				2.549020E-03	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	0.000000
Phenanthrene	85-01-8	Y	Y		1.666667E-08		1.176471E-08	2.047059E-05	2.047059E-05	2.047059E-05	2.047059E-05	0.007472	0.007472	0.007472	0.007472
Propane	74-98-6	N	N				1.568627E-03	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	0.000000
Propylene	115-07-1	N	Y		5.196078E-04		5.882353E-04	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	291.141176	291.141176	291.141176	291.141176
Pyrene	129-00-0	Y	Y		4.901961E-09		1.960784E-09	4.941176E-06	4.941176E-06	4.941176E-06	4.941176E-06	0.001804	0.001804	0.001804	0.001804
Toluene	108-88-3	Y	Y		2.598039E-05		3.333333E-06	2.348235E-02	2.348235E-02	2.348235E-02	2.348235E-02	8.571059	8.571059	8.571059	8.571059
Total xylene	1330-20-7	Y	Y		1.931373E-05		2.058824E-07	1.405412E-02	1.405412E-02	1.405412E-02	1.405412E-02	5.129753	5.129753	5.129753	5.129753
Total PAH(W/Naphthalene)	1150/1151	Y	Y		3.921569E-07		6.543137E-07	6.011294E-04	6.011294E-04	6.011294E-04	6.011294E-04	0.219412	0.219412	0.219412	0.219412
Total PAH(W/O Naphthalene)	1150/1151	Y	Y		3.921569E-07		5.627451E-08	2.181040E-07	2.181040E-07	2.181040E-07	2.181040E-07	0.114636	0.114636	0.114636	0.114636

HAP/TAC Emissions from Natural Gas Fired Heaters

Increase In HAP/TAC Emission From CO2 Injection Heater (60 MMBtu/HR)

Chemical Substance	Chemical CAS No	Status (Y/N)		POM Y/N	Emission Factors (Lb/MMBtu)				MMBtu/Day = HAP Lb/Day	1,440.00 TAC Lb/Day	MMBtu/Year = HAP Lb/Year	525,600.00 TAC Lb/Year
		HAP	TAC		VCAPCD	EPA	SJVAPCD	Average				
Arsenic	7440-38-2	Y	Y	N		1.960784E-07		1.960784E-07	2.823529E-04	2.823529E-04	0.103059	0.103059
Barium	7440-39-3	N	Y	N		4.313725E-06		4.313725E-06	0.000000E+00	6.211765E-03	0.000000	2.267294
Beryllium	7440-41-7	Y	Y	N		1.176471E-08		1.176471E-08	1.694118E-05	1.694118E-05	0.006184	0.006184
Cadmium	7440-43-9	Y	Y	N		1.078431E-06		1.078431E-06	1.552941E-03	1.552941E-03	0.566824	0.566824
Chromium VI	18540-29-9	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Chromium, total	7440-47-3	Y	Y	N		1.372549E-06		1.372549E-06	1.976471E-03	1.976471E-03	0.721412	0.721412
Cobalt	7440-48-4	Y	Y	N		8.235294E-08		8.235294E-08	1.185882E-04	1.185882E-04	0.043285	0.043285
Copper	7440-50-8	N	Y	N		8.333333E-07		8.333333E-07	0.000000E+00	1.200000E-03	0.000000	0.438000
Lead	7439-92-1	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Manganese	7439-96-5	Y	Y	N		3.725490E-07		3.725490E-07	5.364706E-04	5.364706E-04	0.195812	0.195812
Mercury	7439-97-6	Y	Y	N		2.549020E-07		2.549020E-07	3.670588E-04	3.670588E-04	0.133976	0.133976
Molybdenum	7439-98-7	N	Y	N		1.078431E-06		1.078431E-06	0.000000E+00	1.552941E-03	0.000000	0.566824
Nickel	7440-02-0	Y	Y	N		2.058824E-06		2.058824E-06	2.964706E-03	2.964706E-03	1.082118	1.082118
Selenium	7782-49-2	Y	Y	N		2.352941E-08		2.352941E-08	3.388235E-05	3.388235E-05	0.012367	0.012367
Vanadium	7440-62-2	N	Y	N		2.254902E-06		2.254902E-06	0.000000E+00	3.247059E-03	0.000000	1.185176
Zinc	7440-66-6	N	Y	N		2.843137E-05		2.843137E-05	0.000000E+00	4.094118E-02	0.000000	14.943529
Total EPA HAP and CARB TAC (Lb/Year)												
Total EPA Polycyclic Organic Material (POM)												
									1.411071	2.501871	515.040875	913.182875
									0.000626	N/A	0.228557	N/A

HAP/TAC Emissions from Natural Gas Fired Heaters

Increase In HAP/TAC Emission From Mole Sieve Heater (10 MMBtu/Hr)

Chemical Substance	Chemical CAS No	Status (Y/N)		POM Y/N	Emission Factors (Lb/MMBtu)				MMBtu/Day =		240.00 TAC Lb/Day	MMBtu/Year =		87,600.00 TAC Lb/Year
		HAP	TAC		VCAPOD	EPA	SJ/VAPCD	Average	HAP Lb/Day	TAC Lb/Day		HAP Lb/Year	TAC Lb/Year	
1,3 Butadiene	106-99-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	
2-Methylchloroanthrene	56-49-5	Y	Y	Y		1.764706E-09		1.764706E-09	4.235294E-07	4.235294E-07	0.000155	0.000155	0.000155	
2-Methylnaphthalene	91-57-6	Y	Y	Y		2.352941E-08		2.352941E-08	5.647059E-06	5.647059E-06	0.002061	0.002061	0.002061	
7,12-Dimethylbenz(a)anthracene	57-96-6	Y	Y	Y		1.588627E-08		1.588627E-08	3.764706E-06	3.764706E-06	0.001374	0.001374	0.001374	
Acenaphthene	83-32-9	Y	Y	Y		1.764706E-09		3.627451E-10	1.063725E-09	2.552941E-07	0.000093	0.000093	0.000093	
Acenaphthylene	208-96-8	Y	Y	Y		1.764706E-09		5.294118E-10	1.147059E-09	2.752941E-07	0.000100	0.000100	0.000100	
Acetaldehyde	75-07-0	Y	Y	N	3.039216E-06			1.588627E-06	2.303922E-06	5.529412E-04	0.201824	0.201824	0.201824	
Acrolein	107-02-8	Y	Y	N	2.647059E-06			1.372549E-05	8.186275E-06	1.964706E-03	0.717118	0.717118	0.717118	
Anthracene	120-12-7	Y	Y	Y		2.352941E-09		2.352941E-09	5.647059E-07	5.647059E-07	0.000206	0.000206	0.000206	
Benzenes	71-43-2	Y	Y	N	5.686275E-06			1.568627E-06	3.104575E-06	7.450980E-04	0.271961	0.271961	0.271961	
Benzo(a)anthracene	56-55-6	Y	Y	Y		1.764706E-09		1.274510E-09	1.519608E-09	3.647059E-07	0.000133	0.000133	0.000133	
Benzo(a)pyrene	50-32-8	Y	Y	Y		1.176471E-09		3.627451E-10	7.696078E-10	1.847059E-07	0.000067	0.000067	0.000067	
Benzo(b)fluoranthene	205-99-2	Y	Y	Y		1.764706E-09		3.627451E-10	1.063725E-09	2.552941E-07	0.000093	0.000093	0.000093	
Benzo(g,h,i)perylene	191-24-2	Y	Y	Y		1.176471E-09		3.627451E-10	7.696078E-10	1.847059E-07	0.000067	0.000067	0.000067	
Benzo(k)fluoranthene	207-08-9	Y	Y	Y		1.764706E-09		3.627451E-10	1.063725E-09	2.552941E-07	0.000093	0.000093	0.000093	
Butane	106-07-8	N	N	N	2.058824E-03				2.058824E-03	0.000000E+00	0.000000	0.000000	0.000000	
Chlorobenzene	108-90-7	Y	Y	N						0.000000E+00	0.000000	0.000000	0.000000	
Chrysene	218-01-9	Y	Y	Y		1.764706E-09		1.107843E-09	1.436275E-09	3.447059E-07	0.000126	0.000126	0.000126	
Dibenzo(a,h)anthracene	53-70-3	Y	Y	Y		1.176471E-09		3.627451E-10	7.696078E-10	1.847059E-07	0.000067	0.000067	0.000067	
Dibenzochlorine	25321-22-6	Y	Y	N		1.176471E-06			1.76471E-06	2.823529E-04	0.103059	0.103059	0.103059	
Ethane	74-84-00	N	N	N	3.039216E-03				3.039216E-03	0.000000E+00	0.000000	0.000000	0.000000	
Ethylbenzene	100-41-4	Y	Y	N	6.764706E-06			1.176471E-05	9.264706E-06	2.223529E-03	0.811588	0.811588	0.811588	
Fluoranthene	206-44-0	Y	Y	Y		1.176471E-09		1.372549E-09	2.156863E-09	5.176471E-07	0.000189	0.000189	0.000189	
Fluorene	86-73-7	Y	Y	Y		2.745098E-09		2.352941E-09	2.549020E-09	6.117647E-07	0.000223	0.000223	0.000223	
Formaldehyde	50-00-0	Y	Y	N	1.205882E-05			7.352941E-05	9.435294E-03	9.435294E-03	3.443882	3.443882	3.443882	
Hydrogen Chloride	7647-01-0	Y	Y	N						0.000000E+00	0.000000	0.000000	0.000000	
Hydrogen Sulfide (H2S)	77-83-06-4	N	Y	N						0.000000E+00	0.000000	0.000000	0.000000	
Hexane	110-54-3	Y	Y	N	4.509804E-06					0.000000E+00	0.000000	0.000000	0.000000	
Indeno(1,2,3-c,d)pyrene	193-39-5	Y	Y	Y		1.764706E-09		3.627451E-10	1.063725E-09	2.552941E-07	0.000093	0.000093	0.000093	
Naphthalene	91-20-3	Y	Y	Y	2.941176E-07			1.833333E-07	3.584967E-07	8.603922E-05	0.031404	0.031404	0.031404	
Pentane	109-66-0	N	N	N	2.549020E-03			2.549020E-03	2.549020E-03	0.000000E+00	0.000000	0.000000	0.000000	
Phenanthrene	85-01-8	Y	Y	Y		1.666667E-08		1.176471E-08	1.421569E-08	3.411765E-06	0.001245	0.001245	0.001245	
Propane	74-98-6	N	N	N		1.588627E-03				0.000000E+00	0.000000	0.000000	0.000000	
Propylene	115-07-1	N	Y	N	5.196078E-04			5.882353E-04	5.539216E-04	1.329412E-01	48.523529	48.523529	48.523529	
Pyrene	129-00-0	Y	Y	Y		4.901961E-09		1.960784E-09	3.431373E-09	8.235294E-07	0.000301	0.000301	0.000301	
Toluene	108-88-3	Y	Y	N	2.598039E-05			1.960784E-05	1.630719E-05	3.913725E-03	1.428510	1.428510	1.428510	
Total xylene	1330-20-7	Y	Y	N	1.931373E-05			2.058824E-07	9.759804E-06	2.342353E-03	0.854959	0.854959	0.854959	
Total PAH(W/Naphthalene)	1150/1151	Y	Y	Y	3.921569E-07			6.543137E-07	2.058824E-07	1.001882E-04	0.036569	0.036569	0.036569	
Total PAH(W/O Naphthalene)	1150/1151	Y	Y	Y	3.921569E-07			5.627451E-08	2.058824E-07	5.234510E-05	0.019106	0.019106	0.019106	

HAP/TAC Emissions from Natural Gas Fired Heaters

Increase In HAP/TAC Emission From Mole Sieve Heater (10 MMBtu/Hr)

Chemical Substance	Chemical CAS No	Status (Y/N)		POM Y/N	Emission Factors (Lb/MMBtu)			MMBtu/Day =		240.00		MMBtu/Year =		87,600.00	
		HAP	TAC		VCAPCD	EPA	SJVAPCD	Average	HAP Lb/Day	TAC Lb/Day	HAP Lb/Year	TAC Lb/Year			
Arsenic	7440-38-2	Y	Y	N		1.960784E-07		1.960784E-07	4.705882E-05	4.705882E-05	0.017176	0.017176	0.377882	0.377882	
Barium	7440-39-3	N	Y	N		4.313725E-06		4.313725E-06	0.000000E+00	1.035294E-03	0.000000	0.000000	0.001031	0.001031	
Beryllium	7440-41-7	Y	Y	N		1.176471E-08		1.176471E-08	2.823529E-06	2.823529E-06	0.001031	0.001031	0.094471	0.094471	
Cadmium	7440-43-9	Y	Y	N		1.078431E-06		1.078431E-06	2.588235E-04	2.588235E-04	0.094471	0.094471	0.000000	0.000000	
Chromium VI	18540-29-9	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000	0.120235	0.120235	
Chromium, total	7440-47-3	Y	Y	N		1.372549E-06		1.372549E-06	3.294118E-04	3.294118E-04	0.120235	0.120235	0.007214	0.007214	
Cobalt	7440-48-4	Y	Y	N		8.235294E-08		8.235294E-08	1.976471E-05	1.976471E-05	0.000000	0.000000	0.073000	0.073000	
Copper	7440-50-8	N	Y	N		8.333333E-07		8.333333E-07	0.000000E+00	2.000000E-04	0.000000	0.000000	0.000000	0.000000	
Lead	7439-92-1	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000	0.032635	0.032635	
Manganese	7439-96-5	Y	Y	N		3.725490E-07		3.725490E-07	8.941176E-05	8.941176E-05	0.032635	0.032635	0.022329	0.022329	
Mercury	7439-97-6	Y	Y	N		2.549020E-07		2.549020E-07	6.117647E-05	6.117647E-05	0.022329	0.022329	0.094471	0.094471	
Molybdenum	7439-98-7	N	Y	N		1.078431E-06		1.078431E-06	0.000000E+00	2.588235E-04	0.000000	0.000000	0.180353	0.180353	
Nickel	7440-02-0	Y	Y	N		2.058824E-06		2.058824E-06	4.941176E-04	4.941176E-04	0.180353	0.180353	0.002061	0.002061	
Selenium	7782-49-2	Y	Y	N		2.352941E-08		2.352941E-08	5.647059E-06	5.647059E-06	0.002061	0.002061	0.197529	0.197529	
Vanadium	7440-62-2	N	Y	N		2.254902E-06		2.254902E-06	0.000000E+00	5.411765E-04	0.000000	0.000000	2.490588	2.490588	
Zinc	7440-66-6	N	Y	N		2.843137E-05		2.843137E-05	0.000000E+00	6.823529E-03	0.000000	0.000000	152.197146	152.197146	
Total EPA HAP and CARB TAC (Lb/Year)										0.235178	0.416978	85.840146	152.197146	N/A	N/A
Total EPA Polycyclic Organic Material (POM)										0.000104	0.038093	0.038093	N/A	N/A	N/A

HAP/TAC Emissions from Natural Gas Fired Heaters

Increase In HAP/TAC Emission From TEG Heater (5 MMBtu/Hr)

Chemical Substance	Chemical CAS No	Status (Y/N)		POM Y/N	Emission Factors (Lb/MMBtu)				MMBtu/Day =		120.00		MMBtu/Year =		TAC Lb/Year	43,800.00
		HAP	TAC		VCAPCD	EPA	SJAPCD	Average	HAP Lb/Day	TAC Lb/Day	HAP Lb/Year	TAC Lb/Year				
1,3 Butadiene	106-99-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000		0.000000		0.000000	
2-Methylchloranthrene	56-49-5	Y	Y	Y		1.764706E-09		1.764706E-09	2.117647E-07	2.117647E-07	0.000077		0.000077		0.000077	
2-Methylnaphthalene	91-57-6	Y	Y	Y		2.352941E-08		2.352941E-08	2.823529E-06	2.823529E-06	0.001031		0.001031		0.001031	
7,12-Dimethylbenz(a)anthracene	57-96-6	Y	Y	Y		1.568627E-08		1.568627E-08	1.882353E-06	1.882353E-06	0.000687		0.000687		0.000687	
Acenaphthene	83-32-9	Y	Y	Y		1.764706E-09	3.627451E-10	1.063725E-09	1.276471E-07	1.276471E-07	0.000047		0.000047		0.000047	
Acenaphthylene	208-96-8	Y	Y	Y		1.764706E-09	5.294118E-10	1.1470769E-09	1.376471E-07	1.376471E-07	0.000050		0.000050		0.000050	
Acetaldehyde	75-07-0	Y	Y	N	3.039216E-06		1.568627E-06	2.303922E-06	2.764706E-04	2.764706E-04	0.100912		0.100912		0.100912	
Acrolein	107-02-8	Y	Y	N	2.647059E-06		1.372549E-05	8.186275E-06	9.823529E-04	9.823529E-04	0.358559		0.358559		0.358559	
Anthracene	120-12-7	Y	Y	Y			2.352941E-09	2.352941E-09	2.823529E-07	2.823529E-07	0.000103		0.000103		0.000103	
Benzene	71-43-2	Y	Y	Y	5.686275E-06		2.058824E-06	3.104575E-06	3.725490E-04	3.725490E-04	0.135980		0.135980		0.135980	
Benzo(a)anthracene	56-55-6	Y	Y	Y			1.764706E-09	1.274510E-09	1.519608E-09	1.823529E-07	0.000067		0.000067		0.000067	
Benzo(a)pyrene	50-32-8	Y	Y	Y			1.76471E-09	3.627451E-10	7.696078E-10	9.235294E-08	0.000034		0.000034		0.000034	
Benzo(b)fluoranthene	205-99-2	Y	Y	Y			1.764706E-09	3.627451E-10	1.063725E-09	1.276471E-07	0.000047		0.000047		0.000047	
Benzo(g,h,i)perylene	191-24-2	Y	Y	Y			1.76471E-09	3.627451E-10	7.696078E-10	9.235294E-08	0.000034		0.000034		0.000034	
Benzo(k)fluoranthene	207-08-9	Y	Y	Y			1.764706E-09	3.627451E-10	1.063725E-09	1.276471E-07	0.000047		0.000047		0.000047	
Butane	106-07-8	N	N	N			2.058824E-03	2.058824E-03	0.000000E+00	0.000000E+00	0.000000		0.000000		0.000000	
Chlorobenzene	108-90-7	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000		0.000000		0.000000	
Chrysene	218-01-9	Y	Y	Y			1.764706E-09	1.107843E-09	1.436275E-09	1.723529E-07	0.000063		0.000063		0.000063	
Dibenzo(a,h)anthracene	53-70-3	Y	Y	Y			1.176471E-09	3.627451E-10	7.696078E-10	9.235294E-08	0.000034		0.000034		0.000034	
Dibenzochlorine	25321-22-6	Y	Y	N			1.76471E-06		1.76471E-06	1.411765E-04	0.051529		0.051529		0.051529	
Ethane	74-84-00	N	N	N			3.039216E-03		3.039216E-03	0.000000E+00	0.000000		0.000000		0.000000	
Ethylbenzene	100-41-4	Y	Y	N	6.764706E-06			1.176471E-05	9.264706E-06	1.111765E-03	0.405794		0.405794		0.405794	
Fluoranthene	206-44-0	Y	Y	Y			2.941176E-09	1.372549E-09	2.156863E-09	2.588235E-07	0.000094		0.000094		0.000094	
Fluorene	86-73-7	Y	Y	Y			2.745098E-09	2.352941E-09	2.549020E-09	3.058824E-07	0.000112		0.000112		0.000112	
Formaldehyde	50-00-0	Y	Y	N	1.205882E-05		7.352941E-05	3.235294E-05	3.931373E-05	4.717647E-03	1.721941		1.721941		1.721941	
Hydrogen Chloride	7647-01-0	Y	Y	Y						4.717647E-03	4.717647E-03		4.717647E-03		4.717647E-03	
Hydrogen Sulfide (H2S)	77-83-06-4	N	Y	N						0.000000E+00	0.000000E+00		0.000000		0.000000	
Hexane	110-54-3	Y	Y	N	4.509804E-06		1.666667E-04		1.666667E-04	0.000000E+00	0.000000E-02		0.000000		7.3000000	
Indeno(1,2,3-c,d)pyrene	193-39-5	Y	Y	Y			1.764706E-09	3.627451E-10	1.063725E-09	1.061529E-01	38.745824		38.745824		38.745824	
Naphthalene	91-20-3	Y	Y	Y	2.941176E-07		5.980392E-07	1.833333E-07	3.584967E-07	1.276471E-07	0.000047		0.000047		0.000047	
Pentane	109-66-0	N	N	N			2.549020E-03		2.549020E-03	0.000000E+00	0.000000E+00		0.000000		0.000000	
Phenanthrene	85-01-8	Y	Y	Y			1.666667E-08	1.176471E-08	1.421569E-08	1.705882E-06	0.000623		0.000623		0.000623	
Propane	74-98-6	N	N	N			1.568627E-03		1.568627E-03	0.000000E+00	0.000000E+00		0.000000		0.000000	
Propylene	115-07-1	N	Y	N	5.196078E-04		5.882353E-04	5.539216E-04	6.647059E-02	6.647059E-02	0.000000		0.000000		24.261765	
Pyrene	129-00-0	Y	Y	Y			1.960784E-09	3.431373E-09	4.117647E-07	4.117647E-07	0.000150		0.000150		0.000150	
Toluene	108-88-3	Y	Y	N	2.598039E-05		3.333333E-06	1.960784E-05	1.630719E-05	1.958863E-03	0.714255		0.714255		0.714255	
Total xylene	1330-20-7	Y	Y	N	1.931373E-05		2.058824E-07	9.759804E-06	1.171176E-03	1.171176E-03	0.427479		0.427479		0.427479	
Total PAH(W/Naphthalene)	1150/1151	Y	Y	Y	3.921569E-07		6.543137E-07	2.058824E-07	4.174510E-07	5.009412E-05	0.018284		0.018284		0.018284	
Total PAH(W/O Naphthalene)	1150/1151	Y	Y	Y	3.921569E-07		5.627451E-08	2.058824E-07	2.181046E-07	2.617255E-05	0.009553		0.009553		0.009553	

HAP/TAC Emissions from Natural Gas Fired Heaters

Increase In HAP/TAC Emission From TEG Heater (5 MMBtu/Hr)

Chemical Substance	Chemical CAS No	Status (Y/N)		POM Y/N	Emission Factors (Lb/MMBtu)				MMBtu/Day =		120.00		MMBtu/Year =		43,800.00	
		HAP	TAC		VCAPCD	EPA	SJVAPCD	Average	HAP Lb/Day	TAC Lb/Day	HAP Lb/Year	TAC Lb/Year				
Arsenic	7440-38-2	Y	Y	N			1.960784E-07		1.960784E-07	2.352941E-05	2.352941E-05		0.008588		0.008588	
Barium	7440-39-3	N	Y	N			4.313725E-06		4.313725E-06	0.000000E+00	5.176471E-04		0.000000		0.188941	
Beryllium	7440-41-7	Y	Y	N			1.176471E-08		1.176471E-08	1.411765E-06	1.411765E-06		0.000515		0.000515	
Cadmium	7440-43-9	Y	Y	N			1.078431E-06		1.078431E-06	1.294118E-04	1.294118E-04		0.047235		0.047235	
Chromium VI	18540-29-9	Y	Y	N						0.000000E+00	0.000000E+00		0.000000		0.000000	
Chromium, total	7440-47-3	Y	Y	N			1.372549E-06		1.372549E-06	1.647059E-04	1.647059E-04		0.060118		0.060118	
Cobalt	744048-4	Y	Y	N			8.235294E-08		8.235294E-08	9.882353E-06	9.882353E-06		0.003607		0.003607	
Copper	7440-50-8	N	Y	N			8.333333E-07		8.333333E-07	0.000000E+00	1.000000E-04		0.000000		0.036500	
Lead	7439-92-1	Y	Y	N						0.000000E+00	0.000000E+00		0.000000		0.000000	
Manganese	7439-96-5	Y	Y	N			3.725490E-07		3.725490E-07	4.470588E-05	4.470588E-05		0.016318		0.016318	
Mercury	7439-97-6	Y	Y	N			2.549020E-07		2.549020E-07	3.058824E-05	3.058824E-05		0.011165		0.011165	
Molybdenum	7439-98-7	N	Y	N			1.078431E-06		1.078431E-06	0.000000E+00	1.294118E-04		0.000000		0.047235	
Nickel	7440-02-0	Y	Y	N			2.058824E-06		2.058824E-06	2.470588E-04	2.470588E-04		0.090176		0.090176	
Selenium	7782-49-2	Y	Y	N			2.352941E-08		2.352941E-08	2.823529E-06	2.823529E-06		0.001031		0.001031	
Vanadium	7440-62-2	N	Y	N			2.254902E-06		2.254902E-06	0.000000E+00	2.705882E-04		0.000000		0.098765	
Zinc	7440-66-6	N	Y	N			2.843137E-05		2.843137E-05	0.000000E+00	3.411765E-03		0.000000		1.245294	
Total EPA HAP and CARB TAC (Lb/Year)																
Total EPA Polycyclic Organic Material (POM)																
										0.117589	0.208489		42.920073		0.019046	N/A
										0.000052	N/A					

HAP/TAC Emissions from Natural Gas Fired Heaters

Increase In HAP/TAC Emission From TEG Heater (1 MMBtu/Hr)

Chemical Substance	Chemical CAS No	Status (Y/N)		Emission Factors (Lb/MMBtu)			MMBtu/Day =		24.00		MMBtu/Year =	
		HAP	Y/N	POM Y/N	VCAPCD	EPA	SJ/VP/CD	Average	HAP Lb/Day	TAC Lb/Day	HAP Lb/Year	TAC Lb/Year
1,3 Butadiene	106-99-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	8,760.00
2-Methylchloroanthrene	56-49-5	Y	Y	Y		1.764706E-09		1.764706E-09	4.235294E-08	4.235294E-08	0.000015	0.000015
2-Methylnaphthalene	91-57-6	Y	Y	Y		2.352941E-08		2.352941E-08	5.647059E-07	5.647059E-07	0.000206	0.000206
7,12-Dimethylbenz(a)anthracene	57-96-6	Y	Y	Y		1.568627E-08		1.568627E-08	3.764706E-07	3.764706E-07	0.000137	0.000137
Acenaphthene	83-32-9	Y	Y	Y		1.764706E-09		1.063725E-09	2.552941E-08	2.552941E-08	0.000009	0.000009
Acenaphthylene	208-96-8	Y	Y	Y		1.764706E-09		5.294118E-10	2.752941E-08	2.752941E-08	0.000010	0.000010
Acetaldehyde	75-07-0	Y	Y	N	3.039216E-06			1.568627E-06	5.529412E-05	5.529412E-05	0.020182	0.020182
Acrolein	107-02-8	Y	Y	N	2.647059E-06			1.372549E-05	1.964706E-04	1.964706E-04	0.071712	0.071712
Anthracene	120-12-7	Y	Y	Y		2.352941E-09		2.352941E-09	5.647059E-08	5.647059E-08	0.000021	0.000021
Benzene	71-43-2	Y	Y	N	5.686275E-06			2.058824E-06	7.450980E-05	7.450980E-05	0.027196	0.027196
Benzo(a)anthracene	56-55-6	Y	Y	Y		1.764706E-09		1.274510E-09	3.647059E-08	3.647059E-08	0.000013	0.000013
Benzo(a)pyrene	50-32-8	Y	Y	Y		1.176471E-09		3.627451E-10	1.847059E-08	1.847059E-08	0.000007	0.000007
Benzo(b)fluoranthene	205-99-2	Y	Y	Y		1.764706E-09		3.627451E-10	2.552941E-08	2.552941E-08	0.000009	0.000009
Benzo(g,h,i)perylene	191-24-2	Y	Y	Y		1.176471E-09		7.696078E-10	1.847059E-08	1.847059E-08	0.000007	0.000007
Benzo(k)fluoranthene	207-08-9	Y	Y	Y		1.764706E-09		1.063725E-09	2.552941E-08	2.552941E-08	0.000009	0.000009
Butane	106-07-8	N	N	N		2.058824E-03		2.058824E-03	0.000000E+00	0.000000E+00	0.000000	0.000000
Chlorobenzene	108-90-7	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Chrysene	218-01-9	Y	Y	Y		1.764706E-09		1.107843E-09	3.447059E-08	3.447059E-08	0.000013	0.000013
Dibenzo(a,h)anthracene	53-70-3	Y	Y	Y		1.176471E-09		3.627451E-10	1.847059E-08	1.847059E-08	0.000007	0.000007
Dibenzochlorine	25321-22-6	Y	Y	N		1.176471E-06		1.176471E-06	2.823529E-05	2.823529E-05	0.010306	0.010306
Ethane	74-84-00	N	N	N		3.039216E-03			0.000000E+00	0.000000E+00	0.000000	0.000000
Ethylbenzene	100-41-4	Y	Y	N	6.764706E-06			1.176471E-05	2.223529E-04	2.223529E-04	0.081159	0.081159
Fluoranthene	206-44-0	Y	Y	Y		2.941176E-09		1.372549E-09	5.176471E-08	5.176471E-08	0.000019	0.000019
Fluorene	86-73-7	Y	Y	Y		2.745098E-09		2.352941E-09	6.117647E-08	6.117647E-08	0.000022	0.000022
Formaldehyde	50-00-0	Y	Y	N	1.205882E-05			7.352941E-05	9.435294E-04	9.435294E-04	0.344388	0.344388
Hydrogen Chloride	7647-01-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Hydrogen Sulfide (H2S)	77-83-06-4	N	Y	N		1.666667E-04		1.666667E-04	0.000000E+00	0.000000E+00	0.000000	0.000000
Hexane	110-54-3	Y	Y	N	4.509804E-06			8.846078E-04	2.123059E-02	2.123059E-02	7.749165	7.749165
Indeno(1,2,3-c,d)pyrene	193-39-5	Y	Y	Y		1.764706E-09		3.627451E-10	2.552941E-08	2.552941E-08	0.000009	0.000009
Naphthalene	91-20-3	Y	Y	Y	2.941176E-07			1.833333E-07	8.603922E-06	8.603922E-06	0.003140	0.003140
Pentane	109-66-0	N	N	N		2.549020E-03		2.549020E-03	0.000000E+00	0.000000E+00	0.000000	0.000000
Phenanthrene	85-01-8	Y	Y	Y		1.666667E-08		1.176471E-08	3.411765E-07	3.411765E-07	0.000125	0.000125
Propane	74-98-6	N	N	N		1.568627E-03			0.000000E+00	0.000000E+00	0.000000	0.000000
Propylene	115-07-1	N	Y	N	5.196078E-04			5.882353E-04	0.000000E+00	1.329412E-02	0.000000	4.852353
Pyrene	129-00-0	Y	Y	Y		4.901961E-09		1.960784E-09	8.235294E-08	8.235294E-08	0.000030	0.000030
Toluene	108-88-3	Y	Y	N	2.598039E-05			1.960784E-05	3.913725E-04	3.913725E-04	0.142851	0.142851
Total xylene	1330-20-7	Y	Y	N	1.931373E-05			2.058824E-07	2.342353E-04	2.342353E-04	0.085496	0.085496
Total PAH(W/Naphthalene)	1150/1151	Y	Y	Y	3.921569E-07			2.058824E-07	1.001882E-05	1.001882E-05	0.003657	0.003657
Total PAH(W/O Naphthalene)	1150/1151	Y	Y	Y	3.921569E-07			2.058824E-07	5.234510E-06	5.234510E-06	0.001911	0.001911

HAP/TAC Emissions from Natural Gas Fired Heaters

Increase In HAP/TAC Emission From TEG Heater (1 MMBtu/Hr)

Chemical Substance	Chemical CAS No	Status (Y/N)		POM Y/N	Emission Factors (Lb/MMBtu)			MMBtu/Day =		24.00		MMBtu/Year =	
		HAP	TAC		VCAPCD	EPA	SJVAPCD	Average	HAP Lb/Day	TAC Lb/Day	HAP Lb/Year	TAC Lb/Year	
Arsenic	7440-38-2	Y	Y	N		1.960784E-07		1.960784E-07	4.705882E-06	4.705882E-06	0.001718	0.001718	8,760.00
Barium	7440-39-3	N	Y	N		4.313725E-06		4.313725E-06	0.000000E+00	1.035294E-04	0.000000	0.000000	0.037788
Beryllium	7440-41-7	Y	Y	N		1.176471E-08		1.176471E-08	2.823529E-07	2.823529E-07	0.000103	0.000103	0.000103
Cadmium	7440-43-9	Y	Y	N		1.078431E-06		1.078431E-06	2.588235E-05	2.588235E-05	0.009447	0.009447	0.009447
Chromium VI	18540-29-9	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000
Chromium, total	7440-47-3	Y	Y	N		1.372549E-06		1.372549E-06	3.294118E-05	3.294118E-05	0.012024	0.012024	0.012024
Cobalt	744048-4	Y	Y	N		8.235294E-08		8.235294E-08	1.976471E-06	1.976471E-06	0.000721	0.000721	0.000721
Copper	7440-50-8	N	Y	N		8.333333E-07		8.333333E-07	0.000000E+00	2.000000E-05	0.000000	0.000000	0.007300
Lead	7439-92-1	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000
Manganese	7439-96-5	Y	Y	N		3.725490E-07		3.725490E-07	8.941176E-06	8.941176E-06	0.003264	0.003264	0.003264
Mercury	7439-97-6	Y	Y	N		2.549020E-07		2.549020E-07	6.117647E-06	6.117647E-06	0.002233	0.002233	0.002233
Molybdenum	7439-98-7	N	Y	N		1.078431E-06		1.078431E-06	0.000000E+00	2.588235E-05	0.000000	0.000000	0.009447
Nickel	7440-02-0	Y	Y	N		2.058824E-06		2.058824E-06	4.941176E-05	4.941176E-05	0.018035	0.018035	0.018035
Selenium	7782-49-2	Y	Y	N		2.352941E-08		2.352941E-08	5.647059E-07	5.647059E-07	0.000206	0.000206	0.000206
Vanadium	7440-62-2	N	Y	N		2.254902E-06		2.254902E-06	0.000000E+00	5.411765E-05	0.000000	0.000000	0.019753
Zinc	7440-66-6	N	Y	N		2.843137E-05		2.843137E-05	0.000000E+00	6.823529E-04	0.000000	0.000000	0.249059
Total EPA HAP and CARB TAC (Lb/Year)									0.023518	0.041698	8.584015	15.219715	N/A
Total EPA Polycyclic Organic Material (POM)									0.000010	N/A	0.003809	N/A	N/A

HAP/TAC Emissions from Emergency Use IC Engine
Increase In HAP/TAC Emission From Engine (2 @ 175 Hp Each)

Chemical Substance	Chemical CAS No	Status (Y/N)	POM Y/N	Non-Adjusted Emission Factors (Lb per 1000 Gallon)				Adjusted Lb/Day		Adjusted Lb/Year	
				VCAPCD	EPA	SJVAPCD	Average	HAP Lb/Day	TAC Lb/Day	M Gallons/Year = HAP Lb/Year	TAC Lb/Year
1,3 Butadiene	106-99-0	Y	Y	Y	Y	2.1740E-01	5.3880E-03	4.3210E-01	2.1830E-01	0.005219	0.005219
2-Methylchloroanthrene	56-49-5	Y	Y	Y	Y					0.000000	0.000000
2-Methylnaphthalene	91-57-6	Y	Y	Y	Y					0.000000	0.000000
7,12-Dimethylbenz(a)anthracene	57-96-6	Y	Y	Y	Y					0.000000	0.000000
Acenaphthene	83-32-9	Y	Y	Y	Y					0.000000	0.000000
Acenaphthylene	208-96-8	Y	Y	Y	Y					0.000000	0.000000
Acetaldehyde	75-07-0	Y	Y	Y	Y	7.8330E-01	6.9727E-04	2.3390E+00	1.1698E+00	0.056215	0.056215
Acrolein	107-02-8	Y	Y	Y	Y	3.3900E-02	1.0528E-01	8.4100E-01	5.7653E-01	0.013782	0.013782
Anthracene	120-12-7	Y	Y	Y	Y	1.8630E-01	1.2747E-02	5.8750E-02	3.5132E-02	0.000840	0.000840
Benzene	71-43-2	Y	Y	Y	Y		2.5769E-04	2.2630E-04	2.4199E-04	0.000012	0.000012
Benzo(a)anthracene	56-55-6	Y	Y	Y	Y		1.2857E-01	2.4810E-01	1.8766E-01	0.004486	0.004486
Benzo(a)pyrene	50-32-8	Y	Y	Y	Y		2.3150E-04	9.4510E-04	5.8830E-04	0.000028	0.000028
Benzo(b)fluoranthene	205-99-2	Y	Y	Y	Y		2.5906E-05	9.9220E-04	5.0905E-04	0.000024	0.000024
Benzo(g,h,i)perylene	191-24-2	Y	Y	Y	Y		1.3656E-05	1.1830E-04	6.5978E-05	0.000003	0.000003
Benzo(k)fluoranthene	207-08-9	Y	Y	Y	Y		6.7384E-05	3.0510E-05	4.8947E-05	0.000002	0.000002
Butane	106-07-8	N	N	N	N		2.1359E-05	5.5730E-05	3.8545E-05	0.000000	0.000000
Chlorobenzene	108-90-7	Y	Y	Y	Y					0.000000	0.000000
Chrysene	218-01-9	Y	Y	Y	Y	2.0000E-04	4.8643E-05	9.4550E-04	4.9707E-04	0.000005	0.000005
Dibenz(a,h)anthracene	53-70-3	Y	Y	Y	Y		8.0337E-05	7.4990E-05	7.7664E-05	0.000024	0.000024
Dibenzochlorine	25321-22-6	Y	Y	Y	Y					0.000004	0.000004
Ethane	74-84-00	N	N	N	N					0.000000	0.000000
Ethylbenzene	100-41-4	Y	Y	Y	Y	1.0900E-02		1.0850E-02	1.0875E-02	0.000000	0.000000
Fluoranthene	206-44-0	Y	Y	Y	Y		1.0487E-03	8.9370E-04	9.7118E-04	0.000260	0.000260
Fluorene	86-73-7	Y	Y	Y	Y		4.0238E-03	8.9310E-03	6.4774E-03	0.00047	0.00047
Formaldehyde	50-00-0	Y	Y	Y	Y	1.7261E+00	1.6260E-01	1.7310E+00	1.2066E+00	0.000311	0.000311
Hydrogen Chloride (HCl)	7647-01-0	Y	Y	Y	Y					0.028844	0.028844
Hydrogen Sulfide (H2S)	77-83-06-4	N	N	N	N					0.000000	0.000000
Hexane	110-54-3	Y	Y	Y	Y	2.6900E-02		2.6850E-02	2.6875E-02	0.000000	0.000000
Indeno(1,2,3-c,d)pyrene	193-39-5	Y	Y	Y	Y		5.1675E-05	2.7620E-05	3.9648E-05	0.000000	0.000000
Naphthalene	91-20-3	Y	Y	Y	Y	1.9700E-02	1.1685E-02	2.5480E-02	1.8955E-02	0.000002	0.000002
Pentane	109-66-0	N	N	N	N					0.000911	0.000911
Phenanthrene	85-01-8	Y	Y	Y	Y		4.0513E-03	4.0200E-02	2.2126E-02	0.000000	0.000000
Propane	74-98-6	N	N	N	N					0.001063	0.001063
Propylene	115-07-1	N	N	N	N					0.000000	0.000000
Pyrene	129-00-0	Y	Y	Y	Y	4.6700E-01	3.5552E-01		4.1126E-01	0.000000	0.000000
Toluene	108-88-3	Y	Y	Y	Y		6.5868E-04	1.8650E-03	1.2618E-03	0.000061	0.000061
Total xylene	1330-20-7	Y	Y	Y	Y	1.5040E-01	5.6360E-02	1.5810E-01	1.2162E-01	0.002907	0.002907
Total PAH(W/Naphthalene)	1150/1151	Y	Y	Y	Y	4.2400E-02	3.9273E-02	4.9070E-02	4.3581E-02	0.001042	0.001042
Total PAH(W/O Naphthalene)	1150/1151	Y	Y	Y	Y	5.5900E-02	2.3150E-02	5.8200E-02	4.5750E-02	0.002198	0.002198
		Y	Y	Y	Y		1.1465E-02	3.7200E-02	2.4332E-02	0.001169	0.001169

HAP/TAC Emissions from Emergency Use IC Engine
Increase In HAP/TAC Emission From Engine (2 @ 175 Hp Each)

Chemical Substance	Chemical CAS No	Status (Y/N)		POM Y/N	Non-Adjusted Emission Factors (Lb per 1000 Gallon)				Adjusted Lb/Day		Adjusted Lb/Year	
		HAP	TAC		VCAPCD	EPA	SJVAPCD	Average	HAP Lb/Day	TAC Lb/Day	HAP Lb/Year	TAC Lb/Year
Arsenic	7440-38-2	Y	Y	N	1.6000E-03		1.7970E-03	1.6985E-03	0.000041	0.000041	0.000041	0.000041
Barium	7440-39-3	N	Y	N					0.000000	0.000000	0.000000	0.000000
Beryllium	7440-41-7	Y	Y	N			1.7970E-03	1.7970E-03	0.000043	0.000043	0.000043	0.000043
Cadmium	7440-43-9	Y	Y	N	1.5000E-03		7.1850E-04	1.1093E-03	0.000027	0.000027	0.000027	0.000027
Chromium VI	18540-29-9	Y	Y	N			7.1860E-04	7.1860E-04	0.000017	0.000017	0.000017	0.000017
Chromium, total	7440-47-3	Y	Y	N	6.0000E-03			6.0000E-03	0.000143	0.000143	0.000143	0.000143
Cobalt	744048-4	Y	Y	N					0.000000	0.000000	0.000000	0.000000
Copper	7440-50-8	N	Y	N	4.1000E-03		5.5930E-03	4.8465E-03	0.000000	0.000000	0.000000	0.000000
Lead	7439-92-1	Y	Y	N			3.5930E-03	3.5930E-03	0.000086	0.000086	0.000086	0.000086
Manganese	7439-96-5	Y	Y	N	3.1000E-03			3.1000E-03	0.000074	0.000074	0.000074	0.000074
Mercury	7439-97-6	Y	Y	N	2.0000E-03		3.5930E-03	2.7965E-03	0.000067	0.000067	0.000067	0.000067
Molybdenum	7439-98-7	N	Y	N					0.000000	0.000000	0.000000	0.000000
Nickel	7440-02-0	Y	Y	N	3.9000E-03		7.1880E-04	2.3094E-03	0.000055	0.000055	0.000055	0.000055
Selenium	7782-49-2	Y	Y	N	2.2000E-03		3.5930E-03	2.8965E-03	0.000069	0.000069	0.000069	0.000069
Vanadium	7440-62-2	N	Y	N					0.000000	0.000000	0.000000	0.000000
Zinc	7440-66-6	N	Y	N	2.2400E-02		3.8330E-03	1.3117E-02	0.000000	0.000314	0.000000	0.000314
Total EPA HAP and CARB TAC (Lb/Year)												
Total EPA Polycyclic Organic Material (POM)												
										0.117419	0.127680	N/A
										0.528348	N/A	N/A

Diesel Particulate Matter	CAS No	HAP	TAC	Y/N	VCAPCD	EPA	SJVAPCD	Average	HAP Lb/Day	TAC Lb/Day	HAP Lb/Year	TAC Lb/Year
Total PAH(W/Naphthalene)	1150/1151	Y	Y	Y	5.5900E-02	2.3150E-02	5.8200E-02	4.5750E-02	0.002198	0.002198	0.002198	0.002198
Calculated PM as DPM	Tier-3	Y	Y	Y				4.7580E+00	2.055456	2.055456	2.055456	2.055456

Corrections Factors for Tier-3 Engine versus Tier-0 Engine

Adjustment Factors for PM AND Organics			
Adjustment Factor Category	AP42 Engine g/Bhp	Engine g/Bhp	Adjust Factor
VOC	1.1204	0.062	0.05534
PM	0.9979	0.111	0.11123
VOC adjustment factor is applied to non PM (gaseous HAP/TAC)			
PM adjustment factor is applied to POM (HAPS with BP <100 C)			
PM adjustment factor is applied to metals			

HAP/TAC Emissions from Emergency Use Flare

Increase In HAP/TAC Emission From Flare (2856.61 MMBtu/Hr Duing and Emergency Event)

Chemical Substance	Chemical CAS No	Status (Y/N)	POM Y/N	Emission Factors (Lb/MMBtu)			MMBtu/Day =		68,558.64		Emergency Use of Flare	
				VCAPCD	EPA	SJVAPCD	HAP Lb/Day	TAC Lb/Day	HAP Lb/Year	TAC Lb/Year	MMBtu/Year =	42,538.08
1,3 Butadiene	106-99-0	Y	Y				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
2-Methylchloroanthrene	56-49-5	Y	Y				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
2-Methylnaphthalene	91-57-6	Y	Y				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
7,12-Dimethylbenz(a)anthracene	57-96-6	Y	Y				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Acenaphthene	83-32-9	Y	Y				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Acenaphthylene	208-96-8	Y	Y				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Acetaldehyde	75-07-0	Y	Y	4.2157E-05			2.890217E+00	2.890217E+00	1.793272E+00	1.793272E+00	1.793272E+00	1.793272E+00
Acrolein	107-02-8	Y	Y	9.8039E-06			6.721435E-01	6.721435E-01	4.170400E-01	4.170400E-01	4.170400E-01	4.170400E-01
Anthracene	120-12-7	Y	Y				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Benzo(a)anthracene	71-43-2	Y	Y	0.00015588			1.068708E+01	1.068708E+01	6.630935E+00	6.630935E+00	6.630935E+00	6.630935E+00
Benzo(a)pyrene	56-55-6	Y	Y				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Benzo(b)fluoranthene	205-99-2	Y	Y				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Benzo(g,h,i)perylene	191-24-2	Y	Y				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Benzo(k)fluoranthene	207-08-9	Y	Y				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Butane	106-07-8	N	N				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Chlorobenzene	108-90-7	Y	Y				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Chrysene	218-01-9	Y	Y				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Dibenzo(a,h)anthracene	53-70-3	Y	Y				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Dibenzochlorine	25321-22-6	Y	Y				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Ethane	74-84-00	N	N				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Ethylbenzene	100-41-4	Y	Y	0.00141569			9.705753E+01	9.705753E+01	6.022057E+01	6.022057E+01	6.022057E+01	6.022057E+01
Fluoranthene	206-44-0	Y	Y				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Fluorene	86-73-7	Y	Y				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Formaldehyde	50-00-0	Y	Y	0.00114608			7.857358E+01	7.857358E+01	4.875197E+01	4.875197E+01	4.875197E+01	4.875197E+01
Hydrogen Chloride (HCL)	7647-01-0	Y	Y				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Hydrogen Sulfide (H2S)	77-83-06-4	N	N				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Hexane	110-54-3	Y	Y	2.8431E-05			1.949216E+00	1.949216E+00	1.209416E+00	1.209416E+00	1.209416E+00	1.209416E+00
Indeno(1,2,3-c,d)pyrene	193-39-5	Y	Y				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Naphthalene	91-20-3	Y	Y	1.0784E-05			7.393579E-01	7.393579E-01	4.587440E-01	4.587440E-01	4.587440E-01	4.587440E-01
Pentane	109-66-0	N	N				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Phenanthrene	85-01-8	Y	Y				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Propane	74-98-6	N	N				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Propylene	115-07-1	N	Y	0.00141176			0.000000E+00	9.678867E+01	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Pyrene	129-00-0	Y	Y				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Toluene	108-88-3	Y	Y	5.6863E-05			3.898432E+00	3.898432E+00	2.418832E+00	2.418832E+00	2.418832E+00	2.418832E+00
Total xylene	1330-20-7	Y	Y	2.8431E-05			1.949216E+00	1.949216E+00	1.209416E+00	1.209416E+00	1.209416E+00	1.209416E+00
Total PAH(W/Napthalene)	1150/1151	Y	Y	1.3725E-05			9.410009E-01	9.410009E-01	5.838560E-01	5.838560E-01	5.838560E-01	5.838560E-01
Total PAH(W/O Napthalene)	1150/1151	Y	Y	3.9216E-07			2.688574E-02	2.688574E-02	1.668160E-02	1.668160E-02	1.668160E-02	1.668160E-02

HAP/TAC Emissions from Emergency Use Flare

Increase in HAP/TAC Emission From Flare (2856.61 MMBtu/Hr Duing and Emergency Event)

Chemical Substance	Chemical CAS No	Status (Y/N)		POM Y/N	Emission Factors (Lb/MMBtu)			MMBtu/Day =		68,558.64		Emergency Use of Flare	
		HAP	TAC		VCAPOD	EPA	SJVAPOD	HAP Lb/Day	TAC Lb/Day	HAP Lb/Year	TAC Lb/Year	MMBtu/Year =	
Arsenic	7440-38-2	Y	Y	N		1.9608E-07		1.344287E-02	1.344287E-02	8.340799E-03	8.340799E-03		
Barium	7440-39-3	N	Y	N		4.3137E-06		0.000000E+00	2.957432E-01	0.000000E+00	1.834976E-01		
Beryllium	7440-41-7	Y	Y	N		1.1765E-08		8.065722E-04	8.065722E-04	5.004480E-04	5.004480E-04		
Cadmium	7440-43-9	Y	Y	N		1.0784E-06		7.393579E-02	7.393579E-02	4.587440E-02	4.587440E-02		
Chromium VI	18540-29-9	Y	Y	N				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00		
Chromium, total	7440-47-3	Y	Y	N		1.37255E-06		9.410009E-02	9.410009E-02	5.838560E-02	5.838560E-02		
Cobalt	744048-4	Y	Y	N		8.2353E-08		5.646006E-03	5.646006E-03	3.503136E-03	3.503136E-03		
Copper	7440-50-8	N	Y	N		8.3333E-07		0.000000E+00	5.713220E-02	0.000000E+00	3.544840E-02		
Lead	7439-92-1	Y	Y	N				0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00		
Manganese	7439-96-5	Y	Y	N		3.7255E-07		2.554145E-02	2.554145E-02	1.584752E-02	1.584752E-02		
Mercury	7439-97-6	Y	Y	N		2.5490E-07		1.747573E-02	1.747573E-02	1.084304E-02	1.084304E-02		
Molybdenum	7439-98-7	N	Y	N		1.0784E-06		0.000000E+00	7.393579E-02	0.000000E+00	4.587440E-02		
Nickel	7440-02-0	Y	Y	N		2.0588E-06		1.411501E-01	1.411501E-01	8.757839E-02	8.757839E-02		
Selenium	7782-49-2	Y	Y	N		2.35294E-08		1.613144E-03	1.613144E-03	1.000896E-03	1.000896E-03		
Vanadium	7440-62-2	N	Y	N		2.2549E-06		0.000000E+00	1.545930E-01	0.000000E+00	9.591919E-02		
Zinc	7440-66-6	N	Y	N		2.8431E-05		0.000000E+00	1.949216E+00	0.000000E+00	1.209416E+00		
Total EPA HAP and CARB TAC (Lb/Year)								1.987905E+02	2.981098E+02	1.233421E+02	1.849660E+02		
Total EPA Polycyclic Organic Material (POM)								1.707245E+00	N/A	1.059282E+00	N/A		

HAP/TAC Emissions from Emergency Use Flare

Increase In HAP/TAC Emission From Flare (2856.61 MMBtu/Hr Duing and Emergency Event)

Chemical Substance	Chemical CAS No	Status (Y/N)		POM Y/N	Emission Factors (Lb/MMBtu)				MMBtu/Day =		68,558.64		MMBtu/Year =	
		HAP	TAC		VCAPCD	EPA	SJVAPCD	Average	HAP Lb/Day	TAC Lb/Day	HAP Lb/Year	TAC Lb/Year	HAP Lb/Year	TAC Lb/Year
1,3 Butadiene	106-99-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
2-Methylchloroanthrene	56-49-5	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
2-Methylnaphthalene	91-57-6	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
7,12-Dimethylbenz(a)anthracene	57-96-6	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Acenaphthene	83-32-9	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Acenaphthylene	208-96-8	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Acetaldehyde	75-07-0	Y	Y	N	4.2157E-05			4.21569E-05	2.890217E+00	2.890217E+00	1.793272E+00	1.793272E+00	0.000000E+00	0.000000E+00
Acrolein	107-02-8	Y	Y	N	9.8039E-06			9.80392E-06	6.721435E-01	6.721435E-01	4.170400E-01	4.170400E-01	0.000000E+00	0.000000E+00
Anthracene	120-12-7	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Benzene	71-43-2	Y	Y	N	0.00015588			0.000155882	1.068708E+01	1.068708E+01	6.630935E+00	6.630935E+00	0.000000E+00	0.000000E+00
Benzo(a)anthracene	56-55-6	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Benzo(a)pyrene	50-32-8	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Benzo(b)fluoranthene	205-99-2	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Benzo(g,h,i)perylene	191-24-2	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Benzo(k)fluoranthene	207-08-9	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Butane	106-07-8	N	N	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Chlorobenzene	108-90-7	Y	Y	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Chrysene	218-01-9	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Dibenzo(a,h)anthracene	53-70-3	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Dibenzochlorine	25321-22-6	Y	Y	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Ethane	74-84-00	N	N	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Ethylbenzene	100-41-4	Y	Y	N	0.00141569			0.001415686	9.705753E+01	9.705753E+01	6.022057E+01	6.022057E+01	0.000000E+00	0.000000E+00
Fluoranthene	206-44-0	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Fluorene	86-73-7	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Formaldehyde	50-00-0	Y	Y	N	0.00114608			0.001146078	7.857358E+01	7.857358E+01	4.875197E+01	4.875197E+01	0.000000E+00	0.000000E+00
Hydrogen Chloride (HCL)	7647-01-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Hydrogen Sulfide (H2S)	77-83-06-4	N	Y	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Hexane	110-54-3	Y	Y	N	2.8431E-05			2.84314E-05	1.949216E+00	1.949216E+00	1.209416E+00	1.209416E+00	0.000000E+00	0.000000E+00
Indeno(1,2,3,c,d)pyrene	193-39-5	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Naphthalene	91-20-3	Y	Y	Y	1.0784E-05			1.07843E-05	7.393579E-01	7.393579E-01	4.587440E-01	4.587440E-01	0.000000E+00	0.000000E+00
Pentane	109-66-0	N	N	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Phenanthrene	85-01-8	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Propane	74-98-6	N	N	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Propylene	115-07-1	N	Y	N	0.00141176			0.001411765	0.000000E+00	9.678867E+01	0.000000E+00	6.005376E+01	0.000000E+00	0.000000E+00
Pyrene	129-00-0	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Toluene	108-88-3	Y	Y	N	5.6863E-05			5.68627E-05	3.898432E+00	3.898432E+00	2.418832E+00	2.418832E+00	0.000000E+00	0.000000E+00
Total xylene	1330-20-7	Y	Y	N	2.8431E-05			2.84314E-05	1.949216E+00	1.949216E+00	1.209416E+00	1.209416E+00	0.000000E+00	0.000000E+00
Total PAH(W/Napthalene)	1150/1151	Y	Y	Y	1.3725E-05			1.37255E-05	9.410009E-01	9.410009E-01	5.838560E-01	5.838560E-01	0.000000E+00	0.000000E+00
Total PAH(W/O Napthalene)	1150/1151	Y	Y	Y	3.9216E-07			3.92157E-07	2.688574E-02	2.688574E-02	1.668160E-02	1.668160E-02	0.000000E+00	0.000000E+00

HAP/TAC Emissions from Emergency Use Flare

Increase In HAP/TAC Emission From Flare (2856.61 MMBtu/Hr Duing and Emergency Event)

Chemical Substance	Chemical CAS No	Status (Y/N)		POM Y/N	Emission Factors (Lb/MMBtu)				MMBtu/Day =		68,558.64		MMBtu/Year =		42,538.08							
		HAP	TAC		VCAPCD	EPA	SJVAPCD	Average	HAP Lb/Day	TAC Lb/Day	HAP Lb/Year	TAC Lb/Year	HAP Lb/Year	TAC Lb/Year								
Arsenic	7440-38-2	Y	Y	N			1.9608E-07		1.344287E-02	1.344287E-02	8.340799E-03	8.340799E-03	8.340799E-03	8.340799E-03	8.340799E-03	8.340799E-03						
Barium	7440-39-3	N	Y	N			4.3137E-06		0.000000E+00	2.957432E-01	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	1.834976E-01	1.834976E-01						
Beryllium	7440-41-7	Y	Y	N			1.1765E-08		8.065722E-04	8.065722E-04	5.004480E-04	5.004480E-04	5.004480E-04	5.004480E-04	5.004480E-04	5.004480E-04						
Cadmium	7440-43-9	Y	Y	N			1.0784E-06		7.393579E-02	7.393579E-02	4.587440E-02	4.587440E-02	4.587440E-02	4.587440E-02	4.587440E-02	4.587440E-02						
Chromium VI	18540-29-9	Y	Y	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00						
Chromium, total	7440-47-3	Y	Y	N			1.3725E-06		9.410009E-02	9.410009E-02	5.838560E-02	5.838560E-02	5.838560E-02	5.838560E-02	5.838560E-02	5.838560E-02						
Cobalt	744048-4	Y	Y	N			8.2353E-08		5.646006E-03	5.646006E-03	3.503136E-03	3.503136E-03	3.503136E-03	3.503136E-03	3.503136E-03	3.503136E-03						
Copper	7440-50-8	N	Y	N			8.3333E-07		0.000000E+00	5.713220E-02	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	3.544840E-02	3.544840E-02						
Lead	7439-92-1	Y	Y	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00						
Manganese	7439-96-5	Y	Y	N			3.7255E-07		2.554145E-02	2.554145E-02	1.584752E-02	1.584752E-02	1.584752E-02	1.584752E-02	1.584752E-02	1.584752E-02						
Mercury	7439-97-6	Y	Y	N			2.5490E-07		1.747573E-02	1.747573E-02	1.084304E-02	1.084304E-02	1.084304E-02	1.084304E-02	1.084304E-02	1.084304E-02						
Molybdenum	7439-98-7	N	Y	N			1.0784E-06		0.000000E+00	7.393579E-02	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	4.587440E-02	4.587440E-02						
Nickel	7440-02-0	Y	Y	N			2.0588E-06		1.411501E-01	1.411501E-01	8.757839E-02	8.757839E-02	8.757839E-02	8.757839E-02	8.757839E-02	8.757839E-02						
Selenium	7782-49-2	Y	Y	N			2.3529E-08		1.613144E-03	1.613144E-03	1.00896E-03	1.00896E-03	1.00896E-03	1.00896E-03	1.00896E-03	1.00896E-03						
Vanadium	7440-62-2	N	Y	N			2.2549E-06		0.000000E+00	1.545930E-01	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	9.591919E-02	9.591919E-02						
Zinc	7440-66-6	N	Y	N			2.8431E-05		0.000000E+00	1.949216E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	1.209416E+00	1.209416E+00						
Total EPA HAP and CARB TAC (Lb/Year)																1.987905E+02	2.981098E+02	N/A	1.233421E+02	1.849660E+02	N/A	N/A
Total EPA Polycyclic Organic Material (POM)																1.707245E+00			1.059282E+00			

HAP/TAC Emissions from Emergency Use IC Engine
Increase In HAP/TAC Emission From Workover Equipment

Chemical Substance	Chemical CAS No	Status (Y/N)		POM Y/N	Non-Adjusted Emission Factors (Lb per 1000 Gallon)			Adjusted Lb/Day		Adjusted Lb/Year	
		HAP	TAC		VCAPCD	EPA	SJVAPCD	Average	M Gallons/Year = HAP Lb/Day	TAC Lb/Day	M Gallons/Year = HAP Lb/Year
1,3 Butadiene	106-99-0	Y	Y	N	2.1740E-01	5.3880E-03	4.3210E-01	2.1830E-01	0.017715	0.017715	2.657256
2-Methylchloroanthrene	56-49-5	Y	Y	Y					0.000000	0.000000	0.000000
2-Methylnaphthalene	91-57-6	Y	Y	Y					0.000000	0.000000	0.000000
7,12-Dimethylbenz(a)anthracene	57-96-6	Y	Y	Y					0.000000	0.000000	0.000000
Acenaphthene	83-32-9	Y	Y	Y					0.000027	0.000027	0.004077
Acenaphthylene	208-96-8	Y	Y	Y					0.024842	0.024842	3.726280
Acetaldehyde	75-07-0	Y	Y	N	7.8330E-01	6.9727E-04	2.3390E+00	1.1698E+00	0.046786	0.046786	7.017895
Acrolein	107-02-8	Y	Y	N	3.3900E-02	1.2747E-02	5.8750E-02	3.5132E-02	0.002851	0.002851	0.427654
Anthracene	120-12-7	Y	Y	Y					0.000005	0.000005	0.000771
Benzone	71-43-2	Y	Y	N	1.8630E-01	1.2857E-01	2.4810E-01	1.8766E-01	0.015229	0.015229	2.284282
Benzo(a)anthracene	56-55-6	Y	Y	Y					0.000012	0.000012	0.001874
Benzo(a)pyrene	50-32-8	Y	Y	Y					0.000011	0.000011	0.001621
Benzo(b)fluoranthene	205-99-2	Y	Y	Y					0.000001	0.000001	0.000210
Benzo(g,h,i)perylene	191-24-2	Y	Y	Y					0.000001	0.000001	0.000156
Benzo(k)fluoranthene	207-08-9	Y	Y	Y					0.000001	0.000001	0.000123
Butane	106-07-8	N	N	N					0.000000	0.000000	0.000000
Chlorobenzene	108-90-7	Y	Y	N	2.0000E-04				0.000016	0.000016	0.002435
Chrysene	218-01-9	Y	Y	Y					0.000011	0.000011	0.001583
Dibenzo(a,h)anthracene	53-70-3	Y	Y	Y					0.000002	0.000002	0.000247
Dibenzochlorine	25321-22-6	Y	Y	N					0.000000	0.000000	0.000000
Ethane	74-84-00	N	N	N					0.000000	0.000000	0.000000
Ethylbenzene	100-41-4	Y	Y	N	1.0900E-02				0.000883	0.000883	0.132378
Fluoranthene	206-44-0	Y	Y	Y					0.000021	0.000021	0.003093
Fluorene	86-73-7	Y	Y	Y					0.000138	0.000138	0.020632
Formaldehyde	50-00-0	Y	Y	N	1.7261E+00	1.6260E-01	1.7310E+00	1.2066E+00	0.097915	0.097915	14.687217
Hydrogen Chloride (HCl)	7647-01-0	Y	Y	N					0.000000	0.000000	0.000000
Hydrogen Sulfide (H2S)	77-83-06-4	N	Y	N					0.000000	0.000000	0.000000
Hexane	110-54-3	Y	Y	N					0.000000	0.000000	0.000000
Indeno(1,2,3-c,d)pyrene	193-39-5	Y	Y	Y					0.002181	0.002181	0.327142
Naphthalene	91-20-3	Y	Y	Y					0.000001	0.000001	0.000126
Pentane	109-66-0	N	N	N					0.000403	0.000403	0.060377
Phenanthrene	85-01-8	Y	Y	Y					0.000000	0.000000	0.000000
Propane	74-98-6	N	N	N					0.000470	0.000470	0.070476
Propylene	115-07-1	N	Y	N					0.000000	0.000000	0.000000
Pyrene	129-00-0	Y	Y	Y					0.000027	0.000027	0.004019
Toluene	108-88-3	Y	Y	N	1.5040E-01	5.6360E-02	1.5810E-01	1.2162E-01	0.009870	0.009870	1.480447
Total xylene	1330-20-7	Y	Y	N	4.2400E-02	3.9273E-02	4.9070E-02	4.3581E-02	0.003537	0.003537	0.530499
Total PAH(W/Naphthalene)	1150/1151	Y	Y	Y	5.5900E-02	2.3150E-02	5.8200E-02	4.5750E-02	0.000972	0.000972	0.145726
Total PAH(W/O Naphthalene)	1150/1151	Y	Y	Y		1.1465E-02	3.7200E-02	2.4332E-02	0.000517	0.000517	0.077505

HAP/TAC Emissions from Emergency Use IC Engine
Increase In HAP/TAC Emission From Workover Equipment

Chemical Substance	Chemical CAS No	Status (Y/N)		POM Y/N	Non-Adjusted Emission Factors (Lb per 1000 Gallon)			Adjusted Lb/Day		Adjusted Lb/Year	
		HAP	TAC		VCAPCD	EPA	SJVAPCD	HAP Lb/Day	TAC Lb/Day	M Gallons/Year =	HAP Lb/Year
Arsenic	7440-38-2	Y	Y	N	1.6000E-03		1.7970E-03	0.000138	0.000138	0.246401	0.020675
Barium	7440-39-3	N	Y	N				0.000000	0.000000		0.000000
Beryllium	7440-41-7	Y	Y	N			1.7970E-03	0.000146	0.000146		0.021874
Cadmium	7440-43-9	Y	Y	N	1.5000E-03		7.1850E-04	0.000090	0.000090		0.013503
Chromium VI	18540-29-9	Y	Y	N			7.1860E-04	0.000058	0.000058		0.008747
Chromium, total	7440-47-3	Y	Y	N	6.0000E-03			0.000487	0.000487		0.073036
Cobalt	744048-4	Y	Y	N				0.000000	0.000000		0.000000
Copper	7440-50-8	N	Y	N	4.1000E-03		5.5930E-03	0.000000	0.000393		0.000000
Lead	7439-92-1	Y	Y	N			3.5930E-03	0.000292	0.000292		0.043737
Manganese	7439-96-5	Y	Y	N	3.1000E-03		3.1000E-03	0.000252	0.000252		0.037735
Mercury	7439-97-6	Y	Y	N	2.0000E-03		3.5930E-03	0.000227	0.000227		0.034041
Molybdenum	7439-98-7	N	Y	N				0.000000	0.000000		0.000000
Nickel	7440-02-0	Y	Y	N	3.9000E-03		7.1880E-04	0.000187	0.000187		0.028112
Selenium	7782-49-2	Y	Y	N	2.2000E-03		3.5930E-03	0.000235	0.000235		0.035258
Vanadium	7440-62-2	N	Y	N				0.000000	0.000000		0.000000
Zinc	7440-66-6	N	Y	N	2.2400E-02		3.8330E-03	0.000000	0.001064		0.159664
Total EPA HAP and CARB TAC (Lb/Year)											33.759592
Total EPA Polycyclic Organic Material (POM)											45.203330
N/A											N/A

Diesel Particulate Matter	CAS No	HAP	TAC	Y/N	VCAPCD	EPA	SJVAPCD	Average	HAP Lb/Day	TAC Lb/Day	HAP Lb/Year	TAC Lb/Year
Total PAH(W/Naphthalene)	1150/1151	Y	Y	Y	5.5900E-02	2.3150E-02	5.8200E-02	4.5750E-02	0.000972	0.000972	0.145726	0.145726
Calculated PM as DPM	OffRoad2007	Y	Y	Y				2.2667E+00	0.558510	0.558510	83.776490	83.776490

Corrections Factors for Workover Engine and Pump

Adjustment Factors for PM AND Organics			
Adjustment Factor Category	AP42 g/Bhp	Engine g/Bhp	Adjust Factor
VOC	1.1204	0.369	0.32935
PM	0.9979	0.086	0.08618
VOC adjustment factor is applied to non PM (gaseous HAP/TAC)			
PM adjustment factor is applied to POM (HAPS with BP <100 C)			
PM adjustment factor is applied to metals			

Engine factors were obtained from Offroad 2007. SJVAPCD
Mobile workover rigs / workover pumps. 250<Hp<500

HAP/TAC Emissions from Fugitive Hydrocarbon Emissions

Increase In HAP/TAC Emissions From Fugitive Emissions

Chemical Substance	Chemical CAS No	Status (Y/N)		Wt Fraction of Constituent			TOG Lb/Day =		98.03		TOG Lb/Year =	
		HAP	TAC	POM Y/N	VCAPCD	EPA	SJVPAPCD	Average	HAP Lb/Day	TAC Lb/Day	HAP Lb/Year	TAC Lb/Year
1,3 Butadiene	106-99-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
2-Methylchloroanthrene	56-49-5	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
2-Methylnaphthalene	91-57-6	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
7,12-Dimethylbenz(a)anthracene	57-96-6	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Acenaphthene	83-32-9	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Acenaphthylene	208-96-8	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Acetaldehyde	75-07-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Acrolein	107-02-8	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Anthracene	120-12-7	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Benzene	71-43-2	Y	Y	N	1.230000E-03			1.230000E-03	1.205757E-01	1.205757E-01	44.010122	44.010122
Benzo(a)anthracene	56-55-6	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Benzo(a)pyrene	50-32-8	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Benzo(b)fluoranthene	205-99-2	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Benzo(g,h,i)perylene	191-24-2	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Benzo(k)fluoranthene	207-08-9	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Butane	106-07-8	N	N	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Chlorobenzene	108-90-7	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Chrysene	218-01-9	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Dibenzo(a,h)anthracene	53-70-3	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Dibenzochlorine	25321-22-6	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Ethane	74-84-00	N	N	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Ethylbenzene	100-41-4	Y	Y	N	1.000000E-05			1.000000E-05	9.802900E-04	9.802900E-04	0.357806	0.357806
Fluoranthene	206-44-0	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Fluorene	86-73-7	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Formaldehyde	50-00-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Hydrogen Chloride	7647-01-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Hydrogen Sulfide (H2S)	77-83-06-4	N	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Hexane	110-54-3	Y	Y	N	9.230000E-03			9.230000E-03	9.048077E-01	9.048077E-01	330.254814	330.254814
Indeno(1,2,3-c,d)pyrene	193-39-5	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Naphthalene	91-20-3	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Pentane	109-66-0	N	N	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Phenanthrene	85-01-8	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Propane	74-98-6	N	N	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Propylene	115-07-1	N	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Pyrene	129-00-0	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Toluene	108-88-3	Y	Y	N	3.200000E-04			3.200000E-04	3.136928E-02	3.136928E-02	11.449788	11.449788
Total xylene	1330-20-7	Y	Y	N	4.000000E-05			4.000000E-05	3.921160E-03	3.921160E-03	1.431223	1.431223
Total PAH(W/Naphthalene)	1150/1151	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Total PAH(W/O Naphthalene)	1150/1151	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000

HAP/TAC Emissions from Fugitive Hydrocarbon Emissions

Increase In HAP/TAC Emissions From Fugitive Emissions

Chemical Substance	Chemical CAS No	Status (Y/N)		POM Y/N	Wt Fraction of Constituent			TOG Lb/Day =		98.03		TOG Lb/Year =	
		HAP	TAC		VCAPCD	EPA	SJVAPCD	Average	HAP Lb/Day	TAC Lb/Day	HAP Lb/Year	TAC Lb/Year	
Arsenic	7440-38-2	Y	Y	N				0.000000E+00	0.000000E+00	0.000000		0.00000000	0.00000000
Barium	7440-39-3	N	Y	N				0.000000E+00	0.000000E+00	0.000000		0.00000000	0.00000000
Beryllium	7440-41-7	Y	Y	N				0.000000E+00	0.000000E+00	0.000000		0.00000000	0.00000000
Cadmium	7440-43-9	Y	Y	N				0.000000E+00	0.000000E+00	0.000000		0.00000000	0.00000000
Chromium VI	18540-29-9	Y	Y	N				0.000000E+00	0.000000E+00	0.000000		0.00000000	0.00000000
Chromium, total	7440-47-3	Y	Y	N				0.000000E+00	0.000000E+00	0.000000		0.00000000	0.00000000
Cobalt	7440-48-4	Y	Y	N				0.000000E+00	0.000000E+00	0.000000		0.00000000	0.00000000
Copper	7440-50-8	N	Y	N				0.000000E+00	0.000000E+00	0.000000		0.00000000	0.00000000
Lead	7439-92-1	Y	Y	N				0.000000E+00	0.000000E+00	0.000000		0.00000000	0.00000000
Manganese	7439-96-5	Y	Y	N				0.000000E+00	0.000000E+00	0.000000		0.00000000	0.00000000
Mercury	7439-97-6	Y	Y	N				0.000000E+00	0.000000E+00	0.000000		0.00000000	0.00000000
Molybdenum	7439-98-7	N	Y	N				0.000000E+00	0.000000E+00	0.000000		0.00000000	0.00000000
Nickel	7440-02-0	Y	Y	N				0.000000E+00	0.000000E+00	0.000000		0.00000000	0.00000000
Selenium	7782-49-2	Y	Y	N				0.000000E+00	0.000000E+00	0.000000		0.00000000	0.00000000
Vanadium	7440-62-2	N	Y	N				0.000000E+00	0.000000E+00	0.000000		0.00000000	0.00000000
Zinc	7440-66-6	N	Y	N				0.000000E+00	0.000000E+00	0.000000		0.00000000	0.00000000
Total EPA HAP and CARB TAC (Lb/Year)					1.061654				1.061654	387.503753		387.503753	387.503753
Total EPA Polycyclic Organic Material (POM)					0.000000				N/A	0.000000		0.000000	N/A

HAP/TAC Emissions from Vehicles

Increase In HAP/TAC Emissions (Employee Commute and Travel)

Chemical Substance	Chemical CAS No	Status (Y/N)		Wt Fraction of Constituent			TOG Lb/Day =		0.16		TOG Lb/Year =	
		HAP	TAC	POM Y/N	VCAPCD	EPA	SJVAPCD	Average	HAP Lb/Day	TAC Lb/Day	HAP Lb/Year	TAC Lb/Year
1,3 Butadiene	106-99-0	Y	Y	N		4.400000E-03		4.400000E-03	6.903781E-04	6.903781E-04	0.251988	0.251988
2-Methylchloroanthrene	56-49-5	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
2-Methylnaphthalene	91-57-6	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
7,12-Dimethylbenz(a)anthracene	57-96-6	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Acenaphthene	83-32-9	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Acenaphthylene	208-96-8	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Acetaldehyde	75-07-0	Y	Y	N		4.700000E-03		4.700000E-03	7.374493E-04	7.374493E-04	0.269169	0.269169
Acrolein	107-02-8	Y	Y	N		6.000000E-04		6.000000E-04	9.414247E-05	9.414247E-05	0.034362	0.034362
Anthracene	120-12-7	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Benzenes	71-43-2	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Benzo(a)anthracene	56-55-6	Y	Y	N		5.290000E-02		5.290000E-02	8.300227E-03	8.300227E-03	3.029583	3.029583
Benzo(a)pyrene	50-32-8	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Benzo(b)fluoranthene	205-99-2	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Benzo(g,h,i)perylene	191-24-2	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Benzo(k)fluoranthene	207-08-9	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Butane	106-07-8	N	N	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Chlorobenzene	108-90-7	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Chrysene	218-01-9	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Dibenzo(a,h)anthracene	53-70-3	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Dibenzochlorine	25321-22-6	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Ethane	74-84-00	N	N	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Ethylbenzene	100-41-4	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Fluoranthene	206-44-0	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Fluorene	86-73-7	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Formaldehyde	50-00-0	Y	Y	N		1.510000E-02		1.510000E-02	2.369252E-03	2.369252E-03	0.864777	0.864777
Hydrogen Chloride	7647-01-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Hydrogen Sulfide (H2S)	77-83-06-4	N	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Hexane	110-54-3	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Indeno(1,2,3-c,d)pyrene	193-39-5	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Naphthalene	91-20-3	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Pentane	109-66-0	N	N	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Phenanthrene	85-01-8	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Propane	74-98-6	N	N	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Propylene	115-07-1	N	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Pyrene	129-00-0	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Toluene	108-88-3	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Total xylene	1330-20-7	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Total PAH(W/Naphthalene)	1150/1151	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Total PAH(W/O Naphthalene)	1150/1151	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000

HAP/TAC Emissions from Vehicles

Increase In HAP/TAC Emissions (Employee Commute and Travel)

Chemical Substance	Chemical CAS No	Status (Y/N)		POM Y/N	Wt Fraction of Constituent				TOG Lb/Day =		0.16		TOG Lb/Year =	
		HAP	TAC		VCAPCD	EPA	SJVAPCD	Average	HAP Lb/Day	TAC Lb/Day	HAP Lb/Year	TAC Lb/Year		
Arsenic	7440-38-2	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	57.27
Barium	7440-39-3	N	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	
Beryllium	7440-41-7	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	
Cadmium	7440-43-9	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	
Chromium VI	18540-29-9	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	
Chromium, total	7440-47-3	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	
Cobalt	7440-48-4	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	
Copper	7440-50-8	N	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	
Lead	7439-92-1	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	
Manganese	7439-96-5	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	
Mercury	7439-97-6	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	
Molybdenum	7439-98-7	N	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	
Nickel	7440-02-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	
Selenium	7782-49-2	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	
Vanadium	7440-62-2	N	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	
Zinc	7440-66-6	N	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000	0.000000	
Total EPA HAP and CARB TAC (Lb/Year)														
									0.012191	0.012191	4.449879	4.449879	4.449879	N/A
Total EPA Polycyclic Organic Material (POM)														
									0.000000	N/A	0.000000	0.000000	0.000000	N/A

APPENDICES

OPERATIONAL PHASE GREENHOUSE GAS EMISSIONS

Greenhouse Gas Emissions From OEHI Enhance Oil Recovery Project (CO2 Flood)

Maximum GHG Emissions Summary for Operating Activities

Equipment Description and Process Information	Carbon Dioxide CO2e Tonne/Year	Methane CH4 as CO2e Tonne/Year	Nitrous Oxide N2O as CO2e Tonne/Year	Total CO2e Tonne/Year
Stationary Source	46,120.77	137.26	23.29	46,281.33
Indirect (Electric Power)	-----	-----	-----	180,176.63
Mobile Source	551.12	0.50	2.50	340.21
Total GHG Emissions	46,671.90	137.76	25.79	226,798.17

Gas Plant Greenhouse Gas Emissions From Natural Gas Fueled Combustion Equipment

Equipment Description and Process Information	Carbon Dioxide CO2 Tonne/Year	Methane CH4 as CO2e Tonne/Year	Nitrous Oxide N2O as CO2e Tonne/Year	Total CO2e Tonne/Year
CO2 Injection Heater	27,788.47	9.93	16.29	27,814.70
Regeneration Gas Heater	4,631.41	1.66	2.72	4,635.78
TEG Reboiler	2,315.71	0.83	1.36	2,317.89
Amine Unit	463.14	0.17	0.27	463.58
Fire Pump Engines (2 x 175 Hp)	2.23	0.00	0.00	2.23
CTB - Flare (Pilot + Purge)	1,133.77	0.41	0.66	1,134.84
RCP - Flare (Pilot + Purge)	1,133.77	0.41	0.66	1,134.84
Reasonably Foreseeable GHG Emissions From Emergency Use Only Equipment				
CTB - Flare (Emergency Use)	4,443.70	0.40	0.66	4,444.77
RCF - Flare (Emergency Use)	4,131.07	0.40	0.66	4,132.13
Total GHG Emissions	46,043.27	14.20	23.29	46,080.76

GHG Emissions From Plant Maintenance, Injection and Production Operations

Greenhouse Gas Emissions Production Operations	Average Greenhouse Gas Emissions (Tonne/Year)			
	Carbon Dioxide CO2 Tonne/Year	Methane CH4 as CO2e Tonne/Year	Nitrous Oxide N2O as CO2e Tonne/Year	Total CO2e Tonne/Year
Fugitive GHG Emissions	34.88	58.06	-----	92.95
Maintenance GHG	40.47	61.62	-----	102.09
Pressure Relief GHG	0.83	1.17	-----	2.00
Miscellaneous Small Tanks	1.33	2.21	-----	3.53
Total GHG Emissions	77.50	123.06	0.00	200.57
GHG Emissions By Project Year	2015	2017	2019	2025
	389.67	157.61	128.04	112.82

Indirect GHG Emissions From Power Consumption

GHG Emissions from Project Power Consumption (Tonne/Year)				
Horsepower Require For the Project X PG&E CPUC Factor 0.524 CO2e Lb/KWh	Electrical Hp/Hr	MWh/Year	GHG (Kg/MWh)	GHG CO2e
	116,000.00	758,055.36	237.68	180,176.63
Note: The GHG factor is for the PGE Grid within the San Joaquin Valley				

GHG Emissions From Mobile Source Activity (Employee Commute)

GHG Emissions from Employee Commute (Tonne/Year)				
25 Full Time Employees 60 Miles Round Trip 1500 VMT per Day	Carbon Dioxide CO2	Methane CH4 as CO2e	Nitrous Oxide N2O as CO2e	Total CO2e Tonne/Year
	165.07	0.17	1.53	166.77

Average GHG Emissions From Well Maintenance Activities (Year 2016 - 2034)

GHG Emissions from Travel to and From Drilling Site (Tonne/Year)				
Greenhouse Gas Emissions From Well	Carbon Dioxide CO2	Methane CH4 as CO2e	Nitrous Oxide N2O as CO2e	Total CO2e Tonne/Year
Workover Equipment	164.84	0.14	0.42	165.40
Vehicle Travel to Well Sites	8.02	0.00	0.01	8.03
Total GHG Emissions	172.86	0.14	0.43	173.44

Maximum GHG Emissions From Well Maintenance Activities (Year 2034)

GHG Emissions from Travel to and From Drilling Site (Tonne/Year)				
Greenhouse Gas Emissions From Well	Carbon Dioxide CO2	Methane CH4 as CO2e	Nitrous Oxide N2O as CO2e	Total CO2e Tonne/Year
Workover Equipment	368.12	0.32	0.94	165.40
Vehicle Travel to Well Sites	17.93	0.00	0.03	8.03
Total GHG Emissions	386.05	0.32	0.97	173.44

Greenhouse Gas Emissions From Natural Gas Combustion in Gas Processing Equipment

Greenhouse Gas (GHG) Emission Factors for Natural Gas Fueled Combustion Equipment

GHG Emission Factors for Natural Gas Fueled, Stationary Combustion Equipment	CO2 Kg/MMBtu	CH4 Kg/MMBtu	N2O Kg/MMBtu	CO2e Weighted Ave Kg/MMBtu
	52.870000	0.000900	0.000100	1.000925

Gas Plant Greenhouse Gas Emissions From Natural Gas Fueled Combustion Equipment

Equipment Description and Process Information	Annual Heat Input (MMBtu/Yr)/1000	Carbon Dioxide CO2e Tonne/Year	Methane CH4 as CO2e Tonne/Year	Nitrous Oxide N2O as CO2e Tonne/Year
CO2 Injection Heater	525.600	27,788.47	9.93	16.29
Regeneration Gas Heater	87.600	4,631.41	1.66	2.72
TEG Reboiler	43.800	2,315.71	0.83	1.36
Amine Unit	8.760	463.14	0.17	0.27
Fire Pump Engine (175 Hp) X2	0.031	2.23	0.00	0.00
CTB - Flare (Pilot + Purge)	21.444	1,133.77	0.41	0.66
RCP - Flare (Pilot + Purge)	21.444	1,133.77	0.41	0.66
Reasonably Foreseeable GHG Emissions From Emergency Use Only Equipment				
CTB - Flare (Emergency Use)	21.32	4,443.70	0.40	0.66
RCF - Flare (Emergency Use)	21.32	4,131.07	0.40	0.66
Total GHG Emissions	-----	46,043.27	14.20	23.29
Total GHG Emission From All Natural Gas Combustion Equipment (CO2e Tonne/Year)				46,080.76

Calculation Assumptions and Notes

Note:

1. GHG Emission factors are from the CARB "Regulations for the Mandatory Reporting of Greenhouse Emissions", Appendix-A. The CO2 factor is for gas having a HHV of 1000 to 1025 Btu/sdcf.
2. The facility will include two 175 Hp diesel fueled IC engine that will be used to power a fire water pump. The engine will be permitted for 10 hours/year of non-emergency use per year (for engine maintenance). Emissions from the emergency use of the engine are not included because they are not reasonably foreseeable.
3. Total emissions include for non-emergency use of flare include the flare pilot and purge gas. Emergency use of flare includes 10 hours per year for foreseeable power outages plus other emergency events which are not quantified because they are nor reasonable foreseeable.
4. Flare emissions are calculated assuming each flare is used for a total of 7.47 hours per year. The time allocated to emergency flaring was obtained from the Pacific Gas & Electricity (PG&E) reliability report, submitted to the California Public Utility Commissions. It is assumed that flaring would be required during an electrical power outage. Other emergency flaring events could occur but are not included in the emission calculation because the events are not reasonably foreseeable. The total heat input to each flare is estimated to be 2,854 MMBtu/Hr during an emergency event.

Greenhouse Gas Emissions From the Carbon Dioxide (CO₂) Injection Wells

	Average Greenhouse Gas Emissions (Tonne/Year)			
	Gas Mcf/Year	CO ₂	Methane	CO ₂ e
Fugitive GHG Emissions	0.000	0.000	0.000	0.000
Maintenance (Venting & Purge)	0.000	0.000	0.000	0.000
Pressure Relief (PRV)	0.000	0.000	0.000	0.000
Total GHG Emissions	0.000	0.000	0.000	0.000

Notes:

1. Greenhouse gas emissions were calculated using a gas composition expected to be representative of the CO₂ composition during the period 2015 through 2025.
2. In the early stages of the project (circa 2015) the injection gas is expected to have a composition typical of the produced gas and the HECA gas blend.
3. The gas volume estimated for maintenance venting is for oil well workover. The gas volume used in the calculation was estimated to be 2554 Scf/well workover assuming that each well undergoes maintenance annually.
4. The well workover gas volume factor is from the report entitled "Methane Emissions from the Natural Gas Industry, Volume 7: Blow and Purge Activities, Final Report, Shires, T.M. GRI-94/0257.24 and EPA-600/R96-0809, Gas Research Institute and the US Environmental Protection Agency, June 1996

Stream Constituents	Molecular		2015 Gas	2015 HECA	2025 LP CO ₂	2025 HP CO ₂
	Formula	Weight	Mol. Fraction	Mol. Fraction	Mol. Fraction	Mol. Fraction
Water Vapor	H ₂ O	18.020000	0.040	0.0000	0.0000	0.0000
Nitrogen	N ₂	28.010000	0.010	0.0150	0.0150	0.0160
Oxygen	O ₂	32.000000	0.000	0.0000	0.0000	0.0000
Carbon Dioxide	CO ₂	44.010000	0.433	0.9450	0.9450	0.9500
Hydrogen Sulfide	H ₂ S	34.080000	0.000	0.0000	0.0000	0.0000
Methane	C ₁	16.040000	0.467	0.0290	0.0290	0.0260
Ethane	C ₂	30.070000	0.032	0.0040	0.0040	0.0030
Propane	C ₃	44.100000	0.024	0.0030	0.0030	0.0020
iso-Butane	i-C ₄	58.120000	0.006	0.0010	0.0010	0.0010
Butane	n-C ₄	58.120000	0.014	0.0020	0.0020	0.0020
iso-Pentane	i-C ₅	72.150000	0.005	0.0010	0.0010	0.0010
Pentane	n-C ₅	72.150000	0.006	0.0010	0.0010	0.0010
Hexanes	C ₆	86.180000	0.000	0.0000	0.0000	0.0000
Heptanes+	C ₇ +	100.200000	0.000	0.0000	0.0000	0.0000
GHG By Year CO ₂ e (Tonne/Year)			0.00	0.00	0.00	0.00
Non-Permitted VOC (Ton/Year)			0.00	0.00	0.00	0.00

Greenhouse Gas Emissions From Crude Oil and Natural Gas Production Wells

	Average Greenhouse Gas Emissions (Tonne/Year)			
	Gas Mcf/Year	CO2	Methane	CO2e
Fugitive GHG Emissions	584.894	23.831	1.889	63.499
Maintenance (Venting & Purge)	14.400	0.587	0.047	1.563
Pressure Relief (PRV)	0.000	0.000	0.000	0.000
Total GHG Emissions	599.294	24.417	1.935	65.062

Notes:

- Greenhouse gas emissions were calculated using the average composition of the gas from the crude oil production satellite setting and vapor recovery systems for the period 2015 through 2025
- The gas volume estimated for maintenance venting is for oil well workover. The gas volume used in the calculation was estimated to be 96 Scf/well workover assuming that each well undergoes maintenance annually.
- The well workover gas volume factor is from the report entitled "Methane Emissions from the Natural Gas Industry, Volume 7: Blow and Purge Activities, Final Report, Shires, T.M. GRI-94/0257.24 and EPA-600/R96-0809, Gas Research Institute and the US Environmental Protection Agency, June 1996

Stream Constituents	Molecular		2015	2017	2019	2025
	Formula	Weight	Mol. Fraction	Mol. Fraction	Mol. Fraction	Mol. Fraction
Water Vapor	H2O	18.020000	0.040	0.040	0.040	0.040
Nitrogen	N2	28.010000	0.010	0.021	0.021	0.015
Oxygen	O2	32.000000	0.000	0.000	0.000	0.000
Carbon Dioxide	CO2	44.010000	0.433	0.815	0.910	0.941
Hydrogen Sulfide	H2S	34.080000	0.000	0.000	0.000	0.000
Methane	C1	16.040000	0.467	0.120	0.058	0.029
Ethane	C2	30.070000	0.032	0.014	0.006	0.004
Propane	C3	44.100000	0.024	0.011	0.004	0.003
iso-Butane	i-C4	58.120000	0.006	0.003	0.001	0.001
Butane	n-C4	58.120000	0.014	0.007	0.003	0.002
iso-Pentane	i-C5	72.150000	0.005	0.003	0.001	0.001
Pentane	n-C5	72.150000	0.006	0.004	0.002	0.001
Hexanes	C6	86.180000	0.000	0.000	0.000	0.000
Heptanes+	C7+	100.200000	0.000	0.000	0.000	0.000

GHG By Year CO2e (Tonne/Year)	126.29	54.63	42.67	36.65

VOC Emissions By Year (Ton/Year)	2.38	1.24	0.49	0.36

Greenhouse Gas Emissions From Combustion Emissions From Well Maintenance Activities

Greenhouse Gas (GHG) Emission Factors for Diesel Fuel Combustion in Equipment Used for Well Maintenance

CARB Recommended GHG Emission Factors for Diesel Fuel Combustion in IC Engines	CO2	CH4	N2O	Total CO2e
	Kg/Gallon	Kg/Gallon	Kg/Gallon	Kg/Gallon
	9.960000	0.000412	0.000082	9.994208

Greenhouse Gas (GHG) Emissions From Diesel Fuel Combustion in Equipment Used for Well Maintenance

Project Year	Number Of Wells Drilled	Wells Undergoing Maintenance	Annual Fuel Use MGal/Year	Carbon Dioxide CO2e Tonne/Year	Methane CH4 as CO2e Tonne/Year	Nitrous Oxide N2O as CO2e Tonne/Year
2016	18	0	0.00	0.00	0.00E+00	0.00E+00
2017	4	18	4,470.94	44.53	3.87E-02	1.14E-01
2018		22	5,425.82	54.04	4.70E-02	1.39E-01
2019		22	5,425.82	54.04	4.70E-02	1.39E-01
2020	8	22	5,425.82	54.04	4.70E-02	1.39E-01
2021		30	7,398.85	73.69	6.40E-02	1.89E-01
2022	9	30	7,398.85	73.69	6.40E-02	1.89E-01
2023	27	39	9,618.50	95.80	8.32E-02	2.46E-01
2024		66	16,277.46	162.12	1.41E-01	4.16E-01
2025	20	66	16,277.46	162.12	1.41E-01	4.16E-01
2026		86	21,210.03	211.25	1.84E-01	5.42E-01
2027		86	21,210.03	211.25	1.84E-01	5.42E-01
2028		86	21,210.03	211.25	1.84E-01	5.42E-01
2029	20	86	21,210.03	211.25	1.84E-01	5.42E-01
2030		106	26,142.59	260.38	2.26E-01	6.68E-01
2031	21	106	26,142.59	260.38	2.26E-01	6.68E-01
2032		127	31,321.78	311.96	2.71E-01	8.00E-01
2033	23	127	31,321.78	311.96	2.71E-01	8.00E-01
2034	0	150	36,960.21	368.12	3.20E-01	9.44E-01
Average Greenhouse Emissions (Tonne/Year)				164.84	1.43E-01	4.23E-01
Average GHG Emission From Well Maintenance (CO2e Tonne/Year)					-----	165.40

Calculation Assumptions and Notes

Note:

1. GHG Emission factors are from the CARB "Regulations for the Mandatory Reporting of Greenhouse Emissions", Appendix-A. The CO₂ emissions were calculated using the CARB emission factor for California low sulfur diesel fuel (Table-7). The emissions of CH₄ and N₂O were calculated using the stationary source emission factors (Table-6) for diesel fuel combustion. The factors were converted from g/MMBtu to Kg/gallon using the higher heating value of diesel (137,380 Btu/Gallon).
2. The engine fuel use was determined using California Air Resources Board (CARB) OFFROAD2007 model. for mobile workover rigs and workover pumps. Well maintenance will require the use of a single mobile workover rig with a 425 Hp rating. The mobile rig will operate 12 hours per day. Well maintenance will also require the use of a workover pump. The workover pump will operate 6 hours per day.
3. Well workover maintenance is expected to take one day per well to complete. Per EPA guidance, it is assumed that 41% of the wells will undergo maintenance on an annual basis.

Greenhouse Gas Emissions From Crude oil and Natural Gas Production "Satellite" Settings

	Average Greenhouse Gas Emissions (Tonne/Year)			
	Gas Mcf/Year	CO2	Methane	CO2e
Fugitive GHG Emissions	46.801	1.907	0.151	5.081
Maintenance (Venting & Purge)	51.129	2.083	0.165	5.551
Pressure Relief (PRV)	0.884	0.036	0.003	0.000
Total GHG Emissions	98.814	4.026	0.319	10.632

Notes:

1. Greenhouse gas emissions were calculated using the average composition of the gas from the crude oil production satellite setting and vapor recovery systems for the period 2015 through 2025
2. The gas volume estimated for maintenance venting assume that all process vessels and tanks are depressurized to atmospheric pressure via a vapor recovery system prior to opening. The total estimated gas volume is equal to the total volume of the vessels and tanks. One turnaround per year is assumed.
3. Each satellite facility will includes a 100 Bbl emergency use only tank that will prevent liquid carryover during a pressure relief event. GHG emissions from emergency use of the tanks are included in the PRV emission estimate.

Stream Constituents	Molecular		2015	2017	2019	2025
	Formula	Weight	Mol. Fraction	Mol. Fraction	Mol. Fraction	Mol. Fraction
Water Vapor	H2O	18.020000	0.040	0.040	0.040	0.040
Nitrogen	N2	28.010000	0.010	0.021	0.021	0.015
Oxygen	O2	32.000000	0.000	0.000	0.000	0.000
Carbon Dioxide	CO2	44.010000	0.433	0.815	0.910	0.941
Hydrogen Sulfide	H2S	34.080000	0.000	0.000	0.000	0.000
Methane	C1	16.040000	0.467	0.120	0.058	0.029
Ethane	C2	30.070000	0.032	0.014	0.006	0.004
Propane	C3	44.100000	0.024	0.011	0.004	0.003
iso-Butane	i-C4	58.120000	0.006	0.003	0.001	0.001
Butane	n-C4	58.120000	0.014	0.007	0.003	0.002
iso-Pentane	i-C5	72.150000	0.005	0.003	0.001	0.001
Pentane	n-C5	72.150000	0.006	0.004	0.002	0.001
Hexanes	C6	86.180000	0.000	0.000	0.000	0.000
Heptanes+	C7+	100.200000	0.000	0.000	0.000	0.000

GHG By Year CO2e (Tonne/Year)	20.82	9.01	7.04	6.04

VOC Emissions By Year (Ton/Year)	0.39	0.20	0.08	0.06

Greenhouse Gas Emissions From The Central Tank Battery (CTB)

	Average Greenhouse Gas Emissions (Tonne/Year)			
	Gas Mcf/Year	CO2	Methane	CO2e
Fugitive GHG Emissions	17.041	0.694	0.055	1.850
Maintenance (Venting & Purge)	374.396	15.254	1.209	40.646
Pressure Relief (PRV)	0.000	0.000	0.000	0.000
Total GHG Emissions	391.437	15.948	1.264	42.496

Notes:

1. Greenhouse gas emissions were calculated using the average composition of the gas from the crude oil production satellite setting and vapor recovery systems for the period 2015 through 2025
2. The gas volume estimated for maintenance venting assume that all process vessels and tanks are depressurized to atmospheric pressure via a vapor recovery system prior to opening. The total estimated gas volume is equal to the total volume of the vessels and tanks. One turnaround per year is assumed.
3. Compressor blowdown and startup gas is routed to a vapor recovery system and is not vented to the atmosphere.
4. All tanks are served by a vapor recovery system and the pressure relief valves on vessels are routed to the intake compressor of the gas processing plants. During an emergency the gas from the tanks and vessels will be routed to an emergency use only flare. The GHG emissions from flaring CTB gas are accounted for in the GHG emission estimate for the RCF flare .

Stream Constituents	Molecular		2015	2017	2019	2025
	Formula	Weight	Mol. Fraction	Mol. Fraction	Mol. Fraction	Mol. Fraction
Water Vapor	H2O	18.020000	0.040	0.040	0.040	0.040
Nitrogen	N2	28.010000	0.010	0.021	0.021	0.015
Oxygen	O2	32.000000	0.000	0.000	0.000	0.000
Carbon Dioxide	CO2	44.010000	0.433	0.815	0.910	0.941
Hydrogen Sulfide	H2S	34.080000	0.000	0.000	0.000	0.000
Methane	C1	16.040000	0.467	0.120	0.058	0.029
Ethane	C2	30.070000	0.032	0.014	0.006	0.004
Propane	C3	44.100000	0.024	0.011	0.004	0.003
iso-Butane	i-C4	58.120000	0.006	0.003	0.001	0.001
Butane	n-C4	58.120000	0.014	0.007	0.003	0.002
iso-Pentane	i-C5	72.150000	0.005	0.003	0.001	0.001
Pentane	n-C5	72.150000	0.006	0.004	0.002	0.001
Hexanes	C6	86.180000	0.000	0.000	0.000	0.000
Heptanes+	C7+	100.200000	0.000	0.000	0.000	0.000

GHG By Year CO2e (Tonne/Year)	82.49	35.68	27.87	23.94

VOC Emissions By Year (Ton/Year)	1.49	0.77	0.31	0.22

Greenhouse Gas Emissions From The Reinjection Compression Facility (RCF)

	Average Greenhouse Gas Emissions (Tonne/Year)			
	Gas Mcf/Year	CO2	Methane	CO2e
Fugitive GHG Emissions	47.191	1.923	0.152	5.123
Maintenance (Venting & Purge)	18.666	0.761	0.060	2.026
Pressure Relief (PRV)	0.000	0.000	0.000	0.000
Total GHG Emissions	65.857	2.683	0.213	7.150

Notes:

1. Greenhouse gas emissions were calculated using the average composition of the gas from the crude oil production satellite setting and vapor recovery systems for the period 2015 through 2025
2. The gas volume estimated for maintenance venting assume that all process vessels and tanks are depressurized to atmospheric pressure via a vapor recovery system prior to opening. The total estimated gas volume is equal to the total volume of the vessels and tanks x 2. One turnaround per year is assumed.
3. Compressor blowdown and startup gas is routed to a closed process system and is not vented to the atmosphere.
4. Process equipment is not vented to the atmosphere. All process vent emissions (i.e. the TEG) are captured and returned to the process system or routed to the facility vapor recovery unit. During an emergency gas from the RCF will be routed to an emergency use only flare. The GHG emissions from flaring are accounted for in the GHG emission estimate for the CTB flare .

Stream Constituents	Molecular		2015	2017	2019	2025
	Formula	Weight	Mol. Fraction	Mol. Fraction	Mol. Fraction	Mol. Fraction
Water Vapor	H2O	18.020000	0.040	0.040	0.040	0.040
Nitrogen	N2	28.010000	0.010	0.021	0.021	0.015
Oxygen	O2	32.000000	0.000	0.000	0.000	0.000
Carbon Dioxide	CO2	44.010000	0.433	0.815	0.910	0.941
Hydrogen Sulfide	H2S	34.080000	0.000	0.000	0.000	0.000
Methane	C1	16.040000	0.467	0.120	0.058	0.029
Ethane	C2	30.070000	0.032	0.014	0.006	0.004
Propane	C3	44.100000	0.024	0.011	0.004	0.003
iso-Butane	i-C4	58.120000	0.006	0.003	0.001	0.001
Butane	n-C4	58.120000	0.014	0.007	0.003	0.002
iso-Pentane	i-C5	72.150000	0.005	0.003	0.001	0.001
Pentane	n-C5	72.150000	0.006	0.004	0.002	0.001
Hexanes	C6	86.180000	0.000	0.000	0.000	0.000
Heptanes+	C7+	100.200000	0.000	0.000	0.000	0.000

GHG By Year CO2e (Tonne/Year)	13.88	6.00	4.69	4.03

VOC Emissions By Year (Ton/Year)	0.07	0.04	0.02	0.01

Greenhouse Gas Emissions From The Carbon Dioxide Recovery Plant (RCP)

	Average Greenhouse Gas Emissions (Tonne/Year)			
	Gas Mcf/Year	CO2	Methane	CO2e
Fugitive GHG Emissions	160.210	6.527	0.517	17.393
Maintenance (Venting & Purge)	48.372	1.971	0.156	5.252
Pressure Relief (PRV)	0.000	0.000	0.000	0.000
Total GHG Emissions	208.582	8.498	0.674	22.645

Notes:

1. Greenhouse gas emissions were calculated using the average composition of the gas from the crude oil production satellite setting and vapor recovery systems for the period 2015 through 2025
2. The gas volume estimated for maintenance venting assume that all process vessels and tanks are depressurized to atmospheric pressure via a vapor recovery system prior to opening. The total estimated gas volume is equal to the total volume of the vessels and tanks x 2. One turnaround per year is assumed.
3. Compressor blowdown and startup gas is routed to a vapor recovery system and is not vented to the atmosphere.
4. All tanks are served by a vapor recovery system and the pressure relief valves on vessels are routed to the intake compressor of the gas processing plants. During an emergency the gas from the tanks and vessels will be routed to the CRP flare. The GHG emissions from gas flaring are accounted for in the GHG emission estimate for the CRP combustion flare.

Stream Constituents	Molecular		2015	2017	2019	2025
	Formula	Weight	Mol. Fraction	Mol. Fraction	Mol. Fraction	Mol. Fraction
Water Vapor	H2O	18.020000	0.040	0.040	0.040	0.040
Nitrogen	N2	28.010000	0.010	0.021	0.021	0.015
Oxygen	O2	32.000000	0.000	0.000	0.000	0.000
Carbon Dioxide	CO2	44.010000	0.433	0.815	0.910	0.941
Hydrogen Sulfide	H2S	34.080000	0.000	0.000	0.000	0.000
Methane	C1	16.040000	0.467	0.120	0.058	0.029
Ethane	C2	30.070000	0.032	0.014	0.006	0.004
Propane	C3	44.100000	0.024	0.011	0.004	0.003
iso-Butane	i-C4	58.120000	0.006	0.003	0.001	0.001
Butane	n-C4	58.120000	0.014	0.007	0.003	0.002
iso-Pentane	i-C5	72.150000	0.005	0.003	0.001	0.001
Pentane	n-C5	72.150000	0.006	0.004	0.002	0.001
Hexanes	C6	86.180000	0.000	0.000	0.000	0.000
Heptanes+	C7+	100.200000	0.000	0.000	0.000	0.000

GHG By Year CO2e (Tonne/Year)	43.96	19.01	14.85	12.76

VOC Emissions By Year (Ton/Year)	0.19	0.10	0.04	0.03

Greenhouse Gas Emissions From The Crude Oil and Natural Gas Gathering System

	Average Greenhouse Gas Emissions (Tonne/Year)			
	Gas Mcf/Year	CO2	Methane	CO2e
Fugitive GHG Emissions	0.000	0.000	0.000	0.000
Gathering System Blowdown	111.240	4.532	0.359	12.077
Pipeline PRV (One PRV per Mile)	6.120	0.249	0.020	0.664
Total GHG Emissions	117.360	4.782	0.379	12.741

Notes:

1. Greenhouse gas emissions for the new wells were calculated using the average composition of the gas from the crude oil production satellite setting and vapor recovery system for 2015 through 2025.
2. For the most part, the gas gathering system is constructed using welded connections and fugitive GHG emissions from leaking components are expected to be negligible.
4. The gas gathering system blowdown factor (309 Scf/mile) is from the report entitled "Methane Emissions from the Natural Gas Industry, Volume 7: Blow and Purge Activities, Final Report, Shires, T.M. GRI-94/0257.24 and EPA-600/R96-0809, Gas Research Institute and the US Environmental Protection Agency, June 1996.
5. The length of pipeline included in the calculation was estimated to be 180 miles (150 wells x 1.2 miles per well). The line length per well was calculated from the total length of the new pipeline (550 miles) required for the 309 new CO2 injectors and 150 new production wells.

Stream Constituents	Molecular		2015	2017	2019	2025
	Formula	Weight	Mol. Fraction	Mol. Fraction	Mol. Fraction	Mol. Fraction
Water Vapor	H2O	18.020000	0.040	0.040	0.040	0.040
Nitrogen	N2	28.010000	0.010	0.021	0.021	0.015
Oxygen	O2	32.000000	0.000	0.000	0.000	0.000
Carbon Dioxide	CO2	44.010000	0.433	0.815	0.910	0.941
Hydrogen Sulfide	H2S	34.080000	0.000	0.000	0.000	0.000
Methane	C1	16.040000	0.467	0.120	0.058	0.029
Ethane	C2	30.070000	0.032	0.014	0.006	0.004
Propane	C3	44.100000	0.024	0.011	0.004	0.003
iso-Butane	i-C4	58.120000	0.006	0.003	0.001	0.001
Butane	n-C4	58.120000	0.014	0.007	0.003	0.002
iso-Pentane	i-C5	72.150000	0.005	0.003	0.001	0.001
Pentane	n-C5	72.150000	0.006	0.004	0.002	0.001
Hexanes	C6	86.180000	0.000	0.000	0.000	0.000
Heptanes+	C7+	100.200000	0.000	0.000	0.000	0.000

GHG By Year CO2e (Tonne/Year)	24.73	10.70	8.36	7.18

VOC Emissions By Year (Ton/Year)	0.47	0.24	0.10	0.07

Greenhouse Gas Emissions From The CO2 Intake and CO2 Gas Distribution System

	Average Greenhouse Gas Emissions (Tonne/Year)			
	Gas Mcf/Year	CO2	Methane	CO2e
Fugitive GHG Emissions	0.000	0.000	0.000	0.000
Pipeline Gas Blowdown (6615 Scfy/Mile)	355.119	15.281	0.938	34.971
Pipeline PRV (One PRV per Mile)	12.607	0.543	0.033	1.242
Total GHG Emissions	367.726	15.824	0.971	36.212

Notes:

1. Greenhouse gas emissions were calculated using a gas composition expected to be representative of the CO2 composition during the period 2015 through 2025 (listed below)..
2. In the early stages of the project (circa 2015) the injection gas is expected to have a composition typical of the produced gas and the HECA gas blend.
3. The gas volume for the CO2 injection system blowdown is calculated from the total length of the injection system piping which is equal to 309 injection wells x 1.20 miles/well. The gas volume for the HECA pipeline (12" x 4 miles or 16,587.6) is included in the volume estimate. It is assumed that the entire pipeline system (including the HECA line) would be blowdown annually (highly unlikely). The CO2 injection system and the HECA line would be depressurized to about 300 psig before venting to the atmosphere pressure. The gas volume has been adjusted accordingly.
4. The gas distribution system blowdown factor (309 Scf/mile) is from the report entitled "Methane Emissions from the Natural Gas Industry, Volume 7: Blow and Purge Activities, Final Report, Shires, T.M. GRI-94/0257.24 and EPA-600/R96-0809, Gas Research Institute and the US Environmental Protection Agency, June 1996.

Stream Constituents	Molecular		2015 Gas	2015 HECA	2025 LP CO2	2025 HP CO2
	Formula	Weight	Mol. Fraction	Mol. Fraction	Mol. Fraction	Mol. Fraction
Water Vapor	H2O	18.020000	0.040	0.0000	0.0000	0.0000
Nitrogen	N2	28.010000	0.010	0.0150	0.0150	0.0160
Oxygen	O2	32.000000	0.000	0.0000	0.0000	0.0000
Carbon Dioxide	CO2	44.010000	0.433	0.9450	0.9450	0.9500
Hydrogen Sulfide	H2S	34.080000	0.000	0.0000	0.0000	0.0000
Methane	C1	16.040000	0.467	0.0290	0.0290	0.0260
Ethane	C2	30.070000	0.032	0.0040	0.0040	0.0030
Propane	C3	44.100000	0.024	0.0030	0.0030	0.0020
iso-Butane	i-C4	58.120000	0.006	0.0010	0.0010	0.0010
Butane	n-C4	58.120000	0.014	0.0020	0.0020	0.0020
iso-Pentane	i-C5	72.150000	0.005	0.0010	0.0010	0.0010
Pentane	n-C5	72.150000	0.006	0.0010	0.0010	0.0010
Hexanes	C6	86.180000	0.000	0.0000	0.0000	0.0000
Heptanes+	C7+	100.200000	0.000	0.0000	0.0000	0.0000

GHG By Year CO2e (Tonne/Year)	77.49	22.57	22.57	22.22

VOC Emissions By Year (Ton/Year)	1.46	0.22	0.22	0.20

**Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors**

Total Fugitive Emissions (Occidental of Elk Hills CO2 Enhanced Oil Recovery Project)							
Type of Component	Component Service	Total Component Counts	Weighted Average Leak (ppmv)	Weighted Average Leak Fraction	Weighted Average Leak Rate lb/day*component	Fugitive VOC Emissions (lb/day)	VOC Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	11,966	1,786	0.0010	7.835E-04	9.375	145.076
	Light Crude Oil	7,205	1,369	0.0010	4.241E-03	30.558	229.791
	Heavy Crude Oil	248	500	0.0010	8.854E-05	0.022	0.028
Pump Seals	Gas/Light Liquid	720	2,000	0.0010	1.489E-02	10.721	165.899
	Light Crude Oil	59	500	0.0010	7.920E-03	0.469	3.526
	Heavy Crude Oil	12	500	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	880	1,468	0.0010	5.149E-03	4.533	70.149
	Light Crude Oil	1,638	1,489	0.0010	6.126E-03	10.032	75.435
	Heavy Crude Oil	44	500	0.0010	1.167E-03	0.052	0.066
Connectors	Gas/Light Liquid	38,969	1,558	0.0010	1.430E-03	55.730	862.419
	Light Crude Oil	33,772	1,421	0.0010	1.426E-04	4.817	36.225
	Heavy Crude Oil	406	500	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	11,766	1,431	0.0010	2.902E-03	34.147	528.418
	Light Crude Oil	11,422	1,501	0.0010	2.661E-03	30.393	228.551
	Heavy Crude Oil	299	500	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	0	0.0000	0.000E+00	0.000	0.000
	Light Crude Oil	0	0	0.0000	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	0	0.0000	0.000E+00	0.000	0.000
Total Fugitive VOC Emissions From Associated Components						190.848	2345.581
Weight percentage of VOC in the total organic compounds in gas ?							
Weight percentage of VOC in the total organic compounds in oil ?							

**Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors**

Fugitive Emissions From The Reinjection Compression Facility (RCF)

Type of Component	Component Service	Component Counts For RCF	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	VOC Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	319	500	0.0010	5.505E-04	0.176	2.719
	Light Crude Oil	384	500	0.0010	3.612E-03	1.387	10.429
	Heavy Crude Oil	12	500	0.0010	4.805E-04	0.006	0.007
Pump Seals	Gas/Light Liquid	0	500	0.0010	7.234E-03	0.000	0.000
	Light Crude Oil	0	500	0.0010	7.920E-03	0.000	0.000
	Heavy Crude Oil	2	500	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	43	500	0.0010	3.854E-03	0.167	2.577
	Light Crude Oil	61	500	0.0010	4.594E-03	0.281	2.114
	Heavy Crude Oil	1	500	0.0010	1.167E-03	0.001	0.002
Connectors	Gas/Light Liquid	1,496	500	0.0010	1.251E-03	1.873	28.977
	Light Crude Oil	3,850	500	0.0010	1.251E-03	4.817	36.225
	Heavy Crude Oil	7	500	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	1,050	500	0.0010	2.328E-03	2.445	37.835
	Light Crude Oil	558	500	0.0010	2.003E-03	1.118	8.406
	Heavy Crude Oil	26	500	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	500	0.0010	2.170E-03	0.000	0.000
	Light Crude Oil	0	500	0.0010	1.785E-03	0.000	0.000
	Heavy Crude Oil	0	500	0.0010	8.606E-04	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						12.270	129.290
Weight percentage of VOC in the total organic compounds in gas ?						100.0	-----
Weight percentage of VOC in the total organic compounds in oil ?						100.0	-----

**Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors**

Fugitive Emissions From The Carbon Dioxide Recovery Plant (CRP)

Type of Component	Component Service	Component Counts For CRP	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	VOC Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	1,289	500	0.0010	5.505E-04	0.709	10.979
	Light Crude Oil	1,961	500	0.0010	3.612E-03	7.081	53.251
	Heavy Crude Oil	236	500	0.0010	6.864E-05	0.016	0.021
Pump Seals	Gas/Light Liquid	0	500	0.0010	7.234E-03	0.000	0.000
	Light Crude Oil	43	500	0.0010	7.920E-03	0.342	2.573
	Heavy Crude Oil	10	500	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	247	500	0.0010	3.854E-03	0.953	14.745
	Light Crude Oil	416	500	0.0010	4.594E-03	1.913	14.384
	Heavy Crude Oil	43	500	0.0010	1.167E-03	0.050	0.064
Connectors	Gas/Light Liquid	9,662	500	0.0010	1.251E-03	12.091	187.110
	Light Crude Oil	8,204	500	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	398	500	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	3,310	500	0.0010	2.328E-03	7.706	119.255
	Light Crude Oil	2,426	500	0.0010	2.003E-03	4.861	36.551
	Heavy Crude Oil	272	500	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	500	0.0010	2.170E-03	0.000	0.000
	Light Crude Oil	0	500	0.0010	1.785E-03	0.000	0.000
	Heavy Crude Oil	0	500	0.0010	8.606E-04	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						35.723	438.931
Weight percentage of VOC in the total organic compounds in gas?						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

**Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors**

Fugitive Emissions From The Central Tank Battery (CTB)

Type of Component	Component Service	Component Counts For CTB	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	VOC Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	98	500	0.0010	5.505E-04	0.054	0.835
	Light Crude Oil	688	500	0.0010	3.612E-03	2.485	18.685
	Heavy Crude Oil	0	500	0.0010	6.864E-05	0.000	0.000
Pump Seals	Gas/Light Liquid	0	500	0.0010	7.234E-03	0.000	0.000
	Light Crude Oil	16	500	0.0010	7.920E-03	0.127	0.953
	Heavy Crude Oil	0	500	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	22	500	0.0010	3.854E-03	0.085	1.312
	Light Crude Oil	80	500	0.0010	4.594E-03	0.367	2.763
	Heavy Crude Oil	0	500	0.0010	1.167E-03	0.000	0.000
Connectors	Gas/Light Liquid	324	500	0.0010	1.251E-03	0.405	6.274
	Light Crude Oil	982	500	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	500	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	100	500	0.0010	2.328E-03	0.233	3.603
	Light Crude Oil	814	500	0.0010	2.003E-03	1.631	12.262
	Heavy Crude Oil	0	500	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	500	0.0010	2.170E-03	0.000	0.000
	Light Crude Oil	0	500	0.0010	1.785E-03	0.000	0.000
	Heavy Crude Oil	0	500	0.0010	8.606E-04	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						5.387	46.688
Weight percentage of VOC in the total organic compounds in gas?							
						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

**Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors**

Fugitive Emissions From Production Satellite Settings

Type of Component	Component Service	Component Counts Per Setting	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	VOC Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	0	2,000	0.0010	8.222E-04	0.000	0.000
	Light Crude Oil	572	2,000	0.0010	4.699E-03	2.688	20.213
	Heavy Crude Oil	0	2,000	0.0010	4.805E-04	0.000	0.000
Pump Seals	Gas/Light Liquid	0	2,000	0.0010	1.489E-02	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.436E-02	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	208	2,000	0.0010	5.861E-03	1.219	18.865
	Light Crude Oil	0	2,000	0.0010	6.917E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.690E-03	0.000	0.000
Connectors	Gas/Light Liquid	2,106	2,000	0.0010	1.505E-03	3.169	49.042
	Light Crude Oil	936	2,000	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	286	2,000	0.0010	3.252E-03	0.930	14.395
	Light Crude Oil	1,144	2,000	0.0010	2.988E-03	3.419	25.709
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	2,000	0.0010	2.772E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.936E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.373E-03	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						11.425	128.223
Weight percentage of VOC in the total organic compounds in gas?						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

**Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors**

Fugitive Emissions From Crude Oil and Natural Gas Production Wells							
Type of Component	Component Service	Component Counts Per Well	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	VOC Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	10,260	2,000	0.0010	8.222E-04	8.436	130.543
	Light Crude Oil	3,600	2,000	0.0010	4.699E-03	16.917	127.214
	Heavy Crude Oil	0	2,000	0.0010	4.805E-04	0.000	0.000
Pump Seals	Gas/Light Liquid	720	2,000	0.0010	1.489E-02	10.721	165.899
	Light Crude Oil	0	2,000	0.0010	1.436E-02	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	360	2,000	0.0010	5.861E-03	2.110	32.650
	Light Crude Oil	1,080	2,000	0.0010	6.917E-03	7.470	56.174
	Heavy Crude Oil	0	2,000	0.0010	1.690E-03	0.000	0.000
Connectors	Gas/Light Liquid	25,380	2,000	0.0010	1.505E-03	38.192	591.016
	Light Crude Oil	19,800	2,000	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	7,020	2,000	0.0010	3.252E-03	22.832	353.330
	Light Crude Oil	6,480	2,000	0.0010	2.988E-03	19.365	145.624
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	2,000	0.0010	2.772E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.936E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.373E-03	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						126.043	1602.449
Weight percentage of VOC in the total organic compounds in gas?						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

**Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors**

Fugitive Emissions From CO2 Injection Wells

Type of Component	Component Service	Component Counts	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	VOC Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	0	2,000	0.0010	8.222E-04	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	4.699E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	4.805E-04	0.000	0.000
Pump Seals	Gas/Light Liquid	0	2,000	0.0010	1.489E-02	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.436E-02	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	0	2,000	0.0010	5.861E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	6.917E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.690E-03	0.000	0.000
Connectors	Gas/Light Liquid	0	2,000	0.0010	1.505E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	0	2,000	0.0010	3.252E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	2.988E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	2,000	0.0010	2.772E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.936E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.373E-03	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						0.000	0.000
Weight percentage of VOC in the total organic compounds in gas?							
						100.0	
Weight percentage of VOC in the total organic compounds in oil?							
						100.0	

**Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors**

Gathering System for Crude oil and Natural Gas Production

Type of Component	Component Service	Component Counts	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	VOC Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	0	2,000	0.0010	8.222E-04	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	4.699E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	4.805E-04	0.000	0.000
Pump Seals	Gas/Light Liquid	0	2,000	0.0010	1.489E-02	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.436E-02	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	0	2,000	0.0010	5.861E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	6.917E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.690E-03	0.000	0.000
Connectors	Gas/Light Liquid	0	2,000	0.0010	1.505E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	0	2,000	0.0010	3.252E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	2.988E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	2,000	0.0010	2.772E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.936E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.373E-03	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						0.000	0.000
Weight percentage of VOC in the total organic compounds in gas?						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

**Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors**

CO2 Intake and CO2 Distribution System for Injection

Type of Component	Component Service	Component Counts	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	VOC Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	0	2,000	0.0010	8.222E-04	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	4.699E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	4.805E-04	0.000	0.000
Pump Seals	Gas/Light Liquid	0	2,000	0.0010	1.489E-02	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.436E-02	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	0	2,000	0.0010	5.861E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	6.917E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.690E-03	0.000	0.000
Connectors	Gas/Light Liquid	0	2,000	0.0010	1.505E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	0	2,000	0.0010	3.252E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	2.988E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	2,000	0.0010	2.772E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.936E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.373E-03	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						0.000	0.000
Weight percentage of VOC in the total organic compounds in gas?							
						100.0	
Weight percentage of VOC in the total organic compounds in oil?							
						100.0	

**Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors**

Reserved									

Type of Component	Component Service	Component Counts	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	VOC Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid		2,000	0.0200	2.399E-03	0.000	0.000
	Light Crude Oil		2,000	0.0200	7.994E-02	0.000	0.000
	Heavy Crude Oil		2,000	0.0200	1.785E-03	0.000	0.000
Pump Seals	Gas/Light Liquid		2,000	0.0200	6.706E-02	0.000	0.000
	Light Crude Oil		2,000	0.0200	9.662E-02	0.000	0.000
	Heavy Crude Oil		2,000	0.0200	0.000E+00	0.000	0.000
Others	Gas/Light Liquid		2,000	0.0200	7.207E-02	0.000	0.000
	Light Crude Oil		2,000	0.0200	7.413E-02	0.000	0.000
	Heavy Crude Oil		2,000	0.0200	1.690E-03	0.000	0.000
Connectors	Gas/Light Liquid		2,000	0.0200	2.157E-02	0.000	0.000
	Light Crude Oil		2,000	0.0200	0.000E+00	0.000	0.000
	Heavy Crude Oil		2,000	0.0200	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid		2,000	0.0200	6.244E-02	0.000	0.000
	Light Crude Oil		2,000	0.0200	5.816E-02	0.000	0.000
	Heavy Crude Oil		2,000	0.0200	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid		2,000	0.0200	4.792E-02	0.000	0.000
	Light Crude Oil		2,000	0.0200	3.805E-02	0.000	0.000
	Heavy Crude Oil		2,000	0.0200	2.144E-02	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						0.000	0.000
Weight percentage of VOC in the total organic compounds in gas?							
						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

EPA Protocol For Equipment Leak Emission Estimates (November 1995) **Average Leak Rates For Components At Oil and Natural Gas Processing Facilities**

ALR - Fugitive Emissions Factors For A 10,000 ppmv Leak Threshold

Component Type	Component Service Type	Proposed Leak Fraction	EPA Table 5-7 ALR Equations For Proposed Leak Threshold (10,000 ppmv) And Specified leak fraction (LKFRAC)	ALR Factor lb/day per component
Valves	Gas/Light Liquid	0.0000	$ALR = [(0.098 \times LKFRAC) + 2.5E-5] \times 2.2^{*24}$	1.320E-03
	Light Crude Oil	0.0000	$ALR = [(0.087 \times LKFRAC) + 1.9E-5] \times 2.2^{*24}$	1.003E-03
	Heavy Crude Oil	0.0000	$ALR = (8.4 E-6) \times 2.2^{*24}$	4.435E-04
Pump Seals	Gas/Light Liquid	0.0000	$ALR = [(0.074 \times LKFRAC) + 3.5E-4] \times 2.2^{*24}$	1.848E-02
	Light Crude Oil	0.0000	$ALR = [(0.100 \times LKFRAC) + 5.1E-4] \times 2.2^{*24}$	2.693E-02
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Others	Gas/Light Liquid	0.0000	$ALR = [(0.089 \times LKFRAC) + 1.2E-4] \times 2.2^{*24}$	6.336E-03
	Light Crude Oil	0.0000	$ALR = [(0.083 \times LKFRAC) + 1.4E-4] \times 2.2^{*24}$	7.392E-03
	Heavy Crude Oil	0.0000	$ALR = (3.2 E-5) \times 2.2^{*24}$	1.848E-03
Connectors	Gas/Light Liquid	0.0000	$ALR = [(0.026 \times LKFRAC) + 1.0E-5] \times 2.2^{*24}$	5.280E-04
	Light Crude Oil	0.0000	$ALR = [(0.026 \times LKFRAC) + 9.7E-6] \times 2.2^{*24}$	5.122E-04
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Flanges	Gas/Light Liquid	0.0000	$ALR = [(0.082 \times LKFRAC) + 5.7E-6] \times 2.2^{*24}$	3.010E-04
	Light Crude Oil	0.0000	$ALR = [(0.073 \times LKFRAC) + 2.4E-6] \times 2.2^{*24}$	1.267E-04
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Open-ended Lines	Gas/Light Liquid	0.0000	$ALR = [(0.055 \times LKFRAC) + 1.5E-5] \times 2.2^{*24}$	7.920E-04
	Light Crude Oil	0.0000	$ALR = [(0.044 \times LKFRAC) + 1.4E-5] \times 2.2^{*24}$	7.392E-04
	Heavy Crude Oil	0.0000	$ALR = [(0.030 \times LKFRAC) + 7.2E-6] \times 2.2^{*24}$	3.802E-04

EPA Protocol For Equipment Leak Emission Estimates (November 1995) **Average Leak Rates For Components At Oil and Natural Gas Processing Facilities**

ALR - Fugitive Emissions Factors For A 2,000 ppmv Leak Threshold

Component Type	Component Service Type	Proposed Leak Fraction	EPA Table 5-7 ALR Equations For Proposed Leak Threshold (10,000 ppmv) And Specified leak fraction (LKFRAC)	ALR Factor lb/day per component
Valves	Gas/Light Liquid	0.0000	ALR = [(0.083 x LKFRAC) + 1.4E-5]*2.2*24	7.392E-04
	Light Crude Oil	0.0200	ALR = [(0.075 x LKFRAC) + 1.4E-5]*2.2*24	7.994E-02
	Heavy Crude Oil	0.0000	ALR = [(0.0013 x LKFRAC) + 7.8E-6]*2.2*24	4.118E-04
Pump Seals	Gas/Light Liquid	0.0000	ALR = [(0.052 x LKFRAC) + 2.3E-4]*2.2*24	1.214E-02
	Light Crude Oil	0.0000	ALR = [(0.082 x LKFRAC) + 1.9E-4]*2.2*24	1.003E-02
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Others	Gas/Light Liquid	0.0000	ALR = [(0.066 x LKFRAC) + 4.5E-5]*2.2*24	2.376E-03
	Light Crude Oil	0.0000	ALR = [(0.067 x LKFRAC) + 6.4E-5]*2.2*24	3.379E-03
	Heavy Crude Oil	0.0000	ALR = (3.2 E-5)*2.2*24	1.690E-03
Connectors	Gas/Light Liquid	0.0000	ALR = [(0.020 x LKFRAC) + 8.5E-6]*2.2*24	4.488E-04
	Light Crude Oil	0.0000	ALR = [(0.022 x LKFRAC) + 8.6E-6]*2.2*24	4.541E-04
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Flanges	Gas/Light Liquid	0.0000	ALR = [(0.059 x LKFRAC) + 2.6E-6]*2.2*24	1.373E-04
	Light Crude Oil	0.0000	ALR = [(0.055 x LKFRAC) + 1.6E-6]*2.2*24	8.448E-05
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Open-ended Lines	Gas/Light Liquid	0.0000	ALR = [(0.045 x LKFRAC) + 7.5E-6]*2.2*24	3.960E-04
	Light Crude Oil	0.0000	ALR = [(0.036 x LKFRAC) + 6.7E-6]*2.2*24	3.538E-04
	Heavy Crude Oil	0.0000	ALR = [(0.020 x LKFRAC) + 6.0E-6]*2.2*24	3.168E-04

EPA Protocol For Equipment Leak Emission Estimates (November 1995) **Average Leak Rates For Components At Oil and Natural Gas Processing Facilities**

ALR - Fugitive Emissions Factors For A 1,000 ppmv Leak Threshold

Component Type	Component Service Type	Proposed Leak Fraction	EPA Table 5-7 ALR Equations For Proposed Leak Threshold (10,000 ppmv) And Specified leak fraction (LKFRAC)	ALR Factor lb/day per component
Valves	Gas/Light Liquid	0.0000	ALR = [(0.076 x LKFRAC) + 1.1E-5]*2.2*24	5.808E-04
	Light Crude Oil	0.0000	ALR = [(0.069 x LKFRAC) + 1.2E-5]*2.2*24	6.336E-04
	Heavy Crude Oil	0.0000	ALR = (0.0013 x LKFRAC) + 7.8E-6]*2.2*24	4.118E-04
Pump Seals	Gas/Light Liquid	0.0000	ALR = [(0.052 x LKFRAC) + 2.3E-4]*2.2*24	1.214E-02
	Light Crude Oil	0.0000	ALR = [(0.079 x LKFRAC) + 1.5E-4]*2.2*24	7.920E-03
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Others	Gas/Light Liquid	0.0000	ALR = [(0.061 x LKFRAC) + 3.1E-5]*2.2*24	1.637E-03
	Light Crude Oil	0.0000	ALR = [(0.058 x LKFRAC) + 4.4E-5]*2.2*24	2.323E-03
	Heavy Crude Oil	0.0000	ALR = [(0.0011 x LKFRAC) + 2.1E-5]*2.2*24	1.109E-03
Connectors	Gas/Light Liquid	0.0000	ALR = [(0.018 x LKFRAC) + 8.0E-6]*2.2*24	4.224E-04
	Light Crude Oil	0.0000	ALR = [(0.021 x LKFRAC) + 8.3E-6]*2.2*24	4.382E-04
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Flanges	Gas/Light Liquid	0.0000	ALR = [(0.051 x LKFRAC) + 1.8E-6]*2.2*24	9.504E-05
	Light Crude Oil	0.0000	ALR = [(0.046 x LKFRAC) + 1.2E-6]*2.2*24	6.336E-05
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Open-ended Lines	Gas/Light Liquid	0.0000	ALR = [(0.039 x LKFRAC) + 5.0E-6]*2.2*24	2.640E-04
	Light Crude Oil	0.0000	ALR = [(0.032 x LKFRAC) + 4.7E-6]*2.2*24	2.482E-04
	Heavy Crude Oil	0.0000	ALR = [(0.015 x LKFRAC) + 4.9E-6]*2.2*24	2.587E-04

APPENDICES

CONSTRUCTION EMISSIONS

Table A-1
Estimated Facility Installation Emissions (EOR Processing Facility, Tank Batteries, Satellite Stations)
OEHI CO2 EOR PROJECT

Emission Factors (lbs/bhp-hr)										Emissions (lbs/day)						Total Emissions (tons)							
Equipment	Number	Fuel Type	BHP	Load Factor (%)	NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Day	NOX	ROG	CO	CO2	PM10	SOX	Days	NOX	CO	CO2	PM10	SOX
2014																							
Motor Grader	1	Diesel	150	61	3.00E-02	3.95E-03	2.09E-02	3.54E+00	1.64E-03	3.98E-05	8	21.96	2.89	15.30	2591.28	1.20	0.03	3.3	0.04	0.00	0.03	4.28	0.00
Cranes	1	Diesel	300	43	4.15E-03	4.69E-04	1.58E-03	5.76E-01	1.50E-04	5.65E-06	4	2.14	0.24	0.82	297.14	0.08	0.00	62.7	0.07	0.01	0.03	9.32	0.00
Backhoes	1	Diesel	70	55	8.71E-02	1.30E-02	7.19E-02	1.06E+01	6.89E-03	1.25E-04	4	13.42	2.00	11.07	1634.90	1.06	0.02	62.7	0.42	0.06	0.35	51.25	0.03
Welders	1	Diesel	50	43	1.41E-04	3.80E-05	1.46E-04	1.59E-02	1.04E-05	2.06E-07	8	0.02	0.01	0.03	2.74	0.00	0.00	62.7	0.00	0.00	0.00	0.09	0.00
Motor Grader	1	Diesel	150	61	3.00E-02	3.95E-03	2.09E-02	3.54E+00	1.64E-03	3.98E-05	8	21.96	2.89	15.30	2591.28	1.20	0.03	13	0.14	0.02	0.10	16.84	0.01
Cranes	1	Diesel	300	43	4.15E-03	4.69E-04	1.58E-03	5.76E-01	1.50E-04	5.65E-06	4	2.14	0.24	0.82	297.14	0.08	0.00	248	0.27	0.03	0.10	36.85	0.01
Backhoes	1	Diesel	70	55	8.71E-02	1.30E-02	7.19E-02	1.06E+01	6.89E-03	1.25E-04	4	13.42	2.00	11.07	1634.90	1.06	0.02	248	1.66	0.25	1.37	202.73	0.13
Welders	1	Diesel	50	43	1.41E-04	3.80E-05	1.46E-04	1.59E-02	1.04E-05	2.06E-07	8	0.02	0.01	0.03	2.74	0.00	0.00	248	0.00	0.00	0.00	0.34	0.00
2015																							
Motor Grader	1	Diesel	150	61	2.76E-02	3.76E-03	2.12E-02	3.59E+00	1.52E-03	4.04E-05	8	20.20	2.75	15.54	2631.15	1.11	0.03	14.1	0.14	0.02	0.11	18.55	0.01
Cranes	1	Diesel	300	43	3.89E-03	4.52E-04	1.51E-03	5.85E-01	1.38E-04	5.74E-06	4	1.98	0.23	0.78	301.67	0.07	0.00	267.9	0.26	0.03	0.10	40.41	0.01
Backhoes	1	Diesel	70	55	8.03E-02	1.20E-02	7.24E-02	1.08E+01	6.09E-03	1.26E-04	4	12.39	1.84	11.15	1658.60	0.94	0.02	267.9	1.66	0.25	1.49	222.17	0.13
Welders	1	Diesel	50	43	1.37E-04	3.43E-05	1.44E-04	1.62E-02	9.35E-06	2.09E-07	8	0.02	0.01	0.02	2.78	0.00	0.00	267.9	0.00	0.00	0.00	0.37	0.00
Motor Grader	1	Diesel	150	61	2.76E-02	3.76E-03	2.12E-02	3.59E+00	1.52E-03	4.04E-05	8	20.20	2.75	15.54	2631.15	1.11	0.03	13	0.13	0.02	0.10	17.10	0.01
Cranes	1	Diesel	300	43	3.83E-03	4.52E-04	1.51E-03	5.85E-01	1.38E-04	5.74E-06	4	1.98	0.23	0.78	301.67	0.07	0.00	248	0.25	0.03	0.10	37.41	0.01
Backhoes	1	Diesel	70	55	8.03E-02	1.20E-02	7.24E-02	1.08E+01	6.09E-03	1.26E-04	4	12.39	1.84	11.15	1658.60	0.94	0.02	248	1.54	0.23	1.38	205.67	0.12
Welders	1	Diesel	50	43	1.37E-04	3.43E-05	1.44E-04	1.62E-02	9.35E-06	2.09E-07	8	0.02	0.01	0.02	2.78	0.00	0.00	248	0.00	0.00	0.00	0.34	0.00
2016																							
Motor Grader	1	Diesel	150	61	2.53E-02	3.57E-03	2.15E-02	3.65E+00	1.40E-03	4.10E-05	8	18.54	2.61	15.75	2670.44	1.02	0.03	17.7	0.16	0.02	0.14	23.63	0.01
Cranes	1	Diesel	300	43	3.53E-03	4.36E-04	1.46E-03	5.93E-01	1.27E-04	5.82E-06	4	1.82	0.23	0.75	306.19	0.07	0.00	336.3	0.31	0.04	0.13	51.49	0.01
Backhoes	1	Diesel	70	55	7.44E-02	1.10E-02	7.30E-02	1.09E+01	5.33E-03	1.28E-04	4	11.45	1.70	11.25	1682.06	0.82	0.02	336.3	1.93	0.29	1.89	282.84	0.14
Welders	1	Diesel	50	43	1.33E-04	3.09E-05	1.43E-04	1.64E-02	8.36E-06	2.12E-07	8	0.02	0.01	0.02	2.82	0.00	0.00	336.3	0.00	0.00	0.00	0.47	0.00
2017																							
Motor Grader	1	Diesel	150	61	2.32E-02	3.38E-03	2.18E-02	3.70E+00	1.28E-03	4.16E-05	8	16.97	2.48	15.96	2709.32	0.94	0.03	11.3	0.10	0.01	0.09	15.31	0.01
Cranes	1	Diesel	300	43	3.24E-03	4.22E-04	1.42E-03	6.02E-01	1.17E-04	5.91E-06	4	1.67	0.22	0.73	310.71	0.06	0.00	214.7	0.18	0.02	0.08	33.35	0.01
Backhoes	1	Diesel	70	55	6.88E-02	1.02E-02	7.37E-02	1.11E+01	4.62E-03	1.30E-04	4	10.59	1.57	11.34	1705.20	0.71	0.02	214.7	1.14	0.17	1.22	183.05	0.08
Welders	1	Diesel	50	43	1.30E-04	2.77E-05	1.42E-04	1.68E-02	7.40E-06	2.15E-07	8	0.02	0.00	0.02	2.86	0.00	0.00	214.7	0.00	0.00	0.00	0.31	0.00
Motor Grader	1	Diesel	150	61	2.32E-02	3.38E-03	2.18E-02	3.70E+00	1.28E-03	4.16E-05	8	16.97	2.48	15.96	2709.32	0.94	0.03	10	0.08	0.01	0.08	13.55	0.00
Cranes	1	Diesel	300	43	3.24E-03	4.22E-04	1.42E-03	6.02E-01	1.17E-04	5.91E-06	4	1.67	0.22	0.73	310.71	0.06	0.00	195	0.16	0.02	0.07	30.29	0.01
Backhoes	1	Diesel	70	55	6.88E-02	1.02E-02	7.37E-02	1.11E+01	4.62E-03	1.30E-04	4	10.59	1.57	11.34	1705.20	0.71	0.02	195	1.03	0.15	1.11	166.26	0.07
Welders	1	Diesel	50	43	1.30E-04	2.77E-05	1.42E-04	1.68E-02	7.40E-06	2.15E-07	8	0.02	0.00	0.02	2.86	0.00	0.00	195	0.00	0.00	0.00	0.28	0.00
2018																							
Motor Grader	1	Diesel	150	61	2.12E-02	3.20E-03	2.21E-02	3.75E+00	1.16E-03	4.22E-05	8	15.49	2.34	16.17	2747.81	0.85	0.03	4.35	0.03	0.01	0.04	5.98	0.00
Cranes	1	Diesel	300	43	2.96E-03	4.07E-04	1.39E-03	6.11E-01	1.08E-04	6.00E-06	4	1.53	0.21	0.72	315.21	0.06	0.00	82.65	0.06	0.01	0.03	13.03	0.00
Backhoes	1	Diesel	70	55	6.37E-02	9.42E-03	7.43E-02	1.12E+01	3.97E-03	1.32E-04	4	9.80	1.45	11.45	1728.03	0.61	0.02	82.65	0.41	0.06	0.47	71.41	0.03
Welders	1	Diesel	50	43	1.26E-04	2.48E-05	1.41E-04	1.68E-02	6.48E-06	2.18E-07	8	0.02	0.00	0.02	2.90	0.00	0.00	82.65	0.00	0.00	0.00	0.12	0.00
Motor Grader	1	Diesel	150	61	2.12E-02	3.20E-03	2.21E-02	3.75E+00	1.16E-03	4.22E-05	8	15.49	2.34	16.17	2747.81	0.85	0.03	15	0.12	0.02	0.12	20.61	0.01
Cranes	1	Diesel	300	43	2.96E-03	4.07E-04	1.39E-03	6.11E-01	1.08E-04	6.00E-06	4	1.53	0.21	0.72	315.21	0.06	0.00	293	0.22	0.03	0.10	46.18	0.01
Backhoes	1	Diesel	70	55	6.37E-02	9.42E-03	7.43E-02	1.12E+01	3.97E-03	1.32E-04	4	9.80	1.45	11.45	1728.03	0.61	0.02	293	1.44	0.21	1.68	253.16	0.09
Welders	1	Diesel	50	43	1.26E-04	2.48E-05	1.41E-04	1.68E-02	6.48E-06	2.18E-07	8	0.02	0.00	0.02	2.90	0.00	0.00	293	0.00	0.00	0.00	0.42	0.00

Table A-1
Estimated Facility Installation Emissions (EOR Processing Facility, Tank Batteries, Satellite Stations)
OEHI CO2 EOR PROJECT

Equipment				Emission Factors (lbs/bhp-hr)					Emissions (lbs/day)					Total Emissions (tons)				
				Fuel Type	BHP	Load Factor (%)	NOX	ROG	CO	CO2	PM10	SOX	Hrs/Day	NOX	ROG	CO	PM10	SOX
2019																		
Motor Grader	1	Diesel	150	61	1.92E-02	3.02E-03	2.24E-02	3.81E+00	1.05E-03	4.28E-05	8	14.09	2.21	16.38	2786.01	0.77	0.03	11.75
Cranes	1	Diesel	300	43	2.70E-03	3.93E-04	1.36E-03	6.20E-01	9.83E-05	6.08E-06	4	1.39	0.20	0.70	319.70	0.05	0.00	223.3
Backhoes	1	Diesel	70	55	5.91E-02	8.74E-03	7.50E-02	1.14E+01	3.39E-03	1.33E-04	4	9.09	1.35	11.55	1750.65	0.52	0.02	223.3
Welders	1	Diesel	50	43	1.24E-04	2.21E-05	1.40E-04	1.71E-02	5.61E-06	2.21E-07	8	0.02	0.00	0.02	2.94	0.00	0.00	0.33
Motor Grader	1	Diesel	150	61	1.92E-02	3.02E-03	2.24E-02	3.81E+00	1.05E-03	4.28E-05	8	14.09	2.21	16.38	2786.01	0.77	0.03	5
Cranes	1	Diesel	300	43	2.70E-03	3.93E-04	1.36E-03	6.20E-01	9.83E-05	6.08E-06	4	1.39	0.20	0.70	319.70	0.05	0.00	97
Backhoes	1	Diesel	70	55	5.91E-02	8.74E-03	7.50E-02	1.14E+01	3.39E-03	1.33E-04	4	9.09	1.35	11.55	1750.65	0.52	0.02	97
Welders	1	Diesel	50	43	1.24E-04	2.21E-05	1.40E-04	1.71E-02	5.61E-06	2.21E-07	8	0.02	0.00	0.02	2.94	0.00	0.00	0.14
2020																		
Motor Grader	1	Diesel	150	61	1.78E-02	2.85E-03	2.27E-02	3.86E+00	9.41E-04	4.34E-05	8	12.78	2.09	16.59	2824.12	0.69	0.03	3.25
Cranes	1	Diesel	300	43	2.46E-03	3.79E-04	1.34E-03	6.28E-01	8.97E-05	6.17E-06	4	1.27	0.20	0.69	324.19	0.05	0.00	61.75
Backhoes	1	Diesel	70	55	5.49E-02	8.15E-03	7.57E-02	1.15E+01	2.87E-03	1.35E-04	4	8.46	1.25	11.67	1773.34	0.44	0.02	61.75
Welders	1	Diesel	50	43	1.21E-04	2.03E-05	1.40E-04	1.73E-02	4.85E-06	2.24E-07	8	0.02	0.00	0.02	2.98	0.00	0.00	61.75
2021																		
Motor Grader	1	Diesel	150	61	1.75E-02	2.85E-03	2.27E-02	3.86E+00	9.41E-04	4.34E-05	8	12.78	2.09	16.59	2824.12	0.69	0.03	12
Cranes	1	Diesel	300	43	2.23E-03	3.66E-04	1.33E-03	6.37E-01	8.17E-05	6.25E-06	4	1.15	0.19	0.68	328.68	0.04	0.00	228
Backhoes	1	Diesel	70	55	5.13E-02	7.67E-03	7.65E-02	1.17E+01	2.43E-03	1.37E-04	4	7.90	1.18	11.79	1796.38	0.37	0.02	228
Welders	1	Diesel	50	43	1.19E-04	1.90E-05	1.41E-04	1.76E-02	4.18E-06	2.27E-07	8	0.02	0.00	0.02	3.02	0.00	0.00	228
2023																		
Motor Grader	1	Diesel	150	61	1.28E-02	2.40E-03	2.35E-02	4.01E+00	6.62E-04	4.52E-05	8	9.37	1.75	17.23	2938.04	0.48	0.03	3.6
Cranes	1	Diesel	300	43	1.82E-03	3.42E-04	1.31E-03	6.54E+01	6.72E-05	6.42E-06	4	0.94	0.18	0.68	337.70	0.03	0.00	68.4
Backhoes	1	Diesel	70	55	4.57E-02	7.04E-03	7.83E-02	1.20E+01	1.77E-03	1.40E-04	4	7.04	1.08	12.06	1843.46	0.27	0.02	68.4
Welders	1	Diesel	50	43	1.15E-04	1.72E-05	1.42E-04	1.81E-02	3.03E-06	2.33E-07	8	0.02	0.00	0.02	3.11	0.00	0.00	68.4
Motor Grader	1	Diesel	150	61	1.28E-02	2.40E-03	2.35E-02	4.01E+00	6.62E-04	4.52E-05	8	9.37	1.75	17.23	2938.04	0.48	0.03	3
Cranes	1	Diesel	300	43	1.82E-03	3.42E-04	1.31E-03	6.54E+01	6.72E-05	6.42E-06	4	0.94	0.18	0.68	337.70	0.03	0.00	62
Backhoes	1	Diesel	70	55	4.57E-02	7.04E-03	7.83E-02	1.20E+01	1.77E-03	1.40E-04	4	7.04	1.08	12.06	1843.46	0.27	0.02	62
Welders	1	Diesel	50	43	1.15E-04	1.72E-05	1.42E-04	1.81E-02	3.03E-06	2.33E-07	8	0.02	0.00	0.02	3.11	0.00	0.00	62
2024																		
Motor Grader	1	Diesel	150	61	1.15E-02	2.27E-03	2.38E-02	4.07E+00	5.87E-04	4.57E-05	8	8.43	1.66	17.45	2975.71	0.43	0.03	9.9
Cranes	1	Diesel	300	43	1.64E-03	3.31E-04	1.31E-03	6.63E-01	6.07E-05	6.51E-06	4	0.85	0.17	0.68	342.22	0.03	0.00	188.1
Backhoes	1	Diesel	70	55	4.35E-02	6.83E-03	7.93E-02	1.21E+01	1.52E-03	1.42E-04	4	6.71	1.05	12.21	1867.56	0.23	0.02	188.1
Welders	1	Diesel	50	43	1.13E-04	1.66E-05	1.44E-04	1.83E-02	2.60E-06	2.37E-07	8	0.02	0.00	0.02	3.15	0.00	0.00	188.1
Motor Grader	1	Diesel	150	61	1.15E-02	2.27E-03	2.38E-02	4.07E+00	5.87E-04	4.57E-05	8	8.43	1.66	17.45	2975.71	0.43	0.03	3
Cranes	1	Diesel	300	43	1.64E-03	3.31E-04	1.31E-03	6.63E-01	6.07E-05	6.51E-06	4	0.85	0.17	0.68	342.22	0.03	0.00	60
Backhoes	1	Diesel	70	55	4.35E-02	6.83E-03	7.93E-02	1.21E+01	1.52E-03	1.42E-04	4	6.71	1.05	12.21	1867.56	0.23	0.02	60
Welders	1	Diesel	50	43	1.13E-04	1.66E-05	1.44E-04	1.83E-02	2.60E-06	2.37E-07	8	0.02	0.00	0.02	3.15	0.00	0.00	60
2025																		
Motor Grader	1	Diesel	150	61	1.15E-02	2.27E-03	2.38E-02	4.07E+00	5.87E-04	4.57E-05	8	8.43	1.66	17.45	2975.71	0.43	0.03	13.5
Cranes	1	Diesel	300	43	1.64E-03	3.31E-04	1.31E-03	6.63E-01	6.07E-05	6.51E-06	4	0.85	0.17	0.68	342.22	0.03	0.00	237.5
Backhoes	1	Diesel	70	55	4.35E-02	6.83E-03	7.93E-02	1.21E+01	1.52E-03	1.42E-04	4	6.71	1.05	12.21	1867.56	0.23	0.02	237.5
Welders	1	Diesel	50	43	1.13E-04	1.66E-05	1.44E-04	1.83E-02	2.60E-06	2.37E-07	8	0.02	0.00	0.02	3.15	0.00	0.00	237.5

Table A-1
Estimated Facility Installation Emissions (EOR Processing Facility, Tank Batteries, Satellite Stations)
OEHI CO2 EOR PROJECT

	Emission Factors (lbs/bhp-hr)					Emissions (lbs/day)					Total Emissions (tons)														
	Equipment	Number	Fuel Type	BHP	Load Factor (%)	NOX	ROG	CO	CO2	PM10	SOX	Hrs/Day	NOX	ROG	CO	CO2	PM10	SOX							
2026																									
	Motor Grader	1	Diesel	150	61	9.32E-03	2.07E-03	2.44E-02	4.17E+00	4.62E-04	4.69E-05	8	6.82	1.52	17.87	3050.36	0.34	0.03	11.4	0.04	0.01	0.10	17.39	0.00	0.00
	Cranes	1	Diesel	300	43	1.34E-03	3.10E-04	1.33E-03	6.81E-01	4.85E-05	6.68E-06	4	0.69	0.16	0.69	351.32	0.03	0.00	216.6	0.07	0.02	0.07	38.05	0.00	0.00
	Backhoes	1	Diesel	70	55	4.05E-02	6.54E-03	8.13E-02	1.24E+01	1.13E-03	1.46E-04	4	6.24	1.01	12.51	1916.82	0.17	0.02	216.6	0.68	0.11	1.36	207.59	0.02	0.00
	Welders	1	Diesel	50	43	1.11E-04	1.58E-05	1.46E-04	1.88E-02	1.91E-06	2.43E-07	8	0.02	0.00	0.03	3.23	0.00	0.00	216.6	0.00	0.00	0.00	0.35	0.00	0.00
2027																									
	Motor Grader	1	Diesel	150	61	8.40E-03	2.00E-03	2.47E-02	4.22E+00	4.11E-04	4.75E-05	8	6.15	1.46	18.08	3087.67	0.30	0.03	11.3	0.03	0.01	0.10	17.45	0.00	0.00
	Cranes	1	Diesel	300	43	1.21E-03	3.01E-04	1.34E-03	6.90E-01	4.29E-05	6.77E-06	4	0.62	0.16	0.69	355.88	0.02	0.00	214.7	0.07	0.02	0.07	38.20	0.00	0.00
	Backhoes	1	Diesel	70	55	3.94E-02	6.44E-03	8.23E-02	1.26E+01	9.84E-04	1.48E-04	4	6.07	0.99	12.67	1941.63	0.15	0.02	214.7	0.65	0.11	1.36	208.43	0.02	0.00
	Welders	1	Diesel	50	43	1.10E-04	1.54E-05	1.48E-04	1.90E-02	1.61E-06	2.46E-07	8	0.02	0.00	0.03	3.27	0.00	0.00	214.7	0.00	0.00	0.00	0.35	0.00	0.00
2028																									
	Motor Grader	1	Diesel	150	61	7.59E-03	1.93E-03	2.50E-02	4.27E+00	3.66E-04	4.80E-05	8	5.56	1.41	18.30	3125.02	0.27	0.04	9	0.03	0.01	0.08	14.06	0.00	0.00
	Cranes	1	Diesel	300	43	1.21E-03	3.01E-04	1.34E-03	6.90E-01	4.29E-05	6.77E-06	4	0.62	0.16	0.69	355.88	0.02	0.00	171	0.05	0.01	0.06	30.43	0.00	0.00
	Backhoes	1	Diesel	70	55	3.94E-02	6.44E-03	8.23E-02	1.26E+01	9.84E-04	1.48E-04	4	6.07	0.99	12.67	1941.63	0.15	0.02	171	0.52	0.08	1.08	166.01	0.01	0.00
	Welders	1	Diesel	50	43	1.10E-04	1.52E-05	1.49E-04	1.93E-02	1.35E-06	2.49E-07	8	0.02	0.00	0.03	3.31	0.00	0.00	171	0.00	0.00	0.00	0.28	0.00	0.00
2029																									
	Motor Grader	1	Diesel	150	61	6.88E-03	1.87E-03	2.53E-02	4.32E+00	3.28E-04	4.86E-05	8	5.04	1.37	18.51	3162.40	0.24	0.04	8.8	0.02	0.01	0.08	13.91	0.00	0.00
	Cranes	1	Diesel	300	43	1.21E-03	3.01E-04	1.34E-03	6.90E-01	4.29E-05	6.77E-06	4	0.62	0.16	0.69	355.88	0.02	0.00	167.2	0.05	0.01	0.06	29.75	0.00	0.00
	Backhoes	1	Diesel	70	55	3.94E-02	6.44E-03	8.23E-02	1.26E+01	9.84E-04	1.48E-04	4	6.07	0.99	12.67	1941.63	0.15	0.02	167.2	0.51	0.08	1.06	162.32	0.01	0.00
	Welders	1	Diesel	50	43	1.10E-04	1.52E-05	1.49E-04	1.93E-02	1.35E-06	2.49E-07	8	0.02	0.00	0.03	3.31	0.00	0.00	167.2	0.00	0.00	0.00	0.28	0.00	0.00
2030																									
	Motor Grader	1	Diesel	150	61	6.27E-03	1.83E-03	2.56E-02	4.37E+00	2.92E-04	4.92E-05	8	4.59	1.34	18.73	3199.79	0.21	0.04	7.35	0.02	0.00	0.07	11.76	0.00	0.00
	Cranes	1	Diesel	300	43	8.78E-04	2.80E-04	1.37E-03	7.16E-01	3.02E-05	7.03E-06	4	0.45	0.14	0.71	369.58	0.02	0.00	139.7	0.03	0.01	0.05	25.81	0.00	0.00
	Backhoes	1	Diesel	70	55	3.74E-02	6.26E-03	8.53E-02	1.31E+01	6.91E-04	1.54E-04	4	5.76	0.96	13.14	2015.18	0.11	0.02	139.7	0.40	0.07	0.92	140.71	0.01	0.00
	Welders	1	Diesel	50	43	1.11E-04	1.49E-05	1.52E-04	1.97E-02	1.06E-06	2.55E-07	8	0.02	0.00	0.03	3.39	0.00	0.00	139.7	0.00	0.00	0.00	0.24	0.00	0.00
2031																									
	Motor Grader	1	Diesel	150	61	5.72E-03	1.78E-03	2.59E-02	4.42E+00	2.62E-04	4.98E-05	8	4.19	1.31	18.95	3237.24	0.19	0.04	1.15	0.00	0.00	0.01	1.86	0.00	0.00
	Cranes	1	Diesel	300	43	7.95E-04	2.76E-04	1.39E-03	7.25E-01	2.77E-05	7.12E-06	4	0.41	0.14	0.72	374.14	0.01	0.00	21.85	0.00	0.00	0.01	4.09	0.00	0.00
	Backhoes	1	Diesel	70	55	3.71E-02	6.24E-03	8.63E-02	1.32E+01	6.39E-04	1.55E-04	4	5.71	0.96	13.29	2039.33	0.10	0.02	21.85	0.06	0.01	0.15	22.28	0.00	0.00
	Welders	1	Diesel	50	43	1.12E-04	1.49E-05	1.54E-04	2.00E-02	9.62E-07	2.58E-07	8	0.02	0.00	0.03	3.43	0.00	0.00	21.85	0.00	0.00	0.00	0.04	0.00	0.00
2032																									
	Motor Grader	1	Diesel	150	61	5.23E-03	1.75E-03	2.62E-02	4.47E+00	2.37E-04	5.03E-05	8	3.83	1.28	19.17	3274.76	0.17	0.04	1.5	0.00	0.00	0.01	2.46	0.00	0.00
	Cranes	1	Diesel	300	43	7.26E-04	2.73E-04	1.40E-03	7.34E-01	2.58E-05	7.20E-06	4	0.37	0.14	0.72	378.69	0.01	0.00	28.5	0.01	0.00	0.01	5.40	0.00	0.00
	Backhoes	1	Diesel	70	55	3.69E-02	6.24E-03	8.73E-02	1.34E+01	5.96E-04	1.57E-04	4	5.68	0.96	13.45	2063.36	0.09	0.02	28.5	0.08	0.01	0.19	29.40	0.00	0.00
	Welders	1	Diesel	50	43	1.12E-04	1.49E-05	1.56E-04	2.02E-02	8.74E-07	2.61E-07	8	0.02	0.00	0.03	3.47	0.00	0.00	28.5	0.00	0.00	0.00	0.05	0.00	0.00

Table A-1
Estimated Facility Installation Emissions (EOR Processing Facility, Tank Batteries, Satellite Stations)
OEHI CO2 EOR PROJECT

Equipment	Number	Fuel Type	BHP	Load Factor (%)	Emission Factors (lbs/bhp-hr)						Emissions (lbs/day)						Total Emissions (tons)							
					NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Day	NOX	ROG	CO	CO2	PM10	SOX	Days	NOX	ROG	CO	CO2	PM10	SOX
2033																								
Motor Grader	1	Diesel	150	61	4.81E-03	1.72E-03	2.66E-02	4.53E+00	2.16E-04	5.09E-05	8	3.52	1.26	19.39	3312.40	0.16	0.04	12	0.02	0.01	0.12	19.87	0.00	0.00
Cranes	1	Diesel	300	43	2.71E-04	7.42E-03	7.43E-01	2.44E-05	7.29E-06	4	0.35	0.14	0.73	383.23	0.01	0.00	228	0.04	0.02	0.08	43.69	0.00	0.00	
Backhoes	1	Diesel	70	55	3.69E-02	6.25E-03	8.83E-02	1.36E+01	5.60E-04	1.59E-04	4	5.68	0.96	13.60	2087.32	0.09	0.02	228	0.65	0.11	1.55	237.95	0.01	0.00
Welders	1	Diesel	50	43	1.13E-04	1.49E-05	1.58E-04	2.04E-02	8.00E-07	2.64E-07	8	0.02	0.00	0.03	3.52	0.00	0.00	228	0.00	0.00	0.00	0.40	0.00	0.00

Data Sources/Notes:

Emission factors from California Air Resources Board, Offroad 2007, Kern County, Construction Year Specific
 Facility installation equipment spread includes one motor grader, one crane, one backhoe, and one welding machine

Construction Equipment Exhaust Total (tons)

Year	NOX	ROG	CO	CO2	PM10	SOX
2014	2.60	0.37	1.97	321.69	0.19	0.00
2015	3.99	0.57	3.30	542.02	0.28	0.01
2016	2.40	0.35	2.16	358.43	0.16	0.00
2017	2.70	0.39	2.65	442.40	0.17	0.01
2018	2.28	0.34	2.45	410.90	0.13	0.00
2019	1.80	0.27	2.10	355.32	0.10	0.00
2020	0.32	0.05	0.41	69.44	0.02	0.00
2021	1.11	0.17	1.52	259.55	0.05	0.00
2023	0.55	0.09	0.89	152.11	0.02	0.00
2024	0.99	0.16	1.71	293.71	0.04	0.00
2025	0.96	0.16	1.65	282.87	0.03	0.00
2026	0.79	0.14	1.53	263.38	0.02	0.00
2027	0.76	0.13	1.54	264.43	0.02	0.00
2028	0.60	0.10	1.23	210.78	0.02	0.00
2029	0.58	0.10	1.20	206.26	0.02	0.00
2030	0.45	0.08	1.04	178.51	0.01	0.00
2031	0.07	0.01	0.16	28.27	0.00	0.00
2032	0.09	0.02	0.22	37.30	0.00	0.00
2033	0.71	0.13	1.75	301.92	0.01	0.00

Table A-2
Estimated Pipeline Installation Emissions
OEHI CO2 EOR PROJECT

Equipment	Number	Fuel Type	BHP	Load Factor (%)	Emission Factors (lbs/bhp-hr)					Emissions (lbs/day)					Total Emissions (tons)									
					NOX	ROG	CO	CO2	PM10	SOX	Hrs/Day	NOX	ROG	CO	CO2	PM10	SOX	Days	NOX	ROG	CO	CO2	PM10	SOX
2014																								
Cranes	1	Diesel	300	43	4.15E-03	4.69E-04	1.58E-03	5.76E-01	1.50E-04	5.65E-06	8	4.28	0.48	1.63	594.28	0.16	0.01	85	0.18	0.02	0.07	25.26	0.01	0.00
Backhoes	1	Diesel	70	55	8.71E-02	1.30E-02	7.19E-02	1.06E+01	6.89E-03	1.25E-04	8	26.84	4.00	22.14	3269.80	2.12	0.04	32.02	0.43	0.06	0.35	52.34	0.03	0.00
Welders	1	Diesel	50	43	1.41E-04	3.80E-05	1.46E-04	1.59E-02	1.04E-05	2.06E-07	8	0.02	0.01	0.03	2.74	0.00	0.00	85	0.00	0.00	0.00	0.12	0.00	0.00
2015																								
Cranes	1	Diesel	300	43	3.83E-03	4.52E-04	1.51E-03	5.85E-01	1.38E-04	5.74E-06	8	3.95	0.47	1.56	603.34	0.14	0.01	285	0.56	0.07	0.22	85.98	0.02	0.00
Backhoes	1	Diesel	70	55	8.05E-02	1.20E-02	7.24E-02	1.08E+01	6.09E-03	1.28E-04	8	24.79	3.69	22.31	3317.20	1.88	0.04	100.2	1.24	0.18	1.12	186.25	0.09	0.00
Welders	1	Diesel	50	43	1.37E-04	3.43E-05	1.44E-04	1.62E-02	9.35E-06	2.09E-07	8	0.02	0.01	0.02	2.78	0.00	0.00	285	0.00	0.00	0.00	0.40	0.00	0.00
2016																								
Cranes	2	Diesel	300	43	3.53E-03	4.36E-04	1.46E-03	5.93E-01	1.27E-04	5.82E-06	8	7.28	0.90	3.02	1224.76	0.26	0.01	292	1.06	0.13	0.44	178.81	0.04	0.00
Backhoes	2	Diesel	70	55	7.44E-02	1.10E-02	7.30E-02	1.09E+01	5.33E-03	1.28E-04	8	45.81	6.80	44.99	6728.24	3.28	0.08	112.3	2.57	0.38	2.53	377.79	0.18	0.00
Welders	2	Diesel	50	43	1.33E-04	3.09E-05	1.43E-04	1.64E-02	8.36E-06	2.12E-07	8	0.05	0.01	0.05	5.63	0.00	0.00	292	0.01	0.00	0.01	0.82	0.00	0.00
2017																								
Cranes	1	Diesel	300	43	3.24E-03	4.22E-04	1.42E-03	6.02E-01	1.17E-04	5.91E-06	8	3.34	0.44	1.46	621.41	0.12	0.01	310	0.52	0.07	0.23	96.32	0.02	0.00
Backhoes	1	Diesel	70	55	6.88E-02	1.02E-02	7.37E-02	1.11E+01	4.62E-03	1.30E-04	8	21.18	3.14	22.69	3410.41	1.42	0.04	149.2	1.58	0.23	1.69	254.42	0.11	0.00
Welders	1	Diesel	50	43	1.30E-04	2.77E-05	1.42E-04	1.66E-02	7.40E-06	2.15E-07	8	0.02	0.00	0.02	2.86	0.00	0.00	310	0.00	0.00	0.00	0.44	0.00	0.00
2018																								
Cranes	1	Diesel	300	43	2.96E-03	4.07E-04	1.39E-03	6.11E-01	1.08E-04	6.00E-06	8	3.06	0.42	1.43	630.42	0.11	0.01	41	0.06	0.01	0.03	12.92	0.00	0.00
Backhoes	1	Diesel	70	55	6.37E-02	9.42E-03	7.43E-02	1.12E+01	3.97E-03	1.32E-04	8	19.61	2.90	22.89	3456.05	1.22	0.04	21.71	0.21	0.03	0.25	37.52	0.01	0.00
Welders	1	Diesel	50	43	1.26E-04	2.48E-05	1.41E-04	1.68E-02	6.48E-06	2.18E-07	8	0.02	0.00	0.02	2.90	0.00	0.00	41	0.00	0.00	0.00	0.06	0.00	0.00
2019																								
Cranes	1	Diesel	300	43	2.70E-03	3.93E-04	1.36E-03	6.20E-01	9.83E-05	6.08E-06	8	2.79	0.41	1.40	639.41	0.10	0.01	230	0.32	0.05	0.16	73.53	0.01	0.00
Backhoes	1	Diesel	70	55	5.91E-02	8.74E-03	7.50E-02	1.14E+01	3.39E-03	1.33E-04	8	18.19	2.69	23.10	3501.30	1.04	0.04	114.7	1.04	0.15	1.33	200.80	0.06	0.00
Welders	1	Diesel	50	43	1.24E-04	2.21E-05	1.40E-04	1.71E-02	5.61E-06	2.21E-07	8	0.02	0.00	0.02	2.94	0.00	0.00	230	0.00	0.00	0.00	0.34	0.00	0.00
2020																								
Cranes	1	Diesel	300	43	2.46E-03	3.79E-04	1.34E-03	6.28E-01	8.97E-05	6.17E-06	8	2.53	0.39	1.38	648.38	0.09	0.01	82	0.10	0.02	0.06	26.58	0.00	0.00
Backhoes	1	Diesel	70	55	5.49E-02	8.15E-03	7.57E-02	1.15E+01	2.87E-03	1.35E-04	8	16.92	2.51	23.33	3546.68	0.88	0.04	44.45	0.38	0.06	0.52	78.82	0.02	0.00
Welders	1	Diesel	50	43	1.21E-04	2.03E-05	1.40E-04	1.73E-02	4.88E-06	2.24E-07	8	0.02	0.00	0.02	2.98	0.00	0.00	82	0.00	0.00	0.00	0.12	0.00	0.00
2021																								
Cranes	1	Diesel	300	43	2.23E-03	3.66E-04	1.33E-03	6.37E-01	8.17E-05	6.25E-06	8	2.30	0.38	1.37	657.37	0.08	0.01	230	0.26	0.04	0.16	75.60	0.01	0.00
Backhoes	1	Diesel	70	55	5.13E-02	7.67E-03	7.65E-02	1.17E+01	2.43E-03	1.37E-04	8	15.81	2.36	23.58	3592.76	0.75	0.04	128.4	1.01	0.15	1.51	230.60	0.05	0.00
Welders	1	Diesel	50	43	1.19E-04	1.90E-05	1.41E-04	1.76E-02	4.18E-06	2.27E-07	8	0.02	0.00	0.02	3.02	0.00	0.00	230	0.00	0.00	0.00	0.35	0.00	0.00
2023																								
Cranes	1	Diesel	300	43	1.82E-03	3.42E-04	1.31E-03	6.54E-01	6.72E-05	6.42E-06	8	1.88	0.35	1.35	675.40	0.07	0.01	81	0.08	0.01	0.05	27.35	0.00	0.00
Backhoes	1	Diesel	70	55	4.57E-02	7.04E-03	7.83E-02	1.20E+01	1.77E-03	1.40E-04	8	14.07	2.17	24.12	3686.91	0.54	0.04	45.33	0.32	0.05	0.55	83.56	0.01	0.00
Welders	1	Diesel	50	43	1.15E-04	1.72E-05	1.42E-04	1.81E-02	3.03E-06	2.33E-07	8	0.02	0.00	0.02	3.11	0.00	0.00	81	0.00	0.00	0.00	0.13	0.00	0.00

Table A-2
Estimated Pipeline Installation Emissions
OEHI CO2 EOR PROJECT

Equipment				Emission Factors (lbs/bhp-hr)				Emissions (lbs/day)					Total Emissions (tons)														
				NOX	ROG	CO	CO2	PM10	SOX	Hrs/Day	NOX	ROG	CO	CO2	PM10	SOX	Days	NOX	ROG	CO	CO2	PM10	SOX				
2024																											
Cranes				1	Diesel	300	43	1.64E-03	3.31E-04	1.31E-03	6.63E-01	6.07E-05	6.51E-06	8	1.70	0.34	1.36	684.44	0.06	0.01	189	0.16	0.03	0.13	64.68	0.01	0.00
Backhoes				1	Diesel	70	55	4.35E-02	6.83E-03	7.93E-02	1.21E+01	1.52E-03	1.42E-04	8	13.41	2.10	24.42	3735.12	0.47	0.04	105.8	0.71	0.11	1.29	197.53	0.02	0.00
Welders				1	Diesel	50	43	1.13E-04	1.66E-05	1.44E-04	1.83E-02	2.60E-06	2.37E-07	8	0.02	0.00	0.02	3.15	0.00	0.00	189	0.00	0.00	0.00	0.30	0.00	0.00
2026																											
Cranes				1	Diesel	300	43	1.34E-03	3.10E-04	1.33E-03	6.81E-01	4.85E-05	6.68E-06	8	1.38	0.32	1.37	702.63	0.05	0.01	230	0.16	0.04	0.16	80.80	0.01	0.00
Backhoes				1	Diesel	70	55	4.05E-02	6.54E-03	8.13E-02	1.24E+01	1.13E-03	1.46E-04	8	12.47	2.01	25.03	3833.63	0.35	0.04	112.8	0.70	0.11	1.41	216.16	0.02	0.00
Welders				1	Diesel	50	43	1.11E-04	1.58E-05	1.46E-04	1.88E-02	1.91E-06	2.43E-07	8	0.02	0.00	0.03	3.23	0.00	0.00	230	0.00	0.00	0.00	0.37	0.00	0.00
2027																											
Cranes				1	Diesel	300	43	1.21E-03	3.01E-04	1.34E-03	6.90E-01	4.29E-05	6.77E-06	8	1.25	0.31	1.38	711.76	0.04	0.01	349	0.22	0.05	0.24	124.20	0.01	0.00
Backhoes				1	Diesel	70	55	3.94E-02	6.44E-03	8.23E-02	1.26E+01	9.84E-04	1.48E-04	8	12.14	1.98	25.34	3883.27	0.30	0.05	142.7	0.87	0.14	1.81	277.16	0.02	0.00
Welders				1	Diesel	50	43	1.10E-04	1.54E-05	1.48E-04	1.90E-02	1.61E-06	2.46E-07	8	0.02	0.00	0.03	3.27	0.00	0.00	349	0.00	0.00	0.00	0.57	0.00	0.00
2028																											
Cranes				2	Diesel	300	43	1.09E-03	2.93E-04	1.35E-03	6.99E-01	3.78E-05	6.86E-06	8	2.24	0.60	2.78	1441.80	0.08	0.01	187.5	0.21	0.06	0.26	135.17	0.01	0.00
Backhoes				2	Diesel	70	55	3.86E-02	6.36E-03	8.33E-02	1.28E+01	8.60E-04	1.50E-04	8	23.75	3.92	51.30	7865.40	0.53	0.09	83.5	0.99	0.16	2.14	328.38	0.02	0.00
Welders				2	Diesel	50	43	1.10E-04	1.52E-05	1.49E-04	1.93E-02	1.35E-06	2.49E-07	8	0.04	0.01	0.05	6.62	0.00	0.00	187.5	0.00	0.00	0.00	0.62	0.00	0.00
2029																											
Cranes				1	Diesel	300	43	9.75E-04	2.86E-04	1.36E-03	7.07E-01	3.35E-05	6.94E-06	8	1.01	0.30	1.40	730.04	0.03	0.01	162	0.08	0.02	0.11	59.13	0.00	0.00
Backhoes				1	Diesel	70	55	3.86E-02	6.36E-03	8.33E-02	1.28E+01	8.60E-04	1.50E-04	8	11.88	1.96	25.65	3932.70	0.26	0.05	79.31	0.47	0.08	1.02	155.95	0.01	0.00
Welders				1	Diesel	50	43	1.10E-04	1.52E-05	1.49E-04	1.93E-02	1.35E-06	2.49E-07	8	0.02	0.00	0.03	3.31	0.00	0.00	162	0.00	0.00	0.00	0.27	0.00	0.00
2030																											
Cranes				1	Diesel	300	43	8.78E-04	2.80E-04	1.37E-03	7.16E-01	3.02E-05	7.03E-06	8	0.91	0.29	1.42	739.16	0.03	0.01	257	0.12	0.04	0.18	94.98	0.00	0.00
Backhoes				1	Diesel	70	55	3.74E-02	6.26E-03	8.53E-02	1.31E+01	6.91E-04	1.54E-04	8	11.52	1.93	26.28	4030.36	0.21	0.05	104	0.60	0.10	1.37	209.58	0.01	0.00
Welders				1	Diesel	50	43	1.11E-04	1.49E-05	1.52E-04	1.97E-02	1.06E-06	2.55E-07	8	0.02	0.00	0.03	3.39	0.00	0.00	257	0.00	0.00	0.00	0.44	0.00	0.00
2031																											
Cranes				1	Diesel	300	43	7.95E-04	2.76E-04	1.39E-03	7.25E-01	2.77E-05	7.12E-06	8	0.82	0.28	1.43	748.27	0.03	0.01	14	0.01	0.00	0.01	5.24	0.00	0.00
Backhoes				1	Diesel	70	55	3.71E-02	6.24E-03	8.63E-02	1.32E+01	6.39E-04	1.55E-04	8	11.42	1.92	26.59	4078.67	0.20	0.05	5.67	0.03	0.01	0.08	11.56	0.00	0.00
Welders				1	Diesel	50	43	1.12E-04	1.49E-05	1.54E-04	2.00E-02	9.62E-07	2.58E-07	8	0.02	0.00	0.03	3.43	0.00	0.00	14	0.00	0.00	0.00	0.02	0.00	0.00
2032																											
Cranes				1	Diesel	300	43	7.26E-04	2.73E-04	1.40E-03	7.34E-01	2.58E-05	7.20E-06	8	0.75	0.28	1.45	757.37	0.03	0.01	41	0.02	0.01	0.03	15.53	0.00	0.00
Backhoes				1	Diesel	70	55	3.69E-02	6.24E-03	8.73E-02	1.34E+01	5.96E-04	1.57E-04	8	11.37	1.92	26.90	4126.72	0.18	0.05	15.44	0.09	0.01	0.21	31.86	0.00	0.00
Welders				1	Diesel	50	43	1.12E-04	1.49E-05	1.56E-04	2.02E-02	8.74E-07	2.61E-07	8	0.02	0.00	0.03	3.47	0.00	0.00	41	0.00	0.00	0.00	0.07	0.00	0.00

Table A-2
Estimated Pipeline Installation Emissions
OEHI CO2 EOR PROJECT

Equipment	Number	Fuel Type	BHP	Load Factor (%)	Emission Factors (lbs/bhp-hr)						Hrs/ Day	Emissions (lbs/day)						Total Emissions (tons)					
					NOX	ROG	CO	CO2	PM10	SOX		NOX	ROG	CO	CO2	PM10	SOX	NOX	ROG	CO	CO2	PM10	SOX
2033																							
Cranes	1	Diesel	300	43	6.71E-04	2.71E-04	1.42E-03	7.43E-01	2.44E-05	7.29E-06	8	0.69	0.28	1.47	766.46	0.03	0.01	230	0.08	0.03	0.17	88.14	0.00
Backhoes	1	Diesel	70	55	3.69E-02	6.25E-03	8.83E-02	1.36E+01	5.60E-04	1.59E-04	8	11.36	1.93	27.21	4174.63	0.17	0.05	86.6	0.49	0.08	1.18	180.76	0.01
Welders	1	Diesel	50	43	1.13E-04	1.49E-05	1.58E-04	2.04E-02	8.00E-07	2.64E-07	8	0.02	0.00	0.03	3.52	0.00	0.00	230	0.00	0.00	0.00	0.40	0.00

Data Sources/Notes:

Emission factors from California Air Resources Board, Offroad 2007, Kern County, Year Specific
 Backhoe not used for above ground locations and used 50% of days during below ground multi-line installation
 Pipeline installation during 2016 & 2028 assume operation of two equipment spreads due to the total length of piping proposed for installation
 Equipment pipeline installation spread includes one crane, backhoe, and welding machine

Construction Equipment Exhaust Total (tons)										
Year	NOX	ROG	CO	CO2	PM10	SOX				
2014	0.61	0.08	0.42	77.71	0.04	0.00				
2015	1.81	0.25	1.34	252.62	0.11	0.00				
2016	3.64	0.52	2.97	557.43	0.22	0.01				
2017	2.10	0.30	1.92	351.18	0.13	0.00				
2018	0.28	0.04	0.28	50.50	0.02	0.00				
2019	1.37	0.20	1.49	274.67	0.07	0.00				
2020	0.48	0.07	0.58	105.53	0.02	0.00				
2021	1.28	0.20	1.67	306.55	0.06	0.00				
2022										
2023	0.40	0.06	0.60	111.04	0.02	0.00				
2024	0.87	0.14	1.42	262.51	0.03	0.00				
2025										
2026	0.86	0.15	1.57	297.33	0.03	0.00				
2027	1.09	0.20	2.05	401.93	0.03	0.00				
2028	1.21	0.22	2.41	464.17	0.03	0.01				
2029	0.55	0.10	1.13	215.35	0.01	0.00				
2030	0.72	0.14	1.55	305.00	0.02	0.00				
2031	0.04	0.01	0.09	16.82	0.00	0.00				
2032	0.10	0.02	0.24	47.46	0.00	0.00				
2033	0.57	0.12	1.35	269.31	0.01	0.00				

Table A-3
Estimated Well Site Preparation, Drilling and Completion Emissions
OEHI CO2 EOR PROJECT

Equipment					Emission Factors (lbs/bhp-hr)										Emissions (lbs/day)						
					Number	Fuel	BHP	% Load	NOX	ROG	CO	CO2	PM10	SOX	Hrs/Rig Day	NOX	ROG	CO	CO2	PM10	SOX
2016																					
Motor Grader					1	Diesel	150	61	2.53E-02	3.57E-03	2.15E-02	3.65E+00	1.40E-03	4.10E-05	8	18.54	2.61	15.75	2670.44	1.02	0.03
Tracked Tractor					1	Diesel	285	64	1.16E-02	1.63E-03	5.73E-03	2.84E+00	4.08E-04	3.19E-05	8	16.89	2.38	8.36	4139.26	0.60	0.05
Backhoe					1	Diesel	70	55	6.88E-02	1.02E-02	7.37E-02	1.11E+01	4.62E-03	1.30E-04	8	21.18	3.14	22.69	3410.41	1.42	0.04
Compactor					1	Diesel	200	59	3.22E-03	3.85E-04	1.51E-03	7.87E-01	1.08E-04	7.73E-06	4	1.52	0.18	0.71	371.52	0.05	0.00
Generator (3 per drill rig)					2	Diesel	1020	74	4.92E-04	5.91E-05	1.82E-04	8.45E-02	1.72E-05	8.29E-07	24	17.81	2.14	6.59	3060.53	0.62	0.03
Criteria Pollutant Emissions per Rig Day															75.94	10.45	54.10	13652.16	3.72	0.15	

Equipment		Emission Factors (lbs/bhp-hr)					Emissions (lbs/day)											
		Number	Fuel	BHP	% Load	NOX	ROG	CO	CO2	PM10	SOX	Hrs/Rig Day	NOX	ROG	CO	CO2	PM10	SOX
2017																		
	Motor Grader	1	Diesel	150	61	2.32E-02	3.38E-03	2.18E-02	3.70E+00	1.28E-03	4.16E-05	8	16.97	2.48	15.96	2709.32	0.94	0.03
	Tracked Tractor	1	Diesel	285	64	1.03E-02	1.57E-03	5.72E-03	2.88E+00	3.65E-04	3.24E-05	8	14.96	2.29	8.35	4196.22	0.53	0.05
	Backhoe	1	Diesel	70	55	6.88E-02	1.02E-02	7.37E-02	1.11E+01	4.62E-03	1.30E-04	18	47.65	7.06	51.05	7673.42	3.20	0.09
	Compactor	1	Diesel	200	59	2.87E-03	3.71E-04	1.51E-03	7.98E-01	9.76E-05	7.83E-06	4	1.35	0.18	0.71	376.62	0.05	0.00
	Generator (3 per drill rig)	2	Diesel	1020	74	4.92E-04	5.91E-05	1.82E-04	8.45E-02	1.72E-05	8.29E-07	24	17.81	2.14	6.59	3060.53	0.62	0.03
Criteria Pollutant Emissions per Rig Day												98.75	14.15	82.66	18016.10	5.34	0.20	

Equipment					Emission Factors (lbs/bhp-hr)										Emissions (lbs/day)						
	Number	Fuel	BHP	% Load	NOX	ROG	CO	CO2	PM10	SOX	Hrs/Rig Day	NOX	ROG	CO	CO2	PM10	SOX				
2020																					
Motor Grader	1	Diesel	150	61	1.75E-02	2.85E-03	2.27E-02	3.86E+00	9.41E-04	4.34E-05	8	12.78	2.09	16.59	2824.12	0.69	0.03				
Tracked Tractor	1	Diesel	285	64	7.06E-03	1.39E-03	5.76E-03	2.99E+00	2.55E-04	3.36E-05	8	10.30	2.03	8.41	4363.88	0.37	0.05				
Backhoe	1	Diesel	70	55	5.49E-02	8.15E-03	7.57E-02	1.15E+01	2.87E-03	1.35E-04	18	38.06	5.65	52.49	7980.02	1.99	0.09				
Compactor	1	Diesel	200	59	1.99E-03	3.31E-04	1.53E-03	8.32E-01	6.95E-05	8.17E-06	4	0.94	0.16	0.72	392.67	0.03	0.00				
Generator (3 per drill rig)	2	Diesel	1020	74	4.92E-04	5.91E-05	1.82E-04	8.45E-02	1.72E-05	8.29E-07	24	17.81	2.14	6.59	3060.53	0.62	0.03				
Criteria Pollutant Emissions per Rig Day											79.89	12.07	84.81	18621.23	3.71	0.21					

Equipment		Emission Factors (lbs/bhp-hr)					Emissions (lbs/day)											
		Number	Fuel	BHP	% Load	NOX	ROG	CO	CO2	PM10	SOX	Hrs./Rig Day	NOX	ROG	CO	CO2	PM10	SOX
2022																		
	Motor Grader	1	Diesel	150	61	1.42E-02	2.54E-03	2.33E-02	3.96E+00	7.47E-04	4.46E-05	8	10.42	1.86	17.02	2900.17	0.55	0.03
	Tracked Tractor	1	Diesel	285	64	5.47E-03	1.29E-03	5.84E-03	3.07E+00	1.97E-04	3.45E-05	8	7.98	1.88	8.52	4478.08	0.29	0.05
	Backhoe	1	Diesel	70	55	4.83E-02	7.32E-03	7.74E-02	1.18E+01	2.07E-03	1.39E-04	18	33.46	5.07	53.65	8188.84	1.43	0.10
	Compactor	1	Diesel	200	59	1.54E-03	3.07E-04	1.56E-03	8.56E-01	5.37E-05	8.40E-06	4	0.73	0.15	0.74	403.88	0.03	0.00
	Generator (3 per drill rig)	2	Diesel	1020	74	4.92E-04	5.91E-05	1.82E-04	8.45E-02	1.72E-05	8.29E-07	24	17.81	2.14	6.59	3060.53	0.62	0.03
Criteria Pollutant Emissions per Rig Day												70.40	11.09	86.51	19031.51	2.92	0.21	

Table A-3
Estimated Well Site Preparation, Drilling and Completion Emissions
OEHI CO2 EOR PROJECT

Equipment	Number	Fuel	BHP	% Load	Emission Factors (lbs/bhp-hr)						Emissions (lbs/day)						
					NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Rig Day	NOX	ROG	CO	CO2	PM10	SOX
2023																	
Motor Grader	1	Diesel	150	61	1.28E-02	2.40E-03	2.35E-02	4.01E+00	6.62E-04	4.52E-05	8	9.37	1.75	17.23	2938.04	0.48	0.03
Tracked Tractor	1	Diesel	285	64	4.83E-03	1.24E-03	5.89E-03	3.11E+00	1.73E-04	3.50E-05	8	7.05	1.81	8.60	4536.44	0.25	0.05
Backhoe	1	Diesel	70	55	4.57E-02	7.04E-03	7.83E-02	1.20E+01	1.77E-03	1.40E-04	18	31.67	4.88	54.28	8295.55	1.22	0.10
Compactor	1	Diesel	200	59	1.37E-03	2.97E-04	1.58E-03	8.68E-01	4.67E-05	8.52E-06	4	0.65	0.14	0.74	409.51	0.02	0.00
Generator (3 per drill rig)	2	Diesel	1020	74	4.92E-04	5.91E-05	1.82E-04	8.45E-02	1.72E-05	8.29E-07	24	17.81	2.14	6.59	3060.53	0.62	0.03
Criteria Pollutant Emissions per Rig Day												66.55	10.73	87.45	19240.06	2.61	0.22

Equipment	Number	Fuel	BHP	% Load	Emission Factors (lbs/bhp-hr)						Emissions (lbs/day)						
					NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Rig Day	NOX	ROG	CO	CO2	PM10	SOX
2025																	
Motor Grader	1	Diesel	150	61	1.03E-02	2.16E-03	2.41E-02	4.12E+00	5.20E-04	4.63E-05	8	7.57	1.58	17.66	3013.05	0.38	0.03
Tracked Tractor	1	Diesel	285	64	3.82E-03	1.17E-03	6.02E-03	3.19E+00	1.35E-04	3.59E-05	8	5.57	1.71	8.78	4656.05	0.19	0.05
Backhoe	1	Diesel	70	55	4.18E-02	6.67E-03	8.03E-02	1.23E+01	1.31E-03	1.44E-04	18	28.98	4.62	55.62	8514.29	0.91	0.10
Compactor	1	Diesel	200	59	1.06E-03	2.77E-04	1.61E-03	8.91E-01	3.48E-05	8.75E-06	4	0.50	0.13	0.76	420.58	0.02	0.00
Generator (3 per drill rig)	2	Diesel	1020	74	4.92E-04	5.91E-05	1.82E-04	8.45E-02	1.72E-05	8.29E-07	24	17.81	2.14	6.59	3060.53	0.62	0.03
Criteria Pollutant Emissions per Rig Day												60.44	10.18	89.41	19664.50	2.12	0.22

Equipment	Number	Fuel	BHP	% Load	Emission Factors (lbs/bhp-hr)						Emissions (lbs/day)						
					NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Rig Day	NOX	ROG	CO	CO2	PM10	SOX
2029																	
Motor Grader	1	Diesel	150	61	6.88E-03	1.87E-03	2.53E-02	4.32E+00	3.26E-04	4.86E-05	8	5.04	1.37	18.51	3162.40	0.24	0.04
Tracked Tractor	1	Diesel	285	64	2.58E-03	1.10E-03	6.30E-03	3.36E+00	9.08E-05	3.78E-05	8	3.76	1.60	9.20	4899.22	0.13	0.06
Backhoe	1	Diesel	70	55	3.79E-02	6.30E-03	8.43E-02	1.29E+01	7.62E-04	1.52E-04	18	26.26	4.37	58.42	8958.95	0.53	0.11
Compactor	1	Diesel	200	59	6.96E-04	2.58E-04	1.70E-03	9.37E-01	2.50E-05	9.19E-06	4	0.33	0.12	0.80	442.17	0.01	0.00
Generator (3 per drill rig)	2	Diesel	1020	74	4.92E-04	5.91E-05	1.82E-04	8.45E-02	1.72E-05	8.29E-07	24	17.81	2.14	6.59	3060.53	0.62	0.03
Criteria Pollutant Emissions per Rig Day												53.20	9.60	93.52	20523.27	1.54	0.23

Equipment	Number	Fuel	BHP	% Load	Emission Factors (lbs/bhp-hr)						Emissions (lbs/day)						
					NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Rig Day	NOX	ROG	CO	CO2	PM10	SOX
2031																	
Motor Grader	1	Diesel	150	61	5.72E-03	1.78E-03	2.59E-02	4.42E+00	2.62E-04	4.98E-05	8	4.19	1.31	18.95	3237.24	0.19	0.04
Tracked Tractor	1	Diesel	285	64	2.29E-03	1.09E-03	6.45E-03	3.44E+00	8.50E-05	3.87E-05	8	3.34	1.60	9.42	5018.45	0.12	0.06
Backhoe	1	Diesel	70	55	3.71E-02	6.24E-03	8.63E-02	1.32E+01	6.39E-04	1.55E-04	18	25.68	4.33	59.83	9177.00	0.44	0.11
Compactor	1	Diesel	200	59	6.23E-04	2.58E-04	1.74E-03	9.60E-01	2.29E-05	9.42E-06	4	0.29	0.12	0.82	452.92	0.01	0.00
Generator (3 per drill rig)	2	Diesel	1020	74	4.92E-04	5.91E-05	1.82E-04	8.45E-02	1.72E-05	8.29E-07	24	17.81	2.14	6.59	3060.53	0.62	0.03
Criteria Pollutant Emissions per Rig Day												51.32	9.49	95.60	20946.13	1.39	0.24

Table A-3
Estimated Well Site Preparation, Drilling and Completion Emissions
OEHI CO2 EOR PROJECT

Equipment	Number	Fuel	BHP	% Load	Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)						
					NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Rig Day	NOX	ROG	CO	CO2	PM10	SOX	
2033																		
Motor Grader	1	Diesel	150	61	4.81E-03	1.72E-03	2.65E-02	4.53E+00	2.16E-04	5.09E-05	8	3.52	1.26	19.39	3312.40	0.16	0.04	
Tracked Tractor	1	Diesel	285	64	2.15E-03	1.11E-03	6.61E-03	3.52E+00	8.16E-05	3.96E-05	8	3.14	1.61	9.64	5136.53	0.12	0.06	
Backhoe	1	Diesel	70	55	3.69E-02	6.25E-03	8.83E-02	1.36E+01	5.60E-04	1.59E-04	18	25.57	4.33	61.22	9392.92	0.39	0.11	
Compactor	1	Diesel	200	59	5.79E-04	2.59E-04	1.78E-03	9.82E-01	2.14E-05	9.64E-06	4	0.27	0.12	0.84	463.60	0.01	0.00	
Generator (3 per drill rig)	2	Diesel	1020	74	4.92E-04	5.91E-05	1.82E-04	8.45E-02	1.72E-05	8.29E-07	24	17.81	2.14	6.59	3060.53	0.62	0.03	
Criteria Pollutant Emissions per Rig Day												50.31	9.47	97.68	21365.98	1.30	0.24	

Table A-3
Estimated Well Site Preparation, Drilling and Completion Emissions
OEHI CO2 EOR PROJECT

Emissions From Site Preparation (Tons/Year)							
Year	No. Sites	Site Days	NOX	ROG	CO	CO2	SOX
2016	18	36	1.05	0.15	0.86	190.65	0.06
2017	4	8	0.32	0.05	0.30	59.82	0.02
2020	8	16	0.50	0.08	0.63	124.49	0.02
2022	9	18	0.47	0.08	0.72	143.74	0.02
2023	27	54	1.32	0.23	2.18	436.85	0.05
2025	20	40	0.85	0.16	1.66	332.08	0.03
2029	20	40	0.71	0.15	1.74	349.25	0.02
2031	21	42	0.70	0.15	1.87	375.60	0.02
2033	23	46	0.75	0.17	2.09	421.03	0.02
Total	150	300	6.67	1.22	12.05	2,433.50	0.25
							0.03

Emissions From Well Drilling (Tons/Year)							
Year	No. Well	Rig Days	NOX	ROG	CO	CO2	SOX
2016	18	252	2.24	0.27	0.83	385.63	0.08
2017	4	56	0.50	0.06	0.18	85.69	0.02
2020	8	112	1.00	0.12	0.37	171.39	0.03
2022	9	126	1.12	0.13	0.42	192.81	0.04
2023	27	378	3.37	0.40	1.25	578.44	0.12
2025	20	280	2.49	0.30	0.92	428.47	0.09
2029	20	280	2.49	0.30	0.92	428.47	0.09
2031	21	294	2.62	0.31	0.97	449.90	0.09
2033	23	322	2.87	0.34	1.06	492.75	0.10
Total	150	2,100	18.70	2.25	6.92	3,213.56	0.66
							0.03

Emissions From Well Completion (Tons/Year)							
Year	Well	Rig Days	NOX	ROG	CO	CO2	SOX
2016	18	72	2.73	0.34	1.44	336.16	0.11
2017	4	16	0.56	0.07	0.30	74.70	0.02
2020	8	32	0.90	0.13	0.51	150.48	0.04
2022	9	36	0.86	0.13	0.53	117.58	0.03
2023	27	108	2.39	0.37	1.52	507.86	0.09
2025	20	80	1.50	0.25	1.05	376.19	0.06
2029	20	80	1.07	0.21	0.95	376.19	0.04
2031	21	84	1.10	0.22	0.99	395.00	0.04
2033	23	92	0.89	0.22	1.01	432.62	0.03
Total	150	-----	12.01	1.95	8.30	2,766.79	0.48
							0.03

Table A-3
Estimated Well Site Preparation, Drilling and Completion Emissions
OEHI CO2 EOR PROJECT

Total Emissions From Well Installation (Tons/Year)									
Year	Well	Total	NOX	ROG	CO	CO2	PM10	SOX	
2016	18	Total =	6.02	0.76	3.12	912.44	0.25	0.01	
2017	4	Total =	1.38	0.18	0.79	220.22	0.06	0.00	
2020	8	Total =	2.40	0.33	1.51	446.35	0.10	0.00	
2022	9	Total =	2.46	0.35	1.66	454.13	0.09	0.01	
2023	27	Total =	7.07	1.01	4.95	1523.15	0.27	0.02	
2025	20	Total =	4.85	0.71	3.62	1136.75	0.18	0.01	
2029	20	Total =	4.27	0.66	3.61	1153.92	0.15	0.01	
2031	21	Total =	4.42	0.69	3.83	1220.50	0.15	0.01	
2033	23	Total =	4.51	0.73	4.17	1346.39	0.15	0.01	
Total	150	-----	37.37	5.42	27.26	8,413.84	1.39	0.09	

NOTE: Total well installation emissions shown above include site preparation, well drilling and well completions. The summary of well installation emissions shown in Table A-3 include the summary of well completion emissions shown in Table A-4. Table A-4 is a detailed supplement to Table A-3.

Table A-4
Estimated Well Completion Emissions
OEHI CO2 EOR PROJECT

Emission Factors (lbs/bhp-hr)												Emissions (lbs/day)					
Equipment	Number	Fuel	BHP	% Load	NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Day	NOX	ROG	CO	CO2	PM10	SOX
2016																	
Mobile Rig	1	Diesel	425	75.00	0.011693	0.001486	0.006622	1.267635	0.000492	0.000012	12	59.63	7.58	33.77	6464.94	2.51	0.06
Pump	1	Diesel	375	60.00	0.007174	0.000889	0.002742	1.276824	0.000257	0.000013	6	16.14	2.00	6.17	2872.85	0.58	0.03
Criteria Pollutant Emissions per Rig Day												75.77	9.58	39.94	9337.79	3.09	0.09
Emission Factors (lbs/bhp-hr)												Emissions (lbs/day)					
Equipment	Number	Fuel	BHP	% Load	NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Day	NOX	ROG	CO	CO2	PM10	SOX
2017																	
Mobile Rig	1	Diesel	425	75.00	0.010928	0.001410	0.006196	1.267635	0.000459	0.000012	12	55.73	7.19	31.60	6464.94	2.34	0.06
Pump	1	Diesel	375	60.00	0.006428	0.000847	0.002655	1.276824	0.000230	0.000013	6	14.46	1.91	5.97	2872.85	0.52	0.03
Criteria Pollutant Emissions per Rig Day												70.20	9.09	37.57	9337.79	2.86	0.09
Emission Factors (lbs/bhp-hr)												Emissions (lbs/day)					
Equipment	Number	Fuel	BHP	% Load	NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Day	NOX	ROG	CO	CO2	PM10	SOX
2020																	
Mobile Rig	1	Diesel	425	75.00	0.009046	0.001236	0.005196	1.279707	0.000372	0.000013	12	46.14	6.30	26.50	6526.51	1.90	0.06
Pump	1	Diesel	375	60.00	0.004528	0.000730	0.002528	1.279247	0.000166	0.000013	6	10.19	1.64	5.69	2878.31	0.37	0.03
Criteria Pollutant Emissions per Rig Day												56.32	7.94	32.19	9404.81	2.27	0.09
Emission Factors (lbs/bhp-hr)												Emissions (lbs/day)					
Equipment	Number	Fuel	BHP	% Load	NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Day	NOX	ROG	CO	CO2	PM10	SOX
2022																	
Mobile Rig	1	Diesel	425	75.00	0.007855	0.001125	0.004644	1.279707	0.000320	0.000013	12	40.06	5.74	23.69	6526.51	1.63	0.06
Pump	1	Diesel	375	60.00	0.003517	0.000655	0.002484	0.002484	0.000127	0.000013	6	7.91	1.47	5.59	5.59	0.29	0.03
Criteria Pollutant Emissions per Rig Day												47.97	7.21	29.28	6532.10	1.92	0.09
Emission Factors (lbs/bhp-hr)												Emissions (lbs/day)					
Equipment	Number	Fuel	BHP	% Load	NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Day	NOX	ROG	CO	CO2	PM10	SOX
2023																	
Mobile Rig	1	Diesel	425	75.00	0.007314	0.001075	0.004424	1.279707	0.000296	0.000013	12	37.30	5.48	22.56	6526.51	1.51	0.06
Pump	1	Diesel	375	60.00	0.003099	0.000620	0.002462	1.279247	0.000110	0.000013	6	6.97	1.39	5.54	2878.31	0.25	0.03
Criteria Pollutant Emissions per Rig Day												44.28	6.87	28.10	9404.81	1.75	0.09

Table A-4
Estimated Well Completion Emissions
OEHI CO2 EOR PROJECT

Equipment	Number	Fuel	BHP	% Load	Emission Factors (lbs/bhp-hr)						Emissions (lbs/day)						
					NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Day	NOX	ROG	CO	CO2	PM10	SOX
2025																	
Mobile Rig	1	Diesel	425	75.00	0.006321	0.000984	0.004049	1.279707	0.000253	0.000013	12	32.24	5.02	20.65	6526.51	1.29	0.06
Pump	1	Diesel	375	60.00	0.002330	0.000556	0.002440	1.279247	0.000078	0.000013	6	5.24	1.25	5.49	2878.31	0.18	0.03
												0.00	0.00	0.00	0.00	0.00	0.00
Criteria Pollutant Emissions per Rig Day												37.48	6.27	26.14	9404.81	1.46	0.09

Equipment	Number	Fuel	BHP	% Load	Emission Factors (lbs/bhp-hr)						Emissions (lbs/day)						
					NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Day	NOX	ROG	CO	CO2	PM10	SOX
2029																	
Mobile Rig	1	Diesel	425	75.00	0.004655	0.000838	0.003563	1.279707	0.000183	0.000013	12	23.74	4.28	18.17	6526.51	0.93	0.06
Pump	1	Diesel	375	60.00	0.001325	0.000473	0.002440	1.279247	0.000048	0.000013	6	2.98	1.06	5.49	2878.31	0.11	0.03
												0.00	0.00	0.00	0.00	0.00	0.00
Criteria Pollutant Emissions per Rig Day												26.73	5.34	23.66	9404.81	1.04	0.09

Equipment	Number	Fuel	BHP	% Load	Emission Factors (lbs/bhp-hr)						Emissions (lbs/day)						
					NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Day	NOX	ROG	CO	CO2	PM10	SOX
2031																	
Mobile Rig	1	Diesel	425	75.00	0.004655	0.000838	0.003563	1.279707	0.000183	0.000013	12	23.74	4.28	18.17	6526.51	0.93	0.06
Pump	1	Diesel	375	60.00	0.001081	0.000455	0.002440	1.279247	0.000040	0.000013	6	2.43	1.02	5.49	2878.31	0.09	0.03
												0.00	0.00	0.00	0.00	0.00	0.00
Criteria Pollutant Emissions per Rig Day												26.18	5.30	23.66	9404.81	1.02	0.09

Equipment	Number	Fuel	BHP	% Load	Emission Factors (lbs/bhp-hr)						Emissions (lbs/day)						
					NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Day	NOX	ROG	CO	CO2	PM10	SOX
2033																	
Mobile Rig	1	Diesel	425	75.00	0.003398	0.000735	0.003243	1.279707	0.000133	0.000013	12	17.33	3.75	16.54	6526.51	0.68	0.06
Pump	1	Diesel	375	60.00	0.000923	0.000442	0.002440	1.279247	0.000035	0.000013	6	2.08	0.99	5.49	2878.31	0.08	0.03
												0.00	0.00	0.00	0.00	0.00	0.00
Criteria Pollutant Emissions per Rig Day												19.41	4.74	22.03	9404.81	0.76	0.09

Table A-4
Estimated Well Completion Emissions
OEHI CO2 EOR PROJECT

Emissions From Well Completion (Tons/Year)										
Year	Well	Rig Days	NOX	ROG	CO	CO2	PM10	SOX		
2016	18	72	2.73	0.34	1.44	336.16	0.11	0.00		
2017	4	16	0.56	0.07	0.30	74.70	0.02	0.00		
2020	8	32	0.90	0.13	0.51	150.48	0.04	0.00		
2022	9	36	0.86	0.13	0.53	117.58	0.03	0.00		
2023	27	108	2.39	0.37	1.52	507.86	0.09	0.00		
2025	20	80	1.50	0.25	1.05	376.19	0.06	0.00		
2029	20	80	1.07	0.21	0.95	376.19	0.04	0.00		
2031	21	84	1.10	0.22	0.99	395.00	0.04	0.00		
2033	23	92	0.89	0.22	1.01	432.62	0.03	0.00		
Total	150	600	12.01	1.95	8.30	2,766.79	0.48	0.03		

NOTE: Total well installation emissions shown in Table A-3 include the well completion emissions shown above in Table A-4. Table A-4 is a detailed supplement to Table A-3.

Table A-5
Estimated Well Conversion Emissions
OEHI CO2 EOR PROJECT

Average emissions per well conversion (based on annual average of well completion emissions)

Emissions (lbs/day)				
NOX	ROG	CO	CO2	PM10 SOX
44.93	6.93	29.17	9070.73	1.80 0.09

Emissions From Well Conversion (Tons/Year)									
Year	Well	Rig Days	NOX	ROG	CO	CO2	PM10	SOX	
2014	36	144	3.23	0.50	2.10	653.09	0.13	0.01	
2015	36	144	3.23	0.50	2.10	653.09	0.13	0.01	
2016	18	72	1.62	0.25	1.05	326.55	0.06	0.00	
2017	32	128	2.88	0.44	1.87	580.53	0.12	0.01	
2018	36	144	3.23	0.50	2.10	653.09	0.13	0.01	
2019	36	144	3.23	0.50	2.10	653.09	0.13	0.01	
2020	28	112	2.52	0.39	1.63	507.96	0.10	0.01	
2021	36	144	3.23	0.50	2.10	653.09	0.13	0.01	
2022	27	108	2.43	0.37	1.58	489.82	0.10	0.00	
2023	9	36	0.81	0.12	0.53	163.27	0.03	0.00	
2024	36	144	3.23	0.50	2.10	653.09	0.13	0.01	
2025	16	64	1.44	0.22	0.93	290.26	0.06	0.00	
2026	36	144	3.23	0.50	2.10	653.09	0.13	0.01	
2027	36	144	3.23	0.50	2.10	653.09	0.13	0.01	
2028	36	144	3.23	0.50	2.10	653.09	0.13	0.01	
2029	16	64	1.44	0.22	0.93	290.26	0.06	0.00	
2030	36	144	3.23	0.50	2.10	653.09	0.13	0.01	
2031	15	60	1.35	0.21	0.88	272.12	0.05	0.00	
2032	36	144	3.23	0.50	2.10	653.09	0.13	0.01	
2033	13	52	1.17	0.18	0.76	235.84	0.05	0.00	
Total	570	2280	51.22	7.90	33.25	10340.63	2.05	0.10	

TABLE A-6
CONSTRUCTION EMISSIONS-Tons (Assumes 80% Reduction through Controls)
Main Plant

Location	Const. Days	Period	PM 2.5	PM10	PM30
RCF & CTB	522	1/1/2014 - 12/30/2015	0.71	7.08	17.97
EPC & CRP	615	4/1/2017 - 4/30/2019	0.83	8.34	21.18
CTB Phase 2	65	9/1/2023 - 11/30/2023	0.04	0.4	0.83
Additional CTB Tanks & Pumps	313	10/1/2024 - 12/30/2025	0.12	1.2	3.06

$E = 0.15(s/12)^a(W/3)^b$
E=Lbs/vehicle mi traveled
s=silt content
W=mean vehicle weight
a & b factors from AP-42

Assumptions RCF & CTB

11 vehicles
8 mi/day/vehicle
3-hvy duty
3-front end loader
5-truck/tractors
silt content 8.5%
10.75 ton mean vehicle weight
80% dust control

Assumptions CTB Phase 2

5 vehicles
8 mi/day/vehicle
2-hvy duty
1-front end loader
2-truck/tractors
silt content 8.5%
10.75 ton mean vehicle weight
80% dust control

Assumptions EPC & CRP

11 vehicles
8 mi/day/vehicle
3-hvy duty
3-front end loader
5-truck/tractors
silt content 8.5%
10.75 ton mean vehicle weight
80% dust control

Assumptions Additional CTB Tanks & Pumps

5 vehicles
5 mi/day/vehicle
2-hvy duty
1-front end loader
2-truck/tractors
silt content 8.5%
10.75 ton mean vehicle weight
80% dust control

TABLE A-7
FUGITIVE DUST CONSTRUCTION EMISSIONS-Tons (Assumes 80% Reduction through Controls)
SATELLITE LOCATIONS AND PIPELINES

Location	Const. Days	Period	PM 2.5	PM10	PM30
Satellite 1 & Flow Lines	173	10/1/2014 - 6/30/2015	0.05	0.5	1.28
Trunk Lines - 1&2	283	9/1/2014 - 9/30/2015	0.16	1.64	4.17
Satellite 2 & Flow Lines	151	1/1/2015 - 9/30/2015	0.04	0.44	1.11
Satellite 3 & Flow Lines	151	12/1/2015 - 1/30/2016	0.04	0.44	1.11
Trunk Lines 3	218	9/1/2015 - 6/30/2016	0.13	1.26	3.22
Satellite 4 & Flow Lines	270	2/1/2016 - 3/30/2017	0.08	0.78	1.99
Trunk Lines 4-9	262	3/1/2016 - 3/30/2017	0.61	1.52	3.86
Satellite 5 & Flow Lines	270	2/1/2017 - 3/30/2018	0.08	0.78	1.99
Satellite 6 & Flow Lines	270	2/1/2019 - 3/30/2020	0.08	0.78	1.99
Satellite 7 & Flow Lines	270	11/1/2020 - 12/30/2021	0.08	0.78	1.99
Satellite 8 & Flow Lines	270	9/1/2023 - 10/30/2024	0.08	0.78	1.99
Satellite 9 & Flow Lines	270	2/1/2026 - 3/30/2027	0.08	0.78	1.99
Satellite 10 & Flow Lines	270	4/1/2027 - 5/30/2028	0.08	0.78	1.99
Trunk Lines 10-13	304	3/1/2027 - 5/30/2028	0.18	1.76	4.48
Satellite 11 & Flow Lines	270	8/1/2028 - 8/30/2029	0.08	0.78	1.99
Satellite 12 & Flow Lines	270	6/1/2030 - 6/30/2031	0.08	0.78	1.99
Satellite 13 & Flow Lines	270	11/1/2032 - 12/30/2033	0.08	0.78	1.99

Assumptions

5 vehicles
5 mi/day/vehicle
2-hvy duty
1-front end loader
2-truck/tractors
silt content 8.5%
8.1 ton mean vehicle weight
80% dust control

$E=0.15(s/12)a(W/3)b$
 $E=\text{Lbs/vehicle mi traveled}$
 $s=\text{silt content}$
 $W=\text{mean vehicle weight}$
 $a \text{ \& } b = \text{factors from AP-42}$

TABLE A-8
CONSTRUCTION EMISSIONS-Tons (Assumes 80% Reduction through Controls)
Total Fugitive Dust Emissions

Pollutant	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
PM 10	4.21	6.16	2.84	3.98	4.35	2.05	0.30	0.72	0.00	0.64	0.77	1.03	0.66	1.92	1.20	0.48	0.42	0.36	0.12	0.72

TABLE A-9
All Estimated Onroad Vehicle Emissions (Construction Personnel, Supply Transport, and Operations Personnel)
OEHI CO2 EOR PROJECT

Vehicle Class	Number (trips)	VMT	NOX		ROG						CO		CO2		PM10			SOX		Emissions (lbs/day)							
			Run Exhaust (g/mi)	Start-Up Exhaust (g/st)	Start-Up (g/st)	Hot-Soak (g/trip)	Rest Loss (g/hr)	Run Evap (g/hr)	Diurnal Evap (g/hr)	Run Exhaust (g/mi)	Start-Up Exhaust (g/st)	Run Exhaust (g/mi)	Start-Up Exhaust (g/st)	Run Exhaust (g/mi)	Start-Up Exhaust (g/st)	Tire Wear (g/mi)	Brake Wear (g/mi)	Run Exhaust (g/mi)	Start-Up Exhaust (g/st)	NOX	ROG	CO	CO2	PM10	SOX	Days	
2014																											
LDA-AII	140	60	0.123	0.26	0.031	0.601	0.159	0.041	0.031	0.091	1.497	6.885	295.358	207.1	0.009	0.0017	0.008	0.013	0.003	0.002	2.44	1.00	31.97	5597.45	0.56	0.06	250
HDD-AII	3	60	9.806	1.286	0.601	1.658	0.007	0	0.001	0	3.344	30.89	1738.184	42.31	0.334	0.003	0.036	0.028	0.017	0.001	3.91	0.26	1.74	690.32	0.16	0.01	250
2015																											
LDA-AII	256	60	0.109	0.229	0.026	0.529	0.15	0.038	0.029	0.083	1.338	6.184	294.585	206.6	0.009	0.016	0.008	0.013	0.003	0.002	3.95	1.56	52.29	10208.54	1.03	0.10	250
HDD-AII	5	60	8.599	1.258	0.546	3.896	0.006	0	0.001	0	3.048	29.1	1737.649	43.12	0.295	0.003	0.036	0.028	0.017	0.001	5.71	0.45	2.66	1150.19	0.24	0.01	250
2016																											
LDA-AII	50	60	0.097	0.203	0.022	0.468	0.142	0.036	0.027	0.076	1.21	5.576	293.965	206.1	0.009	0.016	0.008	0.013	0.003	0.002	0.69	0.27	9.23	1989.65	0.20	0.02	250
HDD-AII	2	60	7.505	1.229	0.495	1.417	0.005	0	0.001	0	2.781	28.39	1737.172	44.31	0.259	0.003	0.036	0.028	0.017	0.001	2.00	0.14	0.99	459.96	0.09	0.00	250
2017																											
LDA-AII	174	60	0.086	0.179	0.019	0.414	0.135	0.034	0.025	0.07	1.096	5.021	293.425	205.7	0.009	0.016	0.008	0.013	0.003	0.002	2.12	0.81	29.08	6911.24	0.70	0.07	250
HDD-AII	4	60	6.526	1.202	0.448	1.315	0.004	0	0.001	0	2.537	27.62	1736.753	45.49	0.226	0.003	0.036	0.028	0.017	0.001	3.47	0.26	1.83	919.72	0.15	0.01	250
2018																											
LDA-AII	186	60	0.078	0.157	0.016	0.367	0.127	0.032	0.023	0.065	0.997	4.521	292.781	205.2	0.009	0.016	0.008	0.013	0.003	0.002	2.05	0.75	28.24	7371.66	0.75	0.08	250
HDD-AII	4	60	5.666	1.178	0.405	1.237	0.005	0	0.001	0	2.318	27.37	1736.386	46.82	0.197	0.003	0.036	0.028	0.017	0.001	3.02	0.24	1.71	919.55	0.14	0.01	250
2019																											
LDA-AII	268	60	0.07	0.139	0.014	0.326	0.121	0.03	0.022	0.06	0.914	4.081	292.23	204.8	0.009	0.016	0.008	0.013	0.003	0.002	2.65	0.95	37.22	10601.52	1.08	0.11	250
HDD-AII	5	60	4.947	1.153	0.368	1.16	0.003	0	0	0	2.134	27.17	1736.144	47.91	0.173	0.003	0.036	0.028	0.017	0.001	3.30	0.27	2.01	1149.30	0.16	0.01	250
2020																											
LDA-AII	46	60	0.064	0.123	0.013	0.291	0.114	0.028	0.021	0.056	0.845	3.659	291.753	204.5	0.008	0.016	0.008	0.013	0.003	0.002	0.41	0.15	5.88	1816.69	0.18	0.02	250
HDD-AII	2	60	4.362	1.126	0.338	1.084	0.003	0	0	0	1.981	26.93	1735.996	48.8	0.153	0.003	0.036	0.028	0.017	0.001	1.16	0.10	0.76	459.69	0.06	0.00	250
2021																											
LDA-AII	52	60	0.059	0.109	0.012	0.261	0.109	0.026	0.02	0.052	0.787	3.362	291.337	204.1	0.009	0.016	0.008	0.013	0.003	0.002	0.43	0.16	6.18	2050.71	0.21	0.02	250
HDD-AII	2	60	3.92	1.105	0.315	1.021	0.003	0	0	0	1.866	26.84	1735.988	49.6	0.139	0.003	0.036	0.028	0.017	0.001	1.05	0.09	0.73	459.69	0.05	0.00	250
2022																											
LDA-AII	27	60	0.055	0.097	0.011	0.235	0.104	0.025	0.019	0.048	0.736	3.069	290.961	203.8	0.009	0.016	0.008	0.013	0.003	0.002	0.21	0.07	2.99	1063.41	0.11	0.01	250
HDD-AII	1	60	3.576	1.083	0.297	0.953	0.003	0	0	0	1.775	26.59	1736.02	50.26	0.036	0.003	0.036	0.028	0.017	0.001	0.48	0.04	0.35	229.85	0.01	0.02	250
2023																											
LDA-AII	31	60	0.051	0.087	0.01	0.212	0.099	0.023	0.019	0.045	0.692	2.813	290.616	203.5	0.009	0.016	0.008	0.013	0.003	0.002	0.22	0.08	3.22	1219.50	0.13	0.01	250
HDD-AII	2	60	3.305	1.07	0.282	0.81	0.003	0	0	0	1.703	26.51	1736.078	50.8	0.118	0.003	0.036	0.028	0.017	0.001	0.88	0.08	0.68	459.73	0.05	0.00	250
2024																											
LDA-AII	73	60	0.047	0.079	0.009	0.192	0.094	0.022	0.018	0.041	0.652	0.259	290.305	203.3	0.009	0.016	0.008	0.013	0.003	0.002	0.48	0.17	6.38	2868.64	0.29	0.03	250
HDD-AII	2	60	3.087	1.057	0.27	0.896	0.003	0	0	0	1.644	26.4	1736.134	51.2	0.11	0.003	0.036	0.028	0.017	0.001	0.83	0.08	0.67	459.75	0.05	0.00	250
2025																											
LDA-AII	81	60	0.045	0.071	0.008	0.175	0.09	0.02	0.017	0.038	0.62	2.402	290.032	203.1	0.009	0.016	0.008	0.013	0.003	0.002	0.51	0.17	7.50	3180.01	0.33	0.03	250
HDD-AII	3	60	2.916	1.048	0.26	0.829	0.003	0	0	0	1.597	26.2	1736.174	51.5	0.104	0.003	0.036	0.028	0.017	0.001	1.17	0.11	0.98	689.64	0.07	0.01	250
2026																											
LDA-AII	28	60	0.042	0.065	0.008	0.161	0.086	0.019	0.017	0.036	0.592	2.24	289.79	202.9	0.009	0.016	0.008	0.013	0.003	0.002	0.16	0.06	2.47	1098.34	0.11	0.01	250
HDD-AII	1	60	2.779	1.033	0.253	0.777	0.003	0	0	0	1.559	25.63	1736.194	51.64	0.099	0.003	0.036	0.028	0.017	0.001	0.37	0.04	0.32	229.88	0.02	0.00	250
2027																											
LDA-AII	52	60	0.05	0.059	0.007	0.147	0.082	0.018	0.017	0.033	0.567	2.099	289.575	202.7	0.009	0.016	0.008	0.013	0.003	0.002	0.36	0.09	4.38	2038.25	0.21	0.02	250
HDD-AII	2	60	2.672	1.032	0.246	0.758	0.003	0	0	0	1.53	25.71	1736.185	51.93	0.095	0.004	0.036	0.028	0.017	0.001	0.72	0.07	0.63	459.77	0.04	0.00	250

TABLE A-9
All Estimated Onroad Vehicle Emissions (Construction Personnel, Supply Transport, and Operations Personnel)
OEHI CO2 EOR PROJECT

Vehicle Class	Number (trips)	VMT	NOX		ROG						CO		CO2		PM10			SOX		Emissions (lbs/day)							
			Run Exhaust (g/mi)	Start-Up Exhaust (g/st)	Run Exhaust (g/mi)	Start-Up Exhaust (g/st)	Hot-Soak (g/trip)	Rest Loss (g/hr)	Run Evap (g/hr)	Diurnal Evap (g/hr)	Run Exhaust (g/mi)	Start-Up Exhaust (g/st)	Run Exhaust (g/mi)	Start-Up Exhaust (g/st)	Tire Wear (g/mi)	Brake Wear (g/mi)	Run Exhaust (g/mi)	Start-Up Exhaust (g/st)	NOX	ROG	CO	CO2	PM10	SOX	Days		
2028																											
LDA-AII	89	60	0.038	0.054	0.007	0.136	0.078	0.017	0.016	0.03	0.546	1.975	289.384	202.5	0.009	0.016	0.008	0.013	0.003	0.002	0.47	0.15	7.20	3486.23	0.36	0.04	250
HDD-AII	2	60	2.587	1.033	0.241	0.736	0.003	0	0	0	1.506	25.72	1736.161	52.15	0.092	0.004	0.036	0.028	0.017	0.001	0.69	0.07	0.63	459.76	0.04	0.00	250
2029																											
LDA-AII	47	60	0.036	0.05	0.006	0.125	0.075	0.016	0.016	0.027	0.526	1.864	289.215	202.3	0.009	0.016	0.008	0.013	0.003	0.002	0.23	0.07	3.66	1839.96	0.19	0.02	250
HDD-AII	2	60	2.515	1.027	0.236	0.703	0.003	0	0	0	1.484	25.37	1736.117	52.28	0.089	0.004	0.036	0.028	0.017	0.001	0.67	0.07	0.62	459.75	0.04	0.00	250
2030																											
LDA-AII	28	60	0.035	0.046	0.006	0.116	0.071	0.014	0.016	0.025	0.51	1.768	289.077	202.2	0.009	0.016	0.008	0.013	0.003	0.002	0.14	0.04	2.11	1095.62	0.11	0.01	250
HDD-AII	1	60	2.456	1.029	0.233	0.791	0.003	0	0	0	1.467	25.57	1736.057	52.52	0.086	0.004	0.036	0.028	0.017	0.001	0.33	0.06	0.31	229.87	0.02	0.00	250
2031																											
LDA-AII	46	60	0.034	0.042	0.006	0.108	0.068	0.013	0.015	0.023	0.496	1.684	288.959	202.1	0.009	0.016	0.008	0.013	0.003	0.002	0.22	0.07	3.36	1799.21	0.19	0.02	250
HDD-AII	2	60	2.405	1.027	0.229	0.675	0.003	0	0	0	1.451	25.69	1735.987	52.71	0.084	0.004	0.036	0.028	0.017	0.001	0.65	0.07	0.61	459.72	0.04	0.00	250
2032																											
LDA-AII	28	60	0.033	0.039	0.006	0.1	0.065	0.012	0.015	0.021	0.483	1.608	288.858	202	0.009	0.016	0.008	0.013	0.003	0.002	0.13	0.04	1.99	1094.78	0.11	0.01	250
HDD-AII	1	60	2.636	1.023	0.226	0.654	0.003	0	0	0	1.438	25.82	1735.928	52.84	0.083	0.004	0.036	0.028	0.017	0.001	0.35	0.03	0.30	229.85	0.02	0.00	250
2033																											
LDA-AII	44	60	0.032	0.036	0.045	0.094	0.062	0.012	0.015	0.019	0.472	1.54	288.77	201.9	0.009	0.016	0.008	0.013	0.003	0.002	0.19	0.29	3.05	1719.85	0.18	0.02	250
HDD-AII	2	60	2.329	1.021	0.224	0.64	0.003	0	0	0	1.427	25.98	1735.877	53.01	0.081	0.004	0.036	0.028	0.017	0.001	0.63	0.06	0.61	459.69	0.04	0.00	250

Assumptions/Notes:

Onroad emissions factors from EMFAC 2007	Total (tons)	NOX	ROG	CO	CO2	PM10	SOX	Total (tons)	NOX	ROG	CO	CO2	PM10	SOX
SJVPACD, 2013-2035, 70 degrees F, 50% RH	2014	0.79	0.16	4.21	785.97	0.09	0.01	2025	0.21	0.03	1.06	483.71	0.05	0.00
Assumes startup after 12 hours	2015	1.21	0.25	6.87	1419.84	0.16	0.01	2026	0.07	0.01	0.35	166.03	0.02	0.00
Vehicle speed = 40 mph	2016	0.34	0.05	1.28	306.20	0.04	0.00	2027	0.13	0.02	0.63	312.25	0.03	0.00
20 min hot soak per trip	2017	0.70	0.13	3.86	978.87	0.11	0.01	2028	0.15	0.03	0.98	493.25	0.05	0.01
15 min rest each trip	2018	0.63	0.12	3.74	1036.40	0.11	0.01	2029	0.11	0.02	0.53	287.46	0.03	0.00
45 min run time	2019	0.74	0.15	4.90	1468.85	0.15	0.01	2030	0.06	0.01	0.30	165.69	0.02	0.00
Light-Duty Automobile (LDA) assumes all fuel types	2020	0.20	0.03	0.83	284.55	0.03	0.00	2031	0.11	0.02	0.50	282.37	0.03	0.00
Heavy-Duty Truck (HDD) assumes all fuel types	2021	0.18	0.03	0.86	313.80	0.03	0.00	2032	0.06	0.01	0.29	165.58	0.01	0.00
VMT = Vehicle Miles Traveled	2022	0.09	0.01	0.42	161.66	0.02	0.00	2033	0.10	0.04	0.46	272.44	0.02	0.00
	2023	0.14	0.02	0.49	209.90	0.02	0.00							
	2024	0.16	0.03	0.88	416.05	0.04	0.00							

Table A-10
Total Estimated Construction Emissions
OEHI CO2 EOR Project

Year	NOX (tons)	ROG (tons)	CO (tons)	CO2 (tons)	PM10 (tons)	SOX (tons)
2014	7.24	1.11	8.71	1,838.46	4.66	0.02
2015	10.24	1.58	13.61	2,867.58	6.84	0.03
2016	14.01	1.93	10.59	2,461.04	3.57	0.03
2017	9.76	1.45	11.09	2,573.19	4.56	0.03
2018	6.43	1.00	8.57	2,150.89	4.74	0.02
2019	7.14	1.12	10.60	2,751.93	2.50	0.03
2020	5.91	0.87	4.96	1,413.83	0.57	0.01
2021	5.81	0.89	6.16	1,532.98	0.99	0.02
2022	4.97	0.73	3.65	1,105.61	0.21	0.01
2023	8.97	1.30	7.45	2,159.48	1.00	0.02
2024	5.26	0.84	6.12	1,625.36	1.01	0.02
2025	7.45	1.12	7.27	2,193.59	1.35	0.02
2026	4.96	0.80	5.55	1,379.83	0.86	0.01
2027	5.21	0.85	6.32	1,631.71	2.13	0.02
2028	5.18	0.85	6.71	1,821.30	1.43	0.02
2029	6.96	1.11	7.41	2,153.27	0.74	0.02
2030	4.46	0.73	4.99	1,302.29	0.59	0.01
2031	5.98	0.94	5.45	1,820.08	0.60	0.02
2032	3.49	0.55	2.84	903.43	0.26	0.01
2033	7.06	1.20	8.49	2,425.90	0.96	0.03
TOTALS	136.51	20.97	146.55	38,111.74	39.54	0.40
ANNUAL AVERAGE	6.83	1.05	7.33	1,905.59	1.98	0.02

APPENDICES

APPENDIX B NOISE MODELS

SUPPLEMENTAL ENVIRONMENTAL INFORMATION

NOISE ANALYSIS

OEHI CO2 EOR PROJECT

Noise Scenario: Construction Equipment Operating in CO2 EOR Processing Facility Area

Receptor: R1 (Tupman)

Construction Noise Source (Point Source)	Assumed Equipment Use Factor	Maximum Sound Pressure @50 feet (dBA)	Distance to Receptor (Feet)	Point Source Noise Level Attenuation with Distance (dBA)	Ground Attenuation with Distance (dBA)	Total Noise Level Attenuation (dBA)
Crane	0.20	83	7920	34.8	4.8	30.0
Air Compressor	0.73	81	7920	36.2	4.8	31.4
Backhoe	0.73	85	7920	40.2	4.8	35.4
Generator	0.73	78	7920	33.2	4.8	28.4
Pneumatic Tool	0.05	86	7920	34.2	4.8	29.4
Grader	0.73	82.5	7920	37.7	4.8	32.9
Dozer	0.73	83	7920	38.2	4.8	33.4
Welding Machine	0.73	81	7920	36.2	4.8	31.4
Supply Truck	0.73	82	7920	37.2	4.8	32.4

Construction Noise Source (Point Source)	Attenuated Noise Level Rounded to Nearest Whole Decibel	Noise Level Below Loudest	Additive Noise Level
Crane	30.0	5.4	1.5
Air Compressor	31.4	4.0	1.45
Backhoe	35.4	0.0	3
Generator	28.4	7.0	0.79
Pneumatic Tool	29.4	6.0	2.53
Grader	32.9	2.5	1.96
Dozer	33.4	2.0	2.12
Welding Machine	31.4	4.0	1.45
Supply Truck	32.4	3.0	2.53

Total Attenuated Construction Noise LEQ (dBA) at Receptor During Scenario = 49.7

Estimated LEQ (dBA) at Receptor with Addition of Construction Noise = 62.4

Assumed Daytime Ambient Noise Level: 62.2

Assumed Nighttime Ambient Noise Level: 50.0

Est Ldn at Receptor with Construction R1: 61.2 Ambient Ldn: 61.0

Estimated Ldn conservatively estimates 15 hours of equipment operation during daytime & evening (6 am - 9 pm), 0 hours during nighttime.

Ground attenuation estimates assume soft sites, average transmission path of 2 meters above the ground

Data Source: EPA (1971), Noise From Construction Equipment and Operations

SUPPLEMENTAL ENVIRONMENTAL INFORMATION

NOISE ANALYSIS

OEHI CO2 EOR PROJECT

Noise Scenario: Equipment Operating in CO2 EOR Processing Facility
Receptor: R1 (Tupman)

Construction Noise Source (Point Source)	Assumed Equipment Use Factor	Maximum Sound Pressure @50 feet (dBA)	Distance to Receptor (Feet)	Point Source Noise Level Attenuation with Distance (dBA)	Ground Attenuation with Distance (dBA)	Total Noise Level Attenuation (dBA)
Compressors (8)	1.00	61	7920	38.0	4.8	33.2
Pumps (5)	1.00	61	7920	29.0	4.8	24.2

Construction Noise Source (Point Source)	Attenuated Noise Level Rounded to Nearest Whole Decibel	Noise Level Below Loudest	Additive Noise Level
Compressors (8)	33.2	0.0	3.0
Pumps (5)	24.2	0.0	0.5

Total Attenuated Operation Noise LEQ (dBA) at Receptor During Scenario = 33.7
Estimated LEQ (dBA) at Receptor with Addition of Operation Noise = 62.2
Estimated LEQ (dBA) at Receptor with Addition of OEHI and HECA Operation Noise (Cumulative) = 62.2

Assumed Daytime Ambient Noise Level: 62.2
Assumed Nighttime Ambient Noise Level: 50.0
Est Ldn at Receptor with Plant Operation R1: 61.2 Ambient Ldn: 61.0

Estimated Ldn conservatively estimates 15 hours of equipment operation during daytime & evening (6 am - 9 pm), 0 hours during nighttime.
Ground attenuation estimates assume soft sites, average transmission path of 2 meters above the ground
Data Source: EPA (1971), Noise From Construction Equipment and Operations

SUPPLEMENTAL ENVIRONMENTAL INFORMATION
NOISE ANALYSIS
OEHI CO2 EOR PROJECT

Noise Scenario: Piping Installation

Receptor: R2 (North of Dustin Acres), R3 & R4 (Dustin Acres), R7 (Valley Acres)

Construction Noise Source (Point Source)	Assumed Equipment Use Factor	Maximum Sound Pressure @50 feet (dBA)	Distance to Receptor (Feet)	Point Source Noise Level Attenuation with Distance (dBA)	Ground Attenuation with Distance (dBA)	Total Noise Level Attenuation (dBA)
Crane	0.20	83	5280	38.3	4.8	33.5
Backhoe	0.73	85	5280	43.7	4.8	38.9
Backhoe	0.73	85	5280	43.7	4.8	38.9
Welding Machine	0.73	81	5280	39.7	4.8	34.9
Welding Machine	0.73	81	5280	39.7	4.8	34.9
Supply Truck	0.73	82	5280	40.7	4.8	35.9

Construction Noise Source (Point Source)	Attenuated Noise Level Rounded to Nearest Whole Decibel	Noise Level Below Loudest	Additive Noise Level
Crane	33.5	3.7	
Backhoe	38.9	0.0	3
Backhoe	38.9	0.0	3
Welding Machine	34.9	4.0	
Welding Machine	34.9	4.0	
Supply Truck	35.9	3.0	1.83

Total Attenuated Construction Noise LEQ (dBA) at Receptors During Scenario = 43.7

Estimated LEQ (dBA) at Receptor with Addition of Construction Noise (R2) = 73.2

Estimated LEQ (dBA) at Receptor with Addition of Construction Noise (R3) = 71.9

Estimated LEQ (dBA) at Receptor with Addition of Construction Noise (R4) = 66.8

Estimated LEQ (dBA) at Receptor with Addition of Construction Noise (R7) = 76.0

Assumed Daytime Ambient Noise Level R2: 73.2

Assumed Daytime Ambient Noise Level R3: 71.9

Assumed Daytime Ambient Noise Level R4: 66.8

Assumed Daytime Ambient Noise Level R7: 76.0

Assumed Nighttime Ambient Noise Level: 50.0

Est Ldn at Receptor with Construction R2: 72.0 Ambient Ldn: 72.0

Est Ldn at Receptor with Construction R3: 70.7 Ambient Ldn: 70.7

Est Ldn at Receptor with Construction R4: 65.6 Ambient Ldn: 65.6

Est Ldn at Receptor with Construction R7: 74.8 Ambient Ldn: 74.8

Estimated Ldn conservatively estimates 15 hours of equipment operation during daytime & evening (6 am - 9 pm), 0 hours during nighttime.

Ground attenuation estimates assume soft sites, average transmission path of 2 meters above the ground

Data Source: EPA (1971), Noise From Construction Equipment and Operations

SUPPLEMENTAL ENVIRONMENTAL INFORMATION

NOISE ANALYSIS

OEHI CO2 EOR PROJECT

Noise Scenario: Piping Installation

Receptor: R5 and R6 (Valley Acres)

Construction Noise Source (Point Source)	Assumed Equipment Use Factor	Maximum Sound Pressure @50 feet (dBA)	Distance to Receptor (Feet)	Point Source Noise Level Attenuation with Distance (dBA)	Ground Attenuation with Distance (dBA)	Total Noise Level Attenuation (dBA)
Crane	0.20	83	6336	36.7	4.8	32.0
Backhoe	0.73	85	6336	42.1	4.8	37.3
Backhoe	0.73	85	6336	42.1	4.8	37.3
Welding Machine	0.73	81	6336	38.1	4.8	33.3
Welding Machine	0.73	81	6336	38.1	4.8	33.3
Supply Truck	0.73	82	6336	39.1	4.8	34.3

Construction Noise Source (Point Source)	Attenuated Noise Level Rounded to Nearest Whole Decibel	Noise Level Below Loudest	Additive Noise Level
Crane	32.0	3.7	
Backhoe	37.3	0.0	3
Backhoe	37.3	0.0	3
Welding Machine	33.3	4.0	
Welding Machine	33.3	4.0	
Supply Truck	34.3	3.0	1.83

Total Attenuated Construction Noise LEQ (dBA) at Receptors During Scenario = 42.2

Estimated LEQ (dBA) at Receptor with Addition of Construction Noise (R5) = 63.8

Estimated LEQ (dBA) at Receptor with Addition of Construction Noise (R6) = 61.3

Assumed Daytime Ambient Noise Level R5: 63.8

Assumed Daytime Ambient Noise Level R6: 61.2

Assumed Nighttime Ambient Noise Level: 50.0

Est Ldn at Receptor with Construction R5: 62.6 Ambient Ldn: 62.6

Est Ldn at Receptor with Construction R6: 60.1 Ambient Ldn: 60.0

Estimated Ldn conservatively estimates 15 hours of equipment operation during daytime & evening (6 am - 9 pm), 0 hours during nighttime.

Ground attenuation estimates assume soft sites, average transmission path of 2 meters above the ground

Data Source: EPA (1971), Noise From Construction Equipment and Operations

Appendix A-2

OEHI Modified CO₂ Supply



Modified CO2 Supply Line Alignment Data Gap Analysis

An analysis of potential changes in environmental consequences from a modified CO2 Supply Line alignment from the HECA Facility to the OEHI CO2 EOR Processing Facility

APRIL 2012

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Figures

Figure 1 – Project Location Map (URS Figure 2-7)

Figure 2A – CO2 Supply Line Alignment (aerial)

Figure 2B – CO2 Supply Line Alignment (topographic)

Attachments

A – Biological Resources Study for Modified Alignment of CO2 Supply Line

B – Cultural and Paleontological Resources Study for Modified Alignment of CO2 Supply Line

C – An Analysis of Noise Impacts for Modified Alignment of CO2 Supply Line

D – Hazards Assessment for Modified Alignment of CO2 Supply Line

1.0 INTRODUCTION

This Data Gap Analysis evaluates potential changes in environmental consequences that could result from a modification of the CO2 supply line alignment from what was considered in Hydrogen Energy California's (HECA's) 2009 Application for Certification (AFC) filing with the California Energy Commission (CEC).

The CO2 supply line alignments evaluated within HECA's CEC AFC filing are shown in Figure 1. Further evaluation of the previously proposed CO2 supply line alignment since HECA's 2009 CEC AFC filing has resulted in a modification of the preferred alignment (Figure 2). As a result of this modification, Stantec has reviewed the evaluation of environmental consequences that were considered in HECA's 2009 CEC AFC filing to determine the need for further environmental analysis based on the alignment modification. The Data Gap Analysis identifies the issue areas that would remain insubstantially different as a result of the alignment modification as well as the issue areas that warrant further environmental analysis to close potential data gaps. The Data Gap Analysis provides the rationale of why the environmental consequences for some issue areas would remain unchanged and also presents supplemental information to close identified data gaps.

1.1 ISSUE AREAS WHERE NO FURTHER ANALYSIS IS WARRANTED

The evaluation of environmental consequences contained in HECA's 2009 CEC AFC filing determined that no further analysis based on the modification of the CO2 supply line alignment was warranted for the following issue areas:

- Air Quality;
- Land Use;
- Public Health;
- Worker Safety and Health;
- Socioeconomics Environmental Justice;
- Soils;
- Traffic and Transportation;
- Visual Resources;

- Waste Management;
- Water Resources; and,
- Geological Hazards and Resources.

Section 2.0 of this Data Gap Analysis provides a summary of why potential environmental consequences for the above issue areas as analyzed in HECA's 2009 CEC AFC filing remain substantially unchanged as result in the modification of the CO2 supply line alignment.

1.2 ISSUE AREAS WHERE FURTHER ANALYSIS IS WARRANTED

The evaluation of environmental consequences contained in HECA's 2009 CEC AFC filing determined that further analysis based on the modification of the CO2 supply line alignment was warranted for the following issue areas:

- Biological Resources;
- Cultural Resources;
- Noise;
- Hazardous Materials Handling; and
- Paleontological Resources.

Section 2.0 of this Data Gap Analysis provides a summary of why potential environmental consequences for the above issue areas as analyzed in HECA's 2009 CEC AFC filing could substantially be changed as result in the modification of the CO2 supply line alignment. Section 2.0 provides a summary of the approach that was taken to close the data gaps identified.

1.3 DISTURBANCE ESTIMATES

The CO2 supply line alignment evaluated within HECA's CEC AFC filing shown in Figure 1 is approximately 4 miles in linear length and includes one use of horizontal directional drilling techniques (HDD). HECA's calculated disturbance estimates were 25 acres of temporary disturbance and 0.11 acres of permanent disturbance.

The modified CO2 supply line alignment shown in Figure 2 is 3.36 miles in linear length and includes two HDDs. One HDD will be approximately 500 feet in length under the levee and the second HDD will be approximately 2,000 feet in length under the West Side Canal and California Aqueduct. The remainder of the CO2 supply line will be installed using conventional trenching techniques. Calculated disturbance estimates are 28.89 acres of temporary disturbance (which includes two entry and two exit excavations), and 0.11 acres of permanent

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disturbance. The temporary disturbance estimates are based on a 80 foot wide construction disturbance along 15,240.8 feet of pipe anticipated to be installed utilizing conventional trenching methods as well as two HDD entry excavations (120 feet x 100 feet each) and two HDD exit excavations (75 feet x 100 feet each). Temporary disturbances as a result of pipe string fabrication and layout are assumed to occur on lands already disturbed by trenching activities. Permanent disturbances resulting from installing two valve boxes (50 feet x 50 feet each) remain unchanged from HECA's previous disturbance estimates.

1.4 SUMMARY OF DATA GAP ANALYSIS

The following table identifies the issue areas evaluated in HECA's 2009 CEC AFC filing, where no data gaps exist based on the alignment modification, where data gaps do exist that warrant further analysis, and how the identified data gaps will be closed.

HECA 2009 CEC AFC Filing CO2 Supply Line Alignment		Modified CO2 Supply Line Alignment	
Issue Area Evaluated	Section #	Data Gap Present?	Action to Close Data Gap
Air Quality	5.1	No	No Gap - Not applicable
Biological Resources	5.2	Yes	New Biological Survey and Biological Resources Technical Report for Modified Alignment
Cultural Resources	5.3	Yes	New Records Search, Cultural Resources Survey and Cultural Resources Technical Report for Modified Alignment
Land Use	5.4	No	No Gap - Not applicable
Noise	5.5	Yes	Prepare Construction Noise Evaluation for Modified Alignment
Public Health	5.6	No	No Gap - Not applicable
Worker Safety and Health	5.7	No	No Gap - Not applicable
Socioeconomics Environmental Justice	5.8	No	No Gap - Not applicable
Soils	5.9	No	No Gap - Not applicable
Traffic and Transportation	5.10	No	No Gap - Not applicable
Visual Resources	5.11	No	No Gap - Not applicable
Hazardous Materials Handling	5.12	Yes	Prepare Worst-Case Pipeline Release Hazard Assessment
Waste Management	5.13	No	No Gap - Not applicable
Water Resources	5.14	No	No Gap - Not applicable
Geological Hazards and Resources	5.15	No	No Gap - Not applicable
Paleontological Resources	5.16	Yes	Prepare Paleontological Resources Study

2.0 ISSUE SPECIFIC DATA GAP ANALYSIS

The following section provides a brief analysis of potential changes in environmental consequences as a result of the modification to the CO2 supply line alignment. A summary is provided for each of the sixteen issue areas evaluated by HECA in the 2009 CEC AFC filing.

2.1 AIR QUALITY

The modified CO2 supply line alignment at 3.36 miles in length is approximately 0.6 miles shorter than the original 4 mile alignment evaluated by HECA. The installation methodology remains unchanged as a result of the alignment modification. As such, the estimated installation emissions will be comparative to what was previously considered. It is also likely that the installation emissions will incrementally be reduced as a result of the decrease in total line length and corresponding construction schedule. In addition, operational emissions from the pipeline which would be limited to both routine and potentially non-routine pipeline maintenance activities would remain substantially unchanged. As a result, potential air quality impacts resulting from the alignment modification would remain comparatively the same as considered in the 2009 CEC AFC filing and no further analysis is warranted.

2.2 BIOLOGICAL RESOURCES

The environmental consequences to biological resources evaluated by HECA from installation and operation of the CO2 supply line were based on the habitat type and potential presence of sensitive flora and fauna that could be present along the pipeline alignment. Modification of the pipeline alignment would disturb areas that have not been previously considered. As a result, a substantial biological resources data gap has been identified based on the modification to the pipeline alignment. Therefore a supplemental biological survey has been performed and a technical biological resources report completed to evaluate the modification of the CO2 supply line alignment (Attachment A).

2.3 CULTURAL RESOURCES

The environmental consequences to cultural resources evaluated by HECA from installation and operation of the CO2 supply line were based on a records search, cultural resources survey, and technical cultural resources report that were alignment specific. Modification of the pipeline alignment would disturb areas that have not been previously considered. As a result, a substantial cultural resources data gap has been identified based on the modification to the pipeline alignment. Therefore, a supplemental cultural resources survey has been performed and a technical cultural resources report completed to evaluate the modification of the CO2 supply line alignment (Attachment B). It should be noted that the cultural resources survey and technical report also collectively consider paleontological resources (see Section 2.16 below).

2.4 LAND USE

The pipeline alignment evaluated by HECA was located in areas with land use designations Extensive Agriculture and Mineral and Petroleum zoned from Extensive Agriculture and Limited Agriculture. Although the modification to the pipeline alignment will result in temporary disturbances to different parcels, the lands have the same land use and zoning designations. The modified CO2 supply line alignment would not require a change in or conflict with existing land uses. As such, environmental consequences to land use would remain substantially unchanged from what was considered in HECA's 2009 CEC AFC filing. Therefore, no additional analysis based on the alignment modification is warranted.

2.5 NOISE

Potential noise impacts from installation of the CO2 supply line in HECA's 2009 CEC AFC filing focused on the distance away from sensitive receptors. HECA specifically evaluated construction noise impacts from construction of the main HECA Facility. As the main HECA Facility was located closer to sensitive receptors than the CO2 supply line and potential noise impacts from construction were determined to not be significant, construction impacts resulting from pipeline installation were also determined not to be significant. However, the modification of the CO2 supply line alignment results in the pipeline being located closer to the community of Tupman (a sensitive receptor) than what was previously considered. As a result of the decrease in distance to a sensitive receptor, a substantial noise data gap has been identified based on the modification to the pipeline alignment. Therefore, a supplemental construction noise evaluation has been prepared to re-evaluate potential noise impacts from the alignment modification (Attachment C).

2.6 PUBLIC HEALTH

Installation of the CO2 supply line will result in emissions of toxic air contaminants/hazardous air pollutants in the form of diesel particulate matter emissions from the operation of diesel-fueled internal combustion engines. Because equipment used during the installation process will primarily be mobile in nature and will only be operated during the short-term construction period, pollutant concentrations of diesel particulate matter are not expected to result in public health impacts. Although the alignment modification places construction activities closer to the community of Tupman, construction activities will be in excess of 1.25 miles from Tupman. Considering the above, construction-related emissions of hazardous air pollutants are not expected to expose sensitive receptors to substantial pollutant concentrations in excess of what was considered in HECA's 2009 CEC AFC filing and no further analysis is warranted. Public health consequences related to a pipeline release are further discussed in Section 2.12.

2.7 WORKER SAFETY AND HEALTH

The modified CO2 supply line alignment will not add additional worker safety and health issues nor does it include any component with the potential to significantly or otherwise contribute to a worker safety and health impact beyond what was considered in HECA's 2009 CEC AFC filing. Therefore, no additional analysis is warranted.

2.8 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

The modified CO2 supply line alignment does not change the demographic data for the vicinity, nor does it include any component with the potential to magnify or otherwise contribute to an environmental justice impact. There would be no change to socioeconomic environmental justice beyond those considered and evaluated in HECA's 2009 CEC AFC filing. Therefore, no additional analysis is warranted.

2.9 SOILS

The modified CO2 supply line alignment is located in an area with the same soil types present as the previously evaluated pipeline alignment. The installation methodologies are also the same as previously evaluated. As such, the alignment modification does not present the potential for new or magnified environmental consequences related to soils than what was considered and evaluated in HECA's 2009 CEC AFC filing. Therefore, no additional analysis is warranted.

2.10 TRAFFIC AND TRANSPORTATION

The modified CO2 supply line alignment will result in the same route use, traffic patterns and equivalent traffic volumes considered and evaluated for the previously analyzed pipeline alignment. As such, the alignment modification does not present the potential for new or magnified environmental consequences related to traffic and transportation than what was considered and evaluated in HECA's 2009 CEC AFC filing. Therefore, no additional analysis is warranted.

2.11 VISUAL RESOURCES

The modified CO2 supply line alignment will place conventional construction equipment closer to the community of Tupman than what was considered for the previously evaluated pipeline alignment. However, construction activities will be limited to a short-term duration and will still be located in excess of 1.25 miles from the community of Tupman. Due to the limited duration of construction activities and distance to sensitive receptors, no substantial consequence to visual resources beyond what was considered and evaluated in HECA's 2009 CEC AFC filing is anticipated. Therefore, no additional analysis is warranted.

2.12 HAZARDOUS MATERIALS HANDLING

Installation for the CO₂ supply line will require the use of hazardous materials in the form of fuels and lubricants used in support of construction equipment operation. As the installation methodology remains unchanged as a result of the alignment modification, the use, handling practices, and volumes anticipated also remain unchanged from what was previously considered. HECA evaluated the potential consequences of a worst-case CO₂ release scenario from pipeline operation as part of the 2009 CEC AFC filing. This scenario and the resulting dispersion of CO₂ were based on a worst-case volume release that was dependent on pipeline length, block valve locations, and distance to receptors. As a result of these changes, a substantial hazards data gap has been identified based on the modification to the pipeline alignment. Therefore, a supplemental pipeline operation hazards assessment has been prepared to re-evaluate the potential consequences of a worst-case pipeline release scenario (Attachment D).

2.13 WASTE MANAGEMENT

The modified CO₂ supply line alignment would not generate additional waste or change handling practices beyond what was considered in HECA's 2009 CEC AFC filing. Therefore, no additional analysis is warranted.

2.14 WATER RESOURCES

The supply line alignment considered and evaluated by HECA in the 2009 CEC AFC filing crossed the West Side Canal, California Aqueduct, and some unnamed ephemeral channels. Crossings of the West Side Canal and California Aqueduct were proposed to be accomplished using HDD. Specifically the pipeline would be installed approximately 50 feet underneath the waterways and would have entry and exit offsets of approximately 550 feet from the water edge. Although the pipeline alignment has been modified, the new alignment will still cross the West Side Canal, California Aqueduct, and some unnamed ephemeral channels. The only difference is the location of the crossings. However, potential environmental consequences to water resources that were considered and evaluated within HECA's 2009 CEC AFC filing, remain substantially unchanged. Therefore, no additional analysis is warranted.

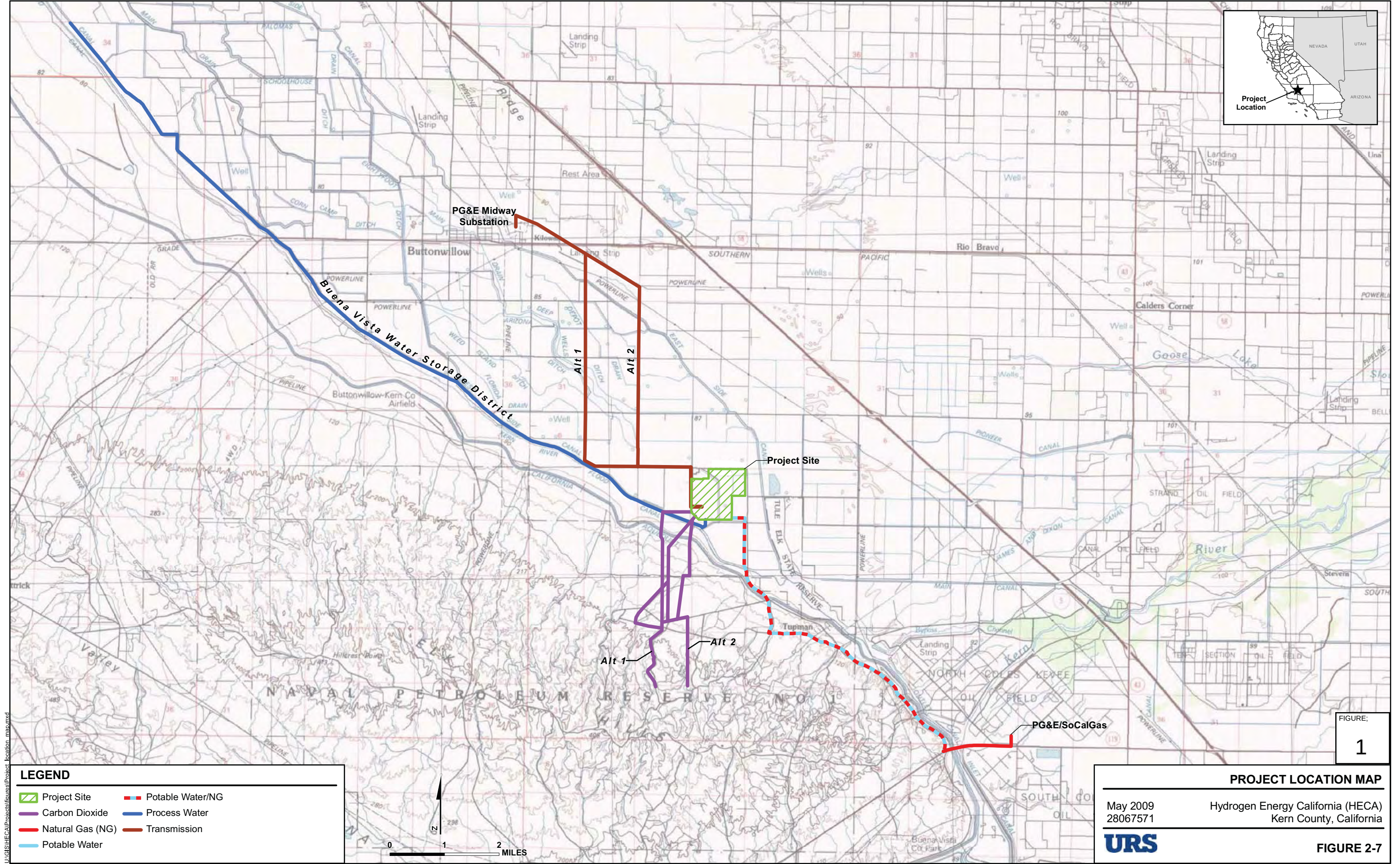
2.15 GEOLOGICAL HAZARDS AND RESOURCES

The geologic hazards present and considered for the pipeline alignment evaluated in HECA's 2009 CEC AFC filing are the same hazards present for the modified pipeline alignment. The alignment modification does not introduce the presence of additional geologic hazards that were not previously evaluated or considered. As a result, the potential environmental consequences for the alignment modification are the same as previously evaluated and no further analysis is warranted.

2.16 PALEONTOLOGICAL RESOURCES

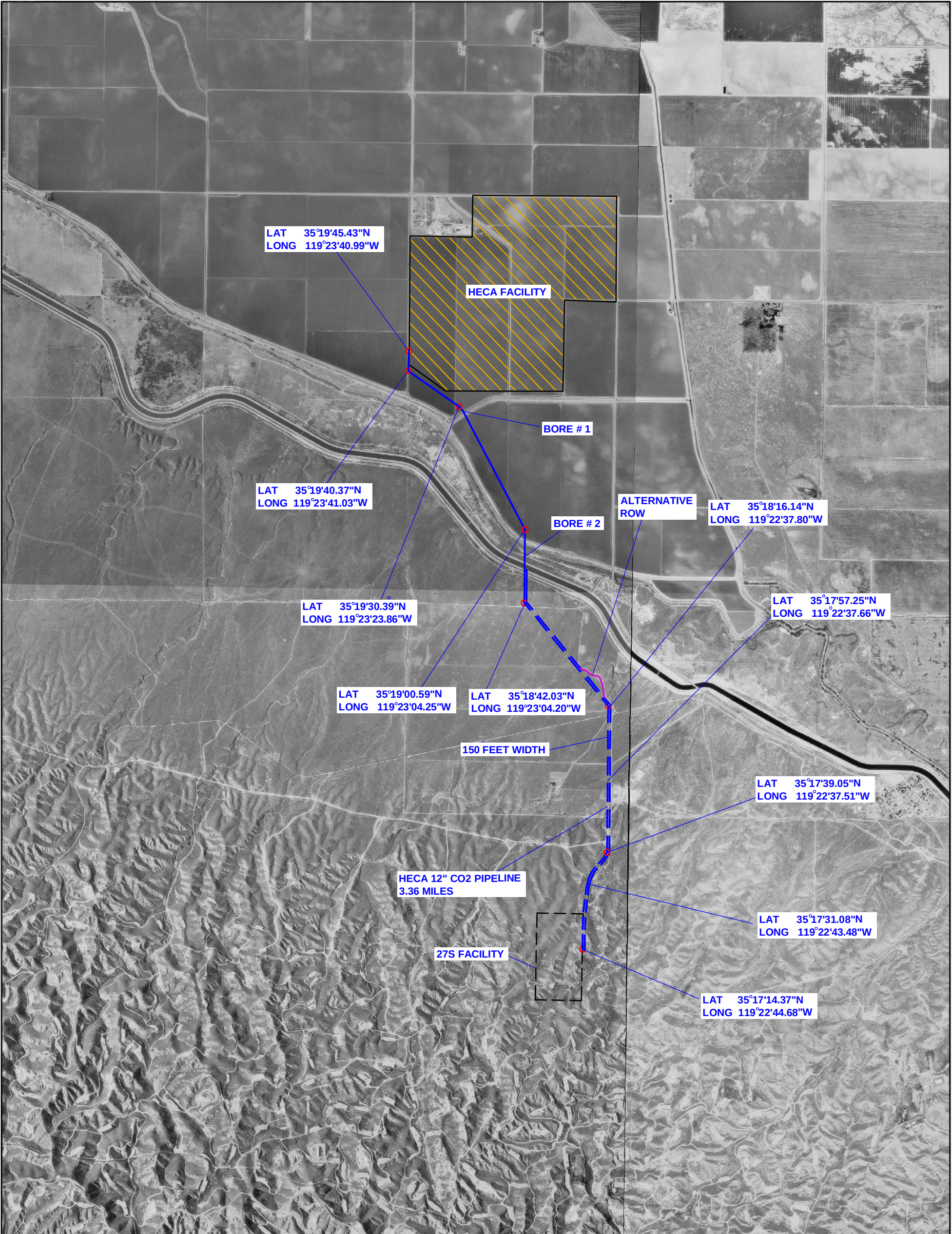
The environmental consequences to paleontological resources evaluated by HECA from installation and operation of the CO₂ supply line were based on a records search and a paleontological resources study that were alignment specific. Modification of the pipeline alignment would disturb areas that have not been previously considered. As a result, a substantial paleontological resources data gap has been identified based on the modification to the pipeline alignment. Therefore a supplemental paleontological resources study has been completed to evaluate the modification of the CO₂ supply line alignment (Attachment B).

FIGURES



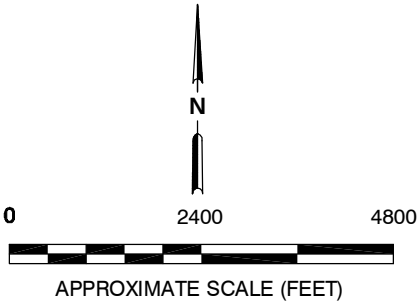
\\GIS\HECA\Projects\GIS\Project Location Map.mxd

Sources: USGS (30"x60" quads: Taft 1982, Delano 1982). Created using TOPOI, ©2006 National Geographic Maps, All Rights Reserved. Kern County and State of California (proposed and approved projects).



NOTES:

1. MAP COORDINATES SYSTEM; NAD 83
CALIFORNIA STATE PLANES, ZONE 5 (FT.)
2. USGS 7.5 MINUTE TOPOGRAPHIC MAPS;
EAST ELKS HILLS QUADRANGLE 1954,
PHOTOREVISED 1973, TUPMAN
QUADRANGLE 1954, PHOTOREVISED 1973.
3. TOPOGRAPHIC CONTOUR INTERVALS;
EAST ELKS HILLS= 20 FEET;
TUPMAN 20 FEET.



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290 Conejo Ridge Avenue.
Thousand Oaks, CA 91361
(805) 230-1266/230-1277 (Fax)

FOR:

CO2 EOR PROJECT
TUPMAN, KERN
COUNTY, CALIFORNIA

JOB NUMBER:
211302586

DRAWN BY:
J.Barboza

CHECKED BY:
J. May

APPROVED BY:
M.Weber

FIGURE:

2A

DATE:
2/22/11