

APPENDIX C

Greenhouse Gas Emissions Analysis



OXY USA Inc.
Dominguez Oil Field
Production Facility
Greenhouse Gas and Climate Change
Technical Report

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Contents

	Page
Glossary	v
1 Introduction	1
2 Project Description	2
3 Existing Conditions	3
3.1 Greenhouse Gas Pollutants	3
3.2 Baseline Emissions from Existing Operations	5
4 Regulatory Context	7
4.1 Federal	7
4.1.1 April 2007 Supreme Court Ruling	7
4.1.2 Corporate Average Fuel Efficiency Standards	7
4.1.3 Energy Independence and Security Act of 2007	8
4.1.4 Reporting Requirements	8
4.1.5 Clean Air Act Permitting for Greenhouse Gases	9
4.1.6 Clean Air Act – Section 111 - New Source Performance Standards (NSPS)	9
4.1.7 Oil and Gas sector NSPS and NESHAPS	10
4.2 Regional Agreements	10
4.2.1 Western Regional Climate Action Initiative (WCI)	10
4.3 California Legislation	10
4.3.1 Executive Order S-3-05 (Statewide GHG Targets)	11
4.3.2 Assembly Bill 32 (Statewide GHG Reductions)	11
4.3.2.1 AB 32 Cap and Trade Requirements	11
4.3.2.2 AB 32 – Other Measures Affecting Oil & Gas	12
4.3.2.3 AB 32 GHG Reporting Requirements	12
4.3.3 Low Carbon Fuel Standard	12
4.3.4 Senate Bill 1368 (GHG Emissions Standard for Baseload Generation)	13
4.3.5 Senate Bills 1078, 107 and 2 (Renewables Portfolio Standard)	13
4.3.6 Senate Bill 375 (Land Use Planning)	13
4.3.7 Energy Conservation Standards	13
4.3.8 Senate Bill 97 (CEQA Guidelines)	14
4.4 Local Air Quality Management District (SCAQMD) Interim GHG Threshold	15
4.5 City of Carson Policies	15
5 Impact Assessment	17
5.1 Thresholds of Significance	17
5.2 Methodology	17
5.3 Construction Activity Emissions	17
5.4 Operational Emissions	19
5.5 Life Cycle Analysis	21
5.5.1 Life Cycle Emissions Impact Methodology	21
5.5.2 Energy Consumption and Demand	23
5.5.3 Crude Recovery And Transport	24

Appendix C

OXY USA Inc. – Dominguez Oil Field Production Facility
Greenhouse Gas and Climate Change Technical Report

5.5.4	Life Cycle Emission Impact Results	24
5.5.5	Project Life Cycle Emissions – Additional Considerations	27
5.6	Climate Change Effects	28
5.7	Impacts Summary	28
6	Project Design Features	30
7	References	31

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List of Tables

Table 1.	Baseline (Existing Oxy Operations and Warehouse) GHG Emissions	5
Table 2:	Annual GHG Emissions Related to Project Construction	18
Table 3.	Oxy Project Operation Direct and Indirect GHG Emissions	20
Table 4:	Crude Oil Feedstock Mix into California Refineries	23
Table 5.	Calculated GHG Intensities – Base Case and Project Case (g/MJ)	25
Table 6:	Net Change in Emissions from Project – CA Waterflood Oil in Lieu of Imported Oil to Refineries	26
Table 7.	Summary of GHG Emission Impacts from Project	29

List of Appendices

Appendix A:	Construction Emission Estimates
Appendix B:	Baseline and Project Emission Estimates
Appendix C:	GHG Life Cycle Model Information Tables
Appendix D:	Evaluation of California Crude Oil Demand and Life Cycle Implications

Acronyms and Abbreviations

BPD	barrels oil per day
CARB	California Air Resources Board
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
CF ₄	tetra fluoromethane
CFC	Chlorofluorocarbons
CFR	Code of Federal Regulations
CH ₄	Methane
CNRA	California Natural Resources Agency
CO ₂	Carbon Dioxide
CO ₂ e	Carbon Dioxide Equivalent
GHG	Greenhouse Gas
GWP	Global Warming Potential
HFC	Hydrofluorocarbons
IPCC	Intergovernmental Panel on Climate Change
LCFS	Low Carbon Fuel Standard
msl	Mean Sea Level
MT	Metric Tonnes
N ₂ O	Nitrous Oxide
NGL	Natural Gas Liquid
NGO	Non-Governmental Organization
NHTSA	National Highway Traffic Safety Administration
NRDC	Natural Resources Defense Council
NSPS	New Source Performance Standard
PFC	Perfluorocarbon
ppb	parts per billion
Project	Dominguez Oil Field Development Project
PSD	Prevention of Significant Deterioration
RFS	The Renewable Fuel Standard
Site	The Project site

Acronyms and Abbreviations

SB	Senate Bill
SBCCOG	South Bay Cities Council of Governments
SCAG	Southern California Association of Governments
SCAQMD	South Coast Air Quality Management District
SCE	Southern California Edison
SCS	Sustainable Communities Strategy
SF ₆	Sulfur Hexafluoride
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

Glossary

Carbon Intensity:

A measure of the direct and indirect GHG emissions associated with each of the steps in the full fuel cycle of a transportation fuel (also referred to as the “well-to-wheels” for fossil fuels, or “seed or field-to-wheels” for biofuels). Depending on the circumstances, GHG emissions from each step can include carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and other GHG contributors. Moreover, the overall GHG contribution from each step is a function of the energy that the step requires. Thus, carbon intensity is typically expressed in terms of grams of CO₂ per mega-Joule (grams CO₂/MJ).

Recovery Efficiency:

The fraction of oil in place that can be economically recovered with a given process.

Direct Energy:

The amount of energy required during the crude recovery stage.

gCO₂/MJ:

Grams of CO₂ released per one megajoule of energy.

gCO₂/mmBtu:

Grams of CO₂ released per one million Btus of energy.

Crude Recovery:

Accounts for crude oil extraction, production, separation up to the point where crude is ready to transport to the refinery.

TEOR (Thermal Enhanced Oil Recovery):

A technique used for extraction of heavy oil using heat to make less viscous oil, thinning it enough that it will flow in to wells and increase the amount of petroleum that may be recovered from a well.

Water Flood:

The secondary oil recovery method in which water is injected back into the reservoir usually to increase pressure and thereby stimulate production.

Gas Injection Enhanced Production:

A secondary oil recovery method that involves injecting natural gas, nitrogen or CO₂ into the reservoir. The gases can either expand and push through the reservoir, or mix with or dissolve within the oil, decreasing viscosity and increasing flow.

Primary Oil Recovery:

The process of pumping out the oil that flows naturally to the bottom of the oil well due to gravity and pressure of the reservoir.

Appendix C

OXY USA Inc. – Dominguez Oil Field Production Facility
Greenhouse Gas and Climate Change Technical Report

Energy Consumption and Demand:

Energy used and needed during the crude recovery stage. Crude oil is produced using different technologies, each of which requires different amounts of energy.

1 Introduction

This report presents the results of ENVIRON International Corporation's (ENVIRON) greenhouse gas (GHG) assessment of the Dominguez Oil Field Development Project (Project). The Project would involve drilling wells and producing oil and gas from the Project Site. The Project Applicant is OXY USA Inc. The Project site (Site) is owned by the Carson Dominguez Properties, LP. Equipment installed at the Site would include vessels and tanks for storing and processing the oil and gas.

The Project will use directional drilling to extract oil and natural gas resources from the subsurface and distribute them via pipeline and tanker truck for off-site treatment and refining. The Project site was chosen to consolidate drilling and production operations at a previously developed industrial site located near existing pipelines, thereby limiting the need to construct additional internal and offsite pipelines and related infrastructure, and to develop local oil reserves to minimize emissions of criteria pollutants and GHGs associated with the transportation of foreign crude oil to local refineries. All crude produced by the Project is expected to be refined at Southern California refineries and that none of the produced crude oil is expected to be exported.

Compliance with the California Environmental Quality Act (CEQA) is required because the Project requires discretionary approval from the City of Carson for a Development Agreement. Therefore, this Draft GHG Technical Study Report provides the basis for preparation of CEQA documentation with the City of Carson as the lead agency under CEQA. This report evaluates the GHG emissions and climate change issues associated with the Project. Activities from construction and operation would affect emissions of GHG in the immediate Project area and the surrounding region. This report includes a description of the affected environment including a discussion of the state of climate change science and the regulatory setting, predicted impacts of the proposed Project and mitigation measures to address the impacts.

2 Project Description

Key attributes of the Project related to the GHG evaluation are summarized here. The full Project description is included in the Draft Environmental Impact Report.

The Project will be located in the northern portion of the City of Carson within Los Angeles County. The Site occupies approximately 6.5 acres and will be located entirely within the Dominguez Technology Centre. The Site currently contains an industrial building located at 1450-1480 Charles Willard Street which is used as a warehouse, and an oil and gas test well facility. The Site is bounded on the north by Charles Willard Street, on the east by Bishop Avenue, on the west by a commercial/light industrial building, and on the south by a vegetated swale that acts as a conveyance for storm water. The existing industrial building will be demolished. The proposed Project will be designed and constructed to incorporate the existing oil and gas test well facility and to be visually compatible with the existing industrial buildings at the Dominguez Technology Centre. The Project plans to begin construction in January 2013 and begin operations in January 2014.

OXY USA Inc. proposes to construct a production facility consisting of wells, an oil and gas processing facility, water treatment, slurry treatment and possible injection operations, water injection operations, an electrical substation, and shipment and pipeline facilities to produce and transport approximately 6,000 barrels oil per day (BPD) of oil and 3 million standard cubic feet of natural gas. Directional drilling techniques will be used to pinpoint oil reservoirs at depths of 4,000 to 13,500 feet. In general, the Project will consist of the following elements: 1) wells surrounded by well cellars; 2) office/control buildings; 3) oil and natural gas processing equipment (e.g. tanks, process heater, vapor recovery system); 4) facades along the streets; 5) ground flares for combusting vent gases; 6) oil and natural gas pipeline interconnections and 7) a Southern California Edison (SCE) electrical substation.

Production operations will require drilling approximately 200 directional wells to access new and previously developed crude oil reservoirs and to develop those resources. Even though approximately 200 wells will be required to fully develop the Dominguez Field, modern drilling technology allows all of the wells to be drilled from one site. This technology is standard drilling practice in an urban setting and minimizes the impact of the oil and gas production operations on the surface and the environment.

Various offsite improvements are also expected. Crude oil and natural gas will be transported to off-site facilities by new pipelines (each approximately 2,000 feet in length) that will connect to the existing crude oil and natural gas pipeline networks in the area of the Project. The connections are expected to be with the Crimson Dominguez oil pipeline and the Southern California Gas Company gas pipeline located at the intersection of Charles Willard Street and South Central Avenue. The new pipelines and connections to utilities (e.g., potable water, electricity, non-industrial wastewater) are expected to be constructed in public right-of-ways.

The Operations are anticipated to have 4 to 8 permanent employees and additional contractors as required at the Project site. A total of 15 workers per day are estimated to be on-site. The facility is expected to operate 24-hours a day, 7-days a week.

3 Existing Conditions

Air pollutants include both GHGs and criteria pollutants. GHGs differ from criteria pollutants in that GHG emissions do not cause direct adverse human health effects. Rather, the direct environmental effect of GHG emissions is a result of their accumulation throughout the atmosphere (lower and upper) which results in an increase in global temperatures and storm intensity, and changing precipitation patterns. These climatic changes in turn have numerous indirect effects on the natural environment and humans.

3.1 Greenhouse Gas Pollutants

Gases that trap heat in the atmosphere are often called GHGs. The term GHGs includes gases that contribute to the natural greenhouse effect, such as carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O), as well as gases that are only human-made and that are emitted through the use of modern industrial processes, such as hydrofluorocarbons (HFCs), chlorinated fluorocarbons (CFCs), and sulfur hexafluoride (SF₆). These last three families of gases, while not naturally present in the atmosphere, have properties that also cause them to trap infrared radiation when they are present in the atmosphere. Together, these six gases comprise the major GHGs that are recognized by the Kyoto Accords.¹ A seventh GHG, nitrogen trifluoride, has been recognized by the State of California to contribute to global climate change. There are other GHGs that are not recognized by the Kyoto Accords or the State of California, due either to the smaller role that they play in climate change or the uncertainties surrounding their effects. Atmospheric water vapor is not recognized by the governments because there is not an obvious correlation between water vapor concentrations and specific human activities. Water vapor appears to act in a positive feedback manner; higher temperatures lead to higher water concentrations, which in turn cause more global warming.

The effect each of these gases has on global warming is a combination of the volume of their emissions and their global warming potential (GWP). GWP indicates, on a pound for pound basis, how much a gas will contribute to global warming relative to how much warming would be caused by the same mass of CO₂. It is a unitless quantity. CH₄ and N₂O are substantially more potent than CO₂, with GWPs (100-year horizon) of 21 and 310, respectively². However, these natural GHGs are nowhere near as potent as SF₆ and various HFCs and CFCs. SF₆ has a 100 year GWP of 23,900 and CFCs and HFCs have GWPs ranging from 140 to 11,700. In emissions inventories, GHG emissions are typically reported in terms of pounds (lbs) or tonnes³ of CO₂ equivalents (CO₂e), which are calculated as the product of the mass emitted of a given GHG and its specific GWP.

¹ This Kyoto Protocol sets legally binding targets and timetables for cutting the greenhouse-gas emissions of industrialized countries. The US has not approved the Kyoto treaty.

² GWP values from IPCC's Second Assessment Report (SAR, 1996) are still used by international convention and are used in this protocol (CCAR, 2009), even though more recent (and slightly different) GWP values were developed in the IPCC's Third Assessment Report (TAR, 2001). The values cited here and most commonly used refer to the gases' global warming potential averaged over 100 years' time in the atmosphere.

³ In this report, "tonnes" will be used to refer to MT (1,000 kilograms). "Tons" will be used to refer to short tons (2,000 pounds).

Appendix C

OXY USA Inc. – Dominguez Oil Field Production Facility
Greenhouse Gas and Climate Change Technical Report

The most important GHG in human-induced global warming is CO₂. While many gases have much higher GWPs than the naturally occurring GHGs, CO₂ is emitted in such vastly higher quantities that it accounts for 85 percent of the GWP of all GHGs emitted by the United States. Fossil fuel combustion, especially for the generation of electricity and powering of motor vehicles, has led to increases in CO₂ emissions and thus increases in atmospheric CO₂ concentrations. In 2005, atmospheric CO₂ concentrations were about 379 parts per million (ppm), over 35 percent higher than the pre-industrial (defined as the year 1750) estimated concentrations of about 280 ppm. CO₂ is a major factor in human-induced global warming because of its lifespan in the atmosphere of 50 to 200 years.

Concentrations of the second most prominent GHG, CH₄, have also increased due to human activities such as rice production, degradation of waste in landfills, cattle farming, and natural gas mining. In 2005, atmospheric levels of CH₄ were more than double pre-industrial levels, up to 1774 parts per billion (ppb) as compared to an estimated 715 ppb. CH₄ has a relatively short atmospheric lifespan of only 12 years, but has a higher GWP than CO₂.

N₂O concentrations have increased from about 270 ppb in pre-industrial times to about 319 ppb by 2005. Most of this increase can be attributed to agricultural practices (such as soil and manure management), as well as fossil-fuel combustion and the production of some acids. N₂O's 120-year atmospheric lifespan means that, in addition to its relatively large GWP, its influence is long-lasting, which increases its role in global warming.

CFCs, used often as refrigerants, and their more stratospheric-ozone-friendly replacements, hydrofluorocarbons (HFCs), and fully fluorinated species, such as SF₆ and tetra fluoromethane (CF₄), are present in the atmosphere in relatively small concentrations, but have extremely long life spans of 50,000 and 3,200 years each, making them potent GHGs.

GHGs differ from criteria pollutants in that GHG emissions do not cause direct adverse human health effects. Rather, the direct environmental effect of GHG emissions is the potential to increase global temperatures, which in turn has numerous indirect effects on the environment and humans. For example, some observed changes include shrinking glaciers, thawing permafrost, later freezing and earlier break-up of ice on rivers and lakes, a lengthened growing season, shifts in plant and animal ranges, and earlier flowering of trees (IPCC, 2001). Other, longer term environmental impacts of global warming include sea level rise, changing weather patterns with increases in the severity of storms and droughts, changes to local and regional ecosystems including the potential loss of species, and a significant reduction in winter snow pack (for example, estimates include a 30-90% reduction in snowpack in the Sierra Mountains). Current data suggests that in the next 25 years, in every season of the year, California would experience much warmer annual temperatures, greater intensity and frequency of heat waves, and longer dry periods. More specifically, the California Climate Action Team (2009) biennial assessment on climate change impacts and adaptation options for California predicted that California could witness the following events:

- Temperature rises between 2.7-10.5F by 2085;
- 11-18 inches of sea level rise by 2050 and 23 to 55 inches of rise by 2100;

Appendix C

OXY USA Inc. – Dominguez Oil Field Production Facility
Greenhouse Gas and Climate Change Technical Report

A majority of the forecasts indicate drier (by 5 percent or more) than historical average precipitation. In Southern California the amount of drying is greater, with precipitation decreases in some scenarios exceeding 15% drier;

For agriculture, in 2050 cotton, maize, sunflower, and wheat yields decrease from 3 percent to 8 percent, while rice and tomato yields are essentially the same. By the end of the century yields of all crops except alfalfa decrease;

Fire risk substantially increases and estimated burned area increases of 57 percent to 169 percent by 2085.

3.2 Baseline Emissions from Existing Operations

Current oil and gas site operations include two production test wells and production testing equipment. The drilling of the two test wells began November 2010 and was completed in May 2011. The production testing began in August 2011 and is ongoing. A process flare, an emergency flare, a backup generator, and several tanks are used during testing operations.

Current operations at the test site occur 24 hours a day, 7 days a week, with two 12-hr shifts. Up to 5 car/delivery trucks may visit the site daily. There are currently no sewer or water connections for the test site. Wastes (e.g., cuttings and produced water) are contained on-site until they can be removed via truck for disposal. Currently, there may be as many as 16 trucks a day removing the oil and produced water.

The following Table 1 summarizes baseline emissions from these existing operations. This annual emission estimate represents the period from November 2010 to November 2011. Refer to Appendix B for detailed calculations for each of these source categories.

Table 1: Baseline (Existing Oxy Operations and Warehouse) GHG Emissions				
Baseline Emission Source	Annual Emissions (MT/yr)¹			
	CO₂	CH₄	N₂O	CO₂e
Stationary Sources and Energy Use in Buildings				
Warehouse ²	3,150	21.70	0.31	3,701
Drilling Rig Generators	2,974	0.12	0.02	2,984
Well Workover	7	0.00	0.00	7
Process flare	12,638	0.21	0.02	12,650
Emergency flare		6.62	0.66	761
Electrical generator	635	0.03	0.01	637
Mobile Sources³				
Workers & Contractors	500	0.03	0.00	501

Appendix C

OXY USA Inc. – Dominguez Oil Field Production Facility
Greenhouse Gas and Climate Change Technical Report

Table 1: Baseline (Existing Oxy Operations and Warehouse) GHG Emissions				
Baseline Emission Source	Annual Emissions (MT/yr)¹			
	CO₂	CH₄	N₂O	CO₂e
Drilling Slurry Trucks	453	0.02	0.00	454
Trucks (oil and gas)	29	0.00	0.00	30
Workover Rig	0	0.00	0.00	< 1
Total Baseline Emissions	20,805	28.71	1.03	21,726
Notes: 1. Annual emissions estimated by CalEEMod are based on 365 day/yr activity. Since some of the activities (e.g. well drilling) occurs less than a year, emissions have to be adjusted based on the actual annual schedule and added to be accounted for the total annual emission. 2. Warehouse operational emissions modeled by CalEEMod, including emissions from energy, water use, and waste. 3. Includes workers and contractor commute trips and delivery trucks related to warehouse operation, drilling, and well production activities.				

4 Regulatory Context

The Project was evaluated against existing federal, state, and local regulations and standards. Climate change has only recently been widely recognized as a threat to the global climate, economy, and population. As a result, the climate change regulatory setting – federal, state, and local – is complex and evolving. This section identifies key legislation, executive orders, and seminal court cases related to climate change germane to the proposed Project.

4.1 Federal

4.1.1 April 2007 Supreme Court Ruling

In *Massachusetts et al. vs. Environmental Protection Agency et al.* (April 2, 2007) the US Supreme Court ruled that GHGs were air pollutants within the meaning of the Clean Air Act and that the Act authorizes the USEPA to regulate CO₂ emissions from new motor vehicles, should those emissions endanger the public health or welfare. The Court did not mandate that the USEPA enact regulations to reduce GHG emissions, but found that the only instances where the USEPA could avoid taking action were if it found that GHGs do not contribute to climate change or if it offered a “reasonable explanation” for not determining that GHGs contribute to climate change. On December 7, 2009, the USEPA Administrator signed two distinct findings regarding GHGs under section 202(a) of the Clean Air Act (USEPA, 2009).

1. Endangerment Finding: The USEPA Administrator finds that the current and projected concentrations of the six key well-mixed GHGs--CO₂, CH₄, N₂O, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and SF₆--in the atmosphere threaten the public health and welfare of current and future generations.
2. Cause or Contribute Finding: The USEPA Administrator finds that the combined emissions of these well-mixed GHGs from new motor vehicles and new motor vehicle engines contribute to the GHG pollution which threatens public health and welfare.

The finding itself does not impose any requirements on industry or other entities. However, this action was a prerequisite to finalizing the EPA’s proposed GHG emissions standards for light-duty vehicles.

4.1.2 Corporate Average Fuel Efficiency Standards

On May 19, 2009, President Obama announced a national policy for fuel efficiency and emissions standards in the US auto industry. The policy was implemented through a joint rulemaking between the Department of Transportation and USEPA. The new federal standards apply to passenger cars, light-duty trucks, and medium duty passenger vehicles built in model years 2012 through 2016. The agencies issued Final Rulemaking establishing standards for 2012 through 2016 model year vehicles on April 1, 2010. The final regulations require an average fuel economy standard of 35.5 miles per gallon and an average GHG emission level of 250 g/mile in 2016. This average standard includes light duty automobiles, SUV’s and light duty pickup trucks. These agencies are now in the process of developing a rulemaking to set even higher standards for model years 2017-2025. On November 16, 2011, the agencies proposed new regulations calling for an average fuel economy standard of 54.5 miles per gallon and an average GHG emission level of 163 g/mile in 2025. On August 9, 2011, EPA and National

Highway Traffic Safety Administration (NHTSA) finalized regulations to reduce GHG emissions and improve fuel efficiency of medium- and heavy-duty vehicles, including large pickup trucks and vans, semi-trucks, and all types and sizes of work trucks and buses. The regulations incorporate all on-road vehicles rated at a gross vehicle weight at or above 8,500 pounds, and the engines that power them. These vehicles make up the transportation segment's second largest contributor to oil consumption and GHG emissions. Under the regulations, fuel economy will be improved and GHG emissions will be reduced in model years 2014-2018.

4.1.3 Energy Independence and Security Act of 2007

The Energy Independence and Security Act of 2007 was signed into law on December 19, 2007 and includes provisions covering:

- Renewable Fuel Standard (RFS) (Section 202);
- Appliance and Lighting Efficiency Standards (Section 301–325); and
- Building Energy Efficiency (Sections 411–441).

Additional provisions of the Energy Independence and Security Act address energy savings in government and public institutions, promoting research for alternative energy, additional research in carbon capture, international energy programs, and the creation of “green jobs.”

The RFS regulations require annual increases in biofuels sold – both biodiesel and bioethanol - from the years 2010-2022. By year 2022, the RFS will require at least 74 billion gallons of biofuel to be sold in the US, as compared to a current (2010) level of approximately 14.5 billion gallons.

4.1.4 Reporting Requirements

Congress passed “The Consolidated Appropriations Act of 2008” (HR 2764) in December 2007, which requires reporting of GHG data and other relevant information from large emission sources and suppliers in the United States. The Rule is referred to as 40 Code of Federal Regulations (CFR) Part 98 - GHG Reporting Program (GHGRP). The stated purpose of the rule is to collect accurate and timely GHG data to inform future policy decisions. Facilities that emit 25,000 metric tonnes (MT) or more per year of GHGs are required to submit annual reports to EPA. The emissions counted towards the threshold are direct emissions from on-site sources. Suppliers of certain products that result in GHG emissions if released, and facilities that inject CO₂ underground for geologic sequestration, are also covered.

The Project would be subject to GHGRP reporting requirements if its emissions exceed the 25,000 MT threshold, but the Project is not projected to exceed these levels of GHG emissions.

EPA extended the deadline for reporting initial year (2010) GHG data to September 30, 2011. Second year (2011) emissions data were due on April 2, 2012, except for a number of industry sectors that were recently added to the reporting requirements, including upstream oil & gas facilities – Petroleum and Natural Gas Systems – which are covered in Subpart W of the Rule. For these facilities, calendar year 2011 reports are due September 28, 2012.

4.1.5 Clean Air Act Permitting for Greenhouse Gases

GHG emissions from the largest stationary sources are covered by the Prevention of Significant Deterioration (PSD) and Title V Operating Permit Programs. The PSD program applies to new major sources and major modifications to existing major sources. The Title V program requires major sources to obtain and operate in compliance with a facility-wide operating permit. However, the thresholds established in the Act for determining when emissions of pollutants make a source “major”, i.e. subject to these permitting programs (100 and 250 tons per year), were based on traditional pollutants and were not originally intended to be applied to GHGs.

To address this issue, EPA's GHG Tailoring Rule, issued in May 2010, established a phased approach to incorporating GHG emissions into these programs. Under the rule, GHG permitting will focus initially on the largest industrial sources. Effective July 1, 2011, PSD permitting requirements cover projects that emit GHG emissions of at least 100,000 tons/year even if they do not exceed the PSD permitting thresholds for any other pollutant. Modifications at existing facilities that increase GHG emissions by at least 75,000 tons/year are subject to PSD permitting requirements, even if they do not significantly increase emissions of any other pollutant. Facilities that emit at least 100,000 tons/year CO₂e are also subject to Title V permitting requirements. While phasing in the Tailoring Rule, EPA has stated that it will also make an assessment of administrative issues and examine GHG permitting for smaller sources in a 5-year study expected to be completed by April 2015; results are expected by April 2016 to determine if successful streamlining will allow further phase-in or exclude smaller sources from permit requirements.

EPA is working with State and Local permitting authorities to ensure that the new requirements are implemented.

The Project is not projected to exceed the thresholds set forth above, so Clean Air Act permitting for GHGs will not be applicable.

4.1.6 Clean Air Act – Section 111 - New Source Performance Standards

New source performance standards (NSPS) have been established since the 1970s for various industrial sources of air pollution. Each NSPS must be reviewed at least every eight years and if appropriate, revised.

In August 2008, Natural Resources Defense Council (NRDC) and others petitioned EPA to reconsider a June 2008 final decision not to set CO₂ and CH₄ NSPS for refineries. The petitioners also brought an action in the U.S. Court of Appeals for the D.C. Circuit challenging several aspects of the final rule including the failure to address GHGs. In December 2009, EPA agreed to reconsider that decision, including the decision to not regulate GHGs. Several State and NGO petitioners also requested (June 2008, August 2009) reconsideration of similar determinations regarding utility boilers. On December 23, 2010, EPA entered into two proposed settlement agreements to issue rules that will address GHG emissions from fossil fuel-fired power plants and refineries. These two industrial sectors make up nearly 40 percent of the nation's GHG emissions.

Under terms of the settlement, the utility boiler NSPS for GHGs was to be developed (draft) by July 2011, final by May 2012. EPA issued the draft NSPS on March 27, 2012. The proposed requirements, which are strictly limited to new sources, would require new fossil fuel-fired electricity generation sources greater than 25 megawatt output to meet an standard of 1,000 pounds of CO₂ per megawatt-hour (lb CO₂/MWh), based on the performance of natural gas combined cycle (NGCC) technology. Comments on the proposed rule were accepted through June 12, 2012.

The refinery NSPS draft was due by December 2011 and was to be finalized by November 2012. A future refinery NSPS for GHGs would be relevant to the Project in that the refineries receiving the oil produced from the Project would be subject to new GHG requirements.

4.1.7 Oil and Gas sector NSPS and NESHAPS

On July 28, 2011, the U.S. EPA proposed a suite of regulations intended to reduce emissions from the oil and natural gas industry. These regulations were finalized and approved on April 17, 2012 and include NSPS provisions covering hydraulically fractured and refractured natural gas wells (Subpart OOOO), as well as NESHAPS regulations covering small glycol dehydrators at oil and gas facilities (Subpart HH) and natural gas transmission facilities (Subpart HHH). EPA intends to cut volatile organic compound (VOC) emissions by nearly one-fourth across the oil and gas industry, including a nearly 95 percent reduction in VOCs emitted from new and modified hydraulically fractured gas wells. EPA estimates that implementation of these amendments will result in annual reductions of 540,000 tons of VOCs, and 3.4 million tons of CH₄, which is equal to 65 million MT of CO₂e, a reduction of about 26 percent.

4.2 Regional Agreements

4.2.1 Western Regional Climate Action Initiative (WCI)

The Western Regional Climate Action Initiative was a partnership among seven states, including California, and four Canadian provinces interested in implementing a regional, economy-wide cap-and-trade system to reduce global warming pollution. The Western Regional Climate Action Initiative's intent was to cap the region's electricity, industrial, and transportation sectors with the goal of reducing the heat-trapping emissions that cause global warming 15 percent below 2005 levels by 2020. However, by late 2011 all of the states had withdrawn from the WCI leaving California and four Canadian provinces. California is working with the remaining provinces to design a regional GHG reduction program that includes a cap-and-trade approach. CARB has developed a cap-and-trade program that could eventually link California and other states and provinces.

4.3 California Legislation

California has enacted a variety of legislation that relates to climate change, much of which sets aggressive goals for GHG reductions within the state. The discussion below provides a brief overview of the CARB and Office of Planning and Research documents and of the primary legislation that relates to climate change which may affect the GHG emissions associated with the proposed Project.

4.3.1 Executive Order S-3-05 (Statewide GHG Targets)

California Executive Order S-03-05 (June 1, 2005) mandates a reduction of GHG emissions to 2000 levels by 2010, to 1990 levels by 2020, and to 80 percent below 1990 levels by 2050.

Although the 2020 target has been incorporated into legislation (AB 32), the 2050 target remains the goal of the Executive Order.

4.3.2 Assembly Bill 32 (Statewide GHG Reductions)

The California Global Warming Solutions Act of 2006, widely known as AB 32, requires CARB to develop and enforce regulations for the reporting and verification of statewide GHG emissions. CARB is directed to set a GHG emission limit, based on 1990 levels, to be achieved by 2020. The bill set a timeline for adopting a scoping plan for achieving GHG reductions in a technologically and economically feasible manner.

The heart of the bill is the requirement that statewide GHG emissions must be reduced to 1990 levels by 2020. California needs to reduce GHG emissions by approximately 16 percent below business-as-usual predictions of year 2020 GHG emissions to achieve this goal.⁴ The bill requires CARB to adopt rules and regulations in an open public process to achieve the maximum technologically feasible and cost-effective GHG reductions.

On December 11, 2008, CARB adopted the AB32 Scoping Plan, which sets forth the framework for facilitating the state's goal of reducing GHG emissions to 1990 levels by 2020. Following is a discussion of applicable requirements that were set forth in the plan and that may be applicable to the Project.

4.3.2.1 AB 32 Cap and Trade Requirements

On October 20, 2011, CARB adopted the final cap-and-trade regulation. As part of finalizing the regulation, CARB considered the related environmental analysis (i.e. functional equivalent document) and written responses to environmental comments. CARB also approved an adaptive management plan which will monitor progress of reductions and recommend corrective actions if progress is not as planned or there are unintended consequences in other environmental areas – e.g. concentration of local criteria pollutants. Oil and gas production facilities are potentially subject to declining emission caps under the AB 32 cap and trade requirements. The cap and trade program covers stationary sources that emit over 25,000 MT of CO₂e of direct operational emissions. The Project is not projected to exceed this level of direct operational emissions so the Project would not be subject to these requirements. Should actual emissions rise above this threshold in the future, the cap and trade requirements of AB 32 would become applicable. The approved Scoping Plan notes that combustion-related emissions from oil and gas production operations are proposed to be covered by the cap and trade program, but fugitive emissions are not proposed to be covered. CARB also noted that they would evaluate the future inclusion of fugitive CH₄ emissions into a cap and trade program

⁴ This estimate is based on CARB's revised business-as-usual predictions for 2020.

if adequate quantification methods are determined to exist. Electrical generation facilities are subject to cap and trade.

4.3.2.2 AB 32 – Other Measures Affecting Oil & Gas

The AB 32 Scoping Plan also contains a control measure (Measure I-2: Oil and Gas Extraction GHG Emissions Reduction) for oil and gas facilities to further reduce their CH₄ emissions from equipment leaks and vents. To date, CARB specified in December 2010 that enhanced measurements be undertaken by existing oil and gas facilities in advance of a potential requirement to further reduce CH₄ emissions from operations. Two draft protocols were released covering the measurement of fugitive and vented gas emissions, and flash gas emissions. If finalized, these measurement protocols would apply to the Project facility.

4.3.2.3 AB 32 GHG Reporting Requirements

AB 32 also specified mandatory reporting of GHG emissions from certain facilities in California. CARB's mandatory GHG reporting regulation, which appears at Sections 95100-95133 of Title 17, California Code of Regulations (CCR), is a set of rules that establishes who must report GHG emissions to CARB and sets forth the requirements for measuring, calculating, reporting and verifying those emissions. Industrial facilities are generally required to report their GHG emissions to the State annually, if they exceed 25,000 MT of direct emissions from operations. The Project is not expected to exceed this level of direct operational emissions, so the Project would not be subject to these requirements.

4.3.3 Low Carbon Fuel Standard

Executive Order S-01-07 (January 18, 2007) requires a 10 percent or greater reduction in the average fuel carbon intensity for transportation fuels in California regulated by CARB. CARB identified the Low Carbon Fuel Standard (LCFS) as a Discrete Early Action item under AB 32, and the final regulation was adopted on April 23, 2009. The regulation went into effect on April 15, 2010, and requires a reduction in the carbon intensity of transportation fuels used in California by at least 10 percent by 2020.

The LCFS baseline of GHG emissions from transportation fuels was based on 2006 assumptions about life cycle carbon intensity values for gasoline and diesel fuel in the State as presented in CARB's LCFS rule justification package (Initial Statement of Reasons) from March 2009. The life cycle emissions for gasoline and diesel fuel were determined based on the mix of crude oil feedstocks sent to the refineries in California from oil produced in California, Alaska, and other foreign import sources. The Project will incrementally increase California oil production and will potentially displace other higher carbon intensity imported crude oils at local refineries.

The impacts section estimates the potential for a reduction in the carbon intensity of California fuels, and the corresponding emission reductions from this Project, against the average carbon intensity of fuels used in the LCFS regulations.

4.3.4 Senate Bill 1368 (GHG Emissions Standard for Baseload Generation)

Senate Bill (SB 1368 prohibits any retail seller of electricity in California from entering into a long-term financial commitment for baseload generation if the GHG emissions are higher than those from a combined-cycle natural gas power plant. This performance standard applies to electricity generated out-of-state as well as in-state, and to publicly-owned as well as investor-owned electric utilities. This requirement, along with renewable energy generation requirements, will substantially reduce utility sector GHG emissions by 2020.

4.3.5 Senate Bills 1078, 107 and 2 (Renewables Portfolio Standard)

Established in 2002 under SB 1078 and accelerated in 2006 under SB 107, and again in 2011, California's Renewables Portfolio Standard (RPS) requires retail suppliers of electric services to increase procurement from eligible renewable energy until they reach 33 percent by December 31, 2020.

4.3.6 Senate Bill 375 (Land Use Planning)

SB 375 provides for a new planning process to coordinate land use planning and regional transportation plans and funding priorities in order to help California meet the GHG reduction goals established in AB 32. SB 375 requires regional transportation plans, developed by Metropolitan Planning Organizations relevant to the proposed Project area (including the Southern California Association of Governments (SCAG)), to incorporate a "sustainable communities strategy" (SCS) in their regional transportation plans that will achieve GHG emission reduction targets set by CARB. SB 375 also includes provisions for streamlined CEQA review for some infill projects such as transit oriented development. SB 375 will be implemented over the next several years.

SB 375 is similar to the Regional Blueprint Planning Program, established by the California Department of Transportation, which provides discretionary grants to fund regional transportation and land use plans voluntarily developed by Metropolitan Planning Organizations working in cooperation with Council of Governments. The scoping plan adopted by CARB in December of 2008 relies on the requirements of SB 375 to implement the carbon emissions reductions anticipated from land use decisions. SCAG adopted their 2012-2035 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) and certified the Programmatic EIR supporting the RTP/SCS on April 4, 2012 (SCAG, 2012).

4.3.7 Energy Conservation Standards

Energy Conservation Standards for new residential and commercial buildings were originally adopted by the California Energy Resources Conservation and Development Commission in June 1977 and most recently revised in 2008 (Title 24, Part 6 of the CCR). In general, Title 24 requires the design of building shells and building components to conserve energy. The standards are updated periodically to allow for consideration and possible incorporation of new energy efficiency technologies and methods. On July 17, 2008, the California Building Standards Commission adopted the nation's first green building standards (CBSC, 2009). The California Green Building Standards Code (proposed Part 11, Title 24) was adopted as part of the California Building Standards Code (Title 24, CCR). Part 11 establishes voluntary standards on planning and design for sustainable site development, energy efficiency (in excess of the

California Energy Code requirements), water conservation, material conservation, and internal air contaminants. Some of these standards have become mandatory in the 2010 edition of the Part 11 Code.

4.3.8 Senate Bill 97 (CEQA Guidelines)

SB 97 required that the California Natural Resources Agency (CNRA) coordinate on the preparation of amendments to the CEQA Guidelines regarding feasible mitigation of GHG emissions or the effects of GHG emissions. Pursuant to SB 97, CNRA adopted CEQA Guidelines amendments on December 30, 2009, which became effective on March 18, 2010.

With respect to determining the significance of GHG emissions, newly added CEQA Guidelines section 15064.4, subdivision (b), indicates:

A lead agency should consider the following factors, among others, when assessing the significance of impacts from GHG emissions on the environment:

1. The extent to which the project may increase or reduce GHG emissions as compared to the existing environmental setting;
2. Whether the project emissions exceed a threshold of significance that the lead agency determines applies to the project;
3. The extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions. Such requirements must be adopted by the relevant public agency through a public review process and must reduce or mitigate the project's incremental contribution of GHG emissions. If there is substantial evidence that the possible effects of a particular project are still cumulatively considerable notwithstanding compliance with the adopted regulations or requirements, an EIR must be prepared for the project.

The amendments also provide that lead agencies should consider feasible means of mitigating the significant effects of GHG emissions including changes that would substantially reduce energy consumption or GHG emissions as described in Appendix F of the CEQA Guidelines. No threshold of significance or any specific mitigation measures are indicated.

Among other things, CNRA noted in its Public Notice for these changes that impacts of GHG emissions should be considered in the context of a cumulative impact, rather than a project impact. The Public Notice states:

“While the Proposed Amendments do not foreclose the possibility that a single project may result in GHG emissions with a direct impact on the environment, the evidence before [CNRA] indicates that in most cases, the impact will be cumulative. Therefore, the Proposed Amendments emphasize that the analysis of GHG emissions should center on whether a project's incremental contribution of GHG emissions is cumulatively considerable.”

4.4 Local Air Quality Management District Interim GHG Threshold

On December 5, 2008, the South Coast Air Quality Management District (SCAQMD) Governing Board adopted a staff proposal for an interim GHG significance threshold using a tiered approach for stationary source and industrial projects where the SCAQMD is lead agency (SCAQMD, 2008). The tiers are as follows:

Tier 1: Determine if CEQA categorical exemptions are applicable. If not move to Tier 2;

Tier 2: Consider whether or not the proposed project is consistent with an adopted GHG reduction plan (often called a Climate Action Plan) that has gone through public hearings and CEQA review, that has an approved inventory, includes monitoring, etc. If not move to Tier 3;

Tier 3: If a stationary source/industrial project's GHG emissions are less than or mitigated to less than 10,000 MT of CO₂e per year (MTCO₂eq/yr) the project is presumed to be less than significant for GHGs. If the project exceeds 10,000 MTCO₂eq/yr; move to Tier 5;

Tier 4: Was not adopted, remains under consideration;

Tier 5: A project is not significant for GHG if offsite mitigation reduces emissions to less than the Tier 3 screening level. If this threshold is used, offsets should have a 30-year project life, and should be Real, Quantifiable, Verifiable, and Surplus and be considered in the following prioritized manner:

- Project design feature/onsite reduction measures
- Offsite within neighborhood
- Offsite within district
- Offsite within state
- Offsite out of state

Substitution allowed via enforceable commitment (e.g. when an offset project ends prematurely).

If the proposed project cannot meet any of the Tiers, it is presumed to be significant for GHG emissions.

4.5 City of Carson Policies

The City of Carson has recently completed GHG inventories for municipal operations (October 2009) and for community wide emissions (March 2011). These inventories were prepared by the South Bay Cities Council of Governments (SBCCOG). SBCCOG is a joint powers authority of 16 local governments and the County. The SBCCOG, through its South Bay Environmental Services Center (SBESC), coordinates common environmental issues in the area, including energy efficiency, water conservation, and recycling. The SBESC has various alliances with the LA County Metropolitan Transportation Authority, West Basin Municipal Water District, Sanitation Districts of LA County, Southern California Edison, Los Angeles County

Appendix C

OXY USA Inc. – Dominguez Oil Field Production Facility
Greenhouse Gas and Climate Change Technical Report

Energy Program, The Gas Company of Southern California, and the Torrance Water Department. Through these alliances, the SBESC offers home energy-efficiency workshops, rebates and incentive programs to residents and businesses; assists cities in identifying and implementing energy and water savings projects; and promotes vanpooling and recycling programs.

The GHG inventories have noted the potential development of a Climate Action Plan to reduce emissions from municipal operations and from city wide activities. The issue of a Climate Action Plan has been (July 2011) discussed by the City's Environmental Commission but to date, no policies specific to GHG emissions reductions have been adopted.

5 Impact Assessment

5.1 Thresholds of Significance

As was noted in the previous regulatory section, on December 5, 2008, the SCAQMD Governing Board adopted a staff proposal for an interim GHG significance threshold using a tiered approach for projects where the SCAQMD is lead agency (SCAQMD, 2008). The interim guidance states that for the purposes of determining whether or not GHG emissions from affected projects are significant, project emissions will include direct, indirect, and, to the extent information is available, life cycle emissions during construction and operation. A stationary source/industrial project significance threshold of 10,000 MT (Tier 3) from direct and indirect emissions was adopted by the SCAQMD Board for the evaluation of projects that were not categorically exempt (Tier 1) or were not covered by an adopted GHG reduction plan (Tier 2). Section 5.7 further discusses project emissions as they relate to these significance tiers.

5.2 Methodology

GHG emissions of CO₂, CH₄, and N₂O were estimated for construction and operation of the proposed Project. In addition, the indirect emissions of GHG's from electricity consumption were estimated from electricity use for the proposed Project.

Emissions from construction equipment were developed using CalEEMod v2011.1. CalEEMod is a California statewide land use emissions computer model designed to provide a uniform platform for government agencies, land use planners, and environmental professionals to quantify potential criteria pollutant and GHG emissions associated with both construction and operational activities from a variety of land use projects. The construction emissions include off-road construction equipment (e.g. excavators, loaders, dozers, backhoes, cranes), on-road trucks (water trucks, dump trucks, delivery trucks, pickup trucks), and worker commute trips. A detailed discussion of the construction emissions and calculations is provided below and in Appendix A.

Emissions from operations were developed by various methodologies specific to the activity. The methodologies used followed local and State procedures where they were available. Where local and State methodologies were not available, Federal level methodologies were used. A detailed discussion of operational emissions and calculations is provided below and in Appendix B. An additional emission category included in the GHG section is the indirect emissions from electricity consumption, which were calculated specifically for the proposed Project. For the oil and gas production facility, expected electricity consumption demand at full operation is 11 MW. GHG emission factors were obtained from CalEEMod for electricity provided by SCE.

5.3 Construction Emissions

Construction for the Project consists of three major components – the production facility, the pipelines serving the Project, and the SCE interconnect and substation. The proposed construction schedule for the facility is estimated to occur over 12-18 months, starting in January of 2013. Pipeline installation is expected to occur in two to three week increments along the pipeline pathway between July and December of 2013. The schedule for the SCE

Appendix C

OXY USA Inc. – Dominguez Oil Field Production Facility
Greenhouse Gas and Climate Change Technical Report

interconnect and substation construction is uncertain, but it is expected to take three to four months to complete.

The primary GHG emissions sources during construction of the Project include on-site diesel-powered construction equipment and off-site vehicular activity from worker commuting and vendor truck delivery trips. Annual GHG emissions were derived for construction activities based on this information.

Facility construction is comprised of the following phases: (1) demolition of the existing building, (2) well cellar preparation, (3) construction at process equipment areas, and (4) tank erection. The emission estimates were calculated using CalEEMod v1.1, which in turn uses equipment emission rates from the OFFROAD model and vehicle emission rates from the EMFAC2007 model. The number of equipment and hours of usage were user-defined inputs as per information from the applicant, but other parameters such as horsepower and trip length used model defaults. Similar emission estimation methods were applied to pipeline and SCE substation construction activities.

Using the models to obtain daily emissions for each source, the annual mass emissions are determined by summing all activities over the number of days each piece of equipment or vehicle will be in operation during a particular year. Table 2 below summarizes the annual mass GHG emissions for Project construction activities; the detailed calculations are shown in Appendix A.

Table 2: Annual GHG Emissions Related to Project Construction				
Construction Activity ¹	Emissions (MT/year)			
	CO₂	CH₄	N₂O	CO₂e
Year 2013				
Facility	776	0.07	0.00	777
Pipeline	82	0.01	0.00	82
SCE Substation ²	90	0.01	0.00	90
Year 2014				
Facility	231	0.02	0.00	232
Total Construction Emissions	1,179	0.11	0.00	1,181
Notes: 1. Construction related GHG emissions include exhaust emissions from construction equipment and on-road vehicle. 2. SCE On-Site Construction shares equipment with the Oxy facility construction. The associated emissions are evaluated to estimate SCE emissions only and are not added to the total Oxy construction emissions. Emissions presented here refer to SCE off-site emissions only.				

5.4 Operational Emissions

As mentioned above, the methodologies used followed local and State guidance where they were available. The main pieces of combustion equipment - the flares and the process heater - used equations listed in 95125(a) (1) of the CARB Regulation for the Mandatory Reporting of GHG Emissions. Fugitive emissions were calculated using SCAQMD's "Guidelines for Fugitive Emissions Calculations," June 2003, for Oil and Gas Production - based on the <10,000 ppmv emission factor in Table IV-2c (Method 3). Where local and State methodologies were not available, Federal level methodologies were used.

From Table 3 below, direct GHG emissions from on-site stationary sources were estimated to be 17,743 MT/year. Virtually all of the GHG emissions are from two combustion devices – the process flare 12,650 MT/year, and the process heater 4,685 MT/year. This level of emissions is below Federal and State GHG reporting requirement levels as well as the applicability of AB 32's cap and trade provisions. Indirect emissions from electricity were calculated using GHG emission factors from the CalEEMod model for electricity provided by SCE. GHG emissions due to waste disposal are also modeled using CalEEMod based on location and land use. There is a small amount of potable water that will be used at the Project's office building for sanitary purposes, but is not considered here as the GHG emissions will be negligible.

On-road mobile emissions are comprised of worker and contractor commutes, hauling trucks for transporting drilling supplies and mud during the drilling phase and natural gas liquid (NGL) and off-site movements of workover rig trucks during the production phase. Their activity levels are quantified based on the transport needs during the drilling and production phases and the emissions are estimated using the CalEEMod model, as summarized in Table 3 below. Additional details for these operational emission calculations are included in Appendix B.

Assuming a demand at 11 MW of continuous electricity use and using current emission factors, GHG emissions from electricity consumption are 28,204 MT/year. As the electricity supply incorporates new sources of renewable power as part of AB 32 RPS requirements, this value will decrease significantly.

These emission calculations are from operational activities and do not take into account overall life cycle GHG implications and emissions. Life cycle emissions are discussed in the next section.

Appendix C

OXY USA Inc. – Dominguez Oil Field Production Facility
Greenhouse Gas and Climate Change Technical Report

Table 3: Oxy Project Operation Direct and Indirect GHG Emissions

Project Emission Source	Potential to Emit (MT/year)			
	CO ₂	CH ₄	N ₂ O	CO ₂ e ⁸
Stationary Source				
Emergency Flare	147	0.00	0.00	148
Carbon Adsorber Unit for Slurry System	0	0.00	0.00	<1
Process Heater Unit	4,681	0.08	0.01	4,685
Truck Loading Unit	0	0.00	0.00	<1
Emergency Generator Unit	15	0.00	0.00	15
Carbon Adsorber Unit for Sump Water	0	0.00	0.00	<1
Fugitives	0	0.51	0.00	11
Workover Rig	220	0.11	0.00	223
Process Flare	12,638	0.21	0.02	12,650
Backhoe	8	0.00	0.00	8
Mobile Sources				
Workers & Contractors ¹	87	0.00	0.00	87
Mud/Hauling Trucks ²	130	0.00	0.00	130
NGL Trucks ³	489	0.02	0.00	489
Solid Trucks ⁴	7	0.00	0.00	7
Workover Rig ⁵	2	0.00	0.00	2
Indirect Sources				
Electricity Consumption (total) ⁶	28,029	1.27	0.48	28,204
Waste Disposal ⁷	2	0.11	0.00	4
Total Operation Emissions	46,455	2.33	0.51	46,666

Notes:

1. Worker, contractor, and pickup trucks emissions during well drilling and production.
2. Haul truck emissions during the initial well drilling phase prior to the startup of the slurry plant.
3. Haul truck emissions to transfer NGL from the site to Bakersfield.
4. Haul truck emissions to transfer slurry to Buttonwillow, CA.
5. When needed, a workover rig will be brought to the Site.
6. 22 MW substation at 50% load providing electricity for the entire facility.
7. GHG emissions from water and solid waste are estimated using CalEEMod using default assumptions.
8. CO₂e emissions less than 1 MT/year is assumed as 1 MT/year. The values shown as zero are less than the significant digits shown.

5.5 Life Cycle Analysis

The analysis in this Section assesses the net impact in the GHG emissions by comparing the GHG emissions from refining and transporting the new California oil production from this Project with the GHG emissions from an equivalent amount of imported crude oils. In other words, the analysis compares GHG emissions with and without the Project.

This analysis considers the life cycle impacts of these two oil sources: the Project's oil vs. imported oils. To provide consistency with State regulations, the life cycle analysis represented here relies upon the same assumptions used by CARB in adopting the LCFS to calculate the carbon intensity of local (California), other domestic (Alaska North Slope), and foreign crude oils.

A Life Cycle Analysis (LCA) is a technique to assess the overall environmental impacts of a product, process, or service. It is a tool that assesses the environmental impacts throughout the life of a product including raw material extraction, material processing, production, assembly, use of the product, and final disposal after the product has finished its useful life. An LCA can be a valuable decision-support tool for both policy makers and product manufacturers in assessing the impact of a product or process and selecting a product/process that results in the least overall impact.

Life cycle emissions from a petroleum fuel have two primary components. The first component includes emissions associated with crude oil recovery (crude oil production and initial processing), transportation to refineries, refining, and delivering fuel to vehicles. This is often referred to as Well-To-Tank (WTT) emissions. The second component includes the combustion of the fuel in vehicles and is often referred to as Tank-To-Wheel (TTW) emissions. This analysis quantitatively considers the GHG emissions associated with a subset of the first component -- the crude oil recovery and transportation of the crude to the refinery. Subsequent life cycle emissions from transportation of the fuel to market and combustion in a vehicle are not considered in this analysis since they will not differ quantitatively for the Project oil and the import oil alternatives.

A qualitative discussion is also included regarding the potential benefits from refining of the Project oil, given its generally superior refining characteristics (lower sulfur content, higher API gravity) compared to imported oils. A quantitative analysis of these benefits was not possible, since the CARB LCFS regulations did not consider sulfur content and crude gravity differences at the refinery.

5.5.1 Life Cycle Emissions Impact Methodology

The Project will incrementally increase California oil production, which will in turn displace higher carbon intensity foreign and domestic crude oils from the local refineries. Increases in California production from projects, such as Dominguez Hills, have the effect of reducing imports, rather than replacing California production, according to several studies performed by the State of California and industry experts. Additional information on these studies and discussion on California crude oil demand and the displacement of foreign oil in California refineries can be found in Appendix D.

Appendix C

OXY USA Inc. – Dominguez Oil Field Production Facility
Greenhouse Gas and Climate Change Technical Report

The life cycle analysis presented here estimates the potential for a reduction in the carbon intensity of California fuels, and the corresponding emission reductions from this Project, against the average carbon intensity of fuels used in the LCFS regulations. As was noted earlier in the Regulatory Setting section, the LCFS determination of GHG emissions from transportation fuels in the State of California was based on 2006 assumptions about life cycle carbon intensity values for gasoline and diesel fuel. The life cycle emissions for gasoline and diesel fuel for 2006 were determined based on the mix of crude oil feedstocks sent to the refineries in California from oil produced in California, Alaska, and foreign import sources. The 2006 information was used since it is the base year for future compliance with the LCFS regulations. It was also the last complete determination of the different types of crudes (four California crude types, Alaska, and foreign imports) used for the LCFS regulation. More recent updates (2010 data) have been made by the State for the relative amounts of Alaskan and foreign imports. Since the quantity of imported Alaska crude has declined slightly from 2006 and foreign imports have increased, a sensitivity analysis was performed to determine if this has an impact on the life cycle emission calculations.

ENVIRON developed an excel-based model which calculates the carbon intensity for crude oil feedstocks used by the California refineries and allows the user to change the percentage of crude oil feedstock mix into California refineries and other inputs used in the analysis. ENVIRON's model is based on CARB's detailed CA-GREET pathway analyses for California Reformulated Gasoline Blendstock for Oxygenate Blending (CARBOB) from average crude refined in California (CARB, 2009), which provides average carbon intensity values from crude oil production and transportation to the refinery.⁵ Details of this model can be found in Appendix C. CARB staff provided ENVIRON with information and assumptions they used to develop the 2006 LCFS baseline GHG intensity from the crude oils used in California refineries, including the percentages of crude oil from California thermal production, California waterflood production, California primary production, California gas injection enhanced production, Alaska imported oil, and all other foreign oil. These percentages were adjusted for a Project case in which the Project oil is added to the California waterflood total, other California production volumes were held constant, and imports from Alaska and foreign sources were proportionally reduced by the same volume as was added from the Project. The basic assumption is that one or more California refineries would reduce their imports from Alaska and foreign sources while adding the oil produced by the Project into their feedstock mix to achieve the same end products. It is important to note here that all crude produced by the Project is expected to be refined at Southern California refineries and that none of the produced crude oil is expected to be exported. The following table summarizes the base LCFS case and the Project case volumes of crude sent to California refineries.

⁵ CARB is currently developing a model through a research project at Stanford University that will take a more detailed look at the marginal barrel of oil that is displaced from a California refinery from different domestic and imported crude oils. This model will also explore different forms of production and the carbon intensities associated with each. However, this model is not expected to be available until July 2012.

Appendix C

OXY USA Inc. – Dominguez Oil Field Production Facility
Greenhouse Gas and Climate Change Technical Report

Table 4: Crude Oil Feedstock Mix into California Refineries						
	CA TEOR	CA Water Flood	CA Gas Injection	CA Primary	Alaskan	Imported
Base - % Total CA Crude in 2006 (LCFS baseline)	14.88%	6.13%	1.31%	16.59%	16.10%	45.00%
Project case – increased waterflood production	14.88%	8.34%	1.31%	16.59%	15.52%	43.37%

The life cycle analysis evaluates the GHG intensity for the production of the crude oil (called crude recovery in the LCFS documentation), transportation of the crude to the refinery and the overall total change in GHG intensity from production and transportation for this Base and a Project case. To accomplish this, several tables of information from CARB's detailed CA - GREET pathway analyses for CARBOB from average crude refined in California (February 27, 2009) were used and modified to develop the life cycle GHG impact estimates. For the upstream production calculations, the model ENVIRON developed for this analysis used information from Tables 1.02, 1.07 1.10, 1.11, 1.12 and 1.13 of the CARBOB pathway analysis. For crude oil transportation emissions to the refinery, information provided in Tables 2.01, 2.04, 2.05, and 2.07 of the CARBOB pathway analysis were utilized. These tables are reprinted and presented in Appendix C to provide additional details on how the model was constructed.

5.5.2 Energy Consumption and Demand

Crude oil is produced using different technologies, each of which requires different amounts of energy. In turn, the energy used to produce the oil can come from different sources or fuels, each of which has its own carbon intensity. The life cycle model then calculates the associated energy consumption and demand. For both the Project and Base cases, the model determines the energy requirement (direct energy) for fuels used in the crude recovery (production) process by using equations provided in Tables 1.02 of the CARBOB LCFS analysis (see Table C-1 in the Appendix C). The proportions of different fuels used in crude recovery and recovery efficiency assumptions provided by CARB staff are summarized in Table C-2 of the Appendix for four different California produced oils, crude transported from Alaska as well as worldwide crude that is imported into California. Table C-3 in Appendix C then provides the detailed energy consumption calculations for all oil types. The four crude oil types produced in California include: California thermal production; California waterflood production; California primary production; and California gas injection enhanced production. The life cycle model estimated a weighted average energy requirement based on the information provided by CARB for these produced oils.

Two assumptions made in regard to the energy requirement estimates in the model for the natural gas flaring and electricity are of note. First, the average energy requirement of natural gas flaring is only provided in the CARBOB LCFS analysis as an average worldwide figure. This worldwide average figure was then conservatively disaggregated to the individual crude oil feedstocks on a simple percentage of that feedstock into California refineries. This is a

conservative assumption when considering California crudes and the lower amount of flaring associated with these oils versus foreign oils. Second, for the electricity component of the direct energy calculation, CARB did not provide a breakdown of the fuel types used to generate the electricity by geographic region other than California where CARB assumed that 95% of the power generation capacity is natural gas derived with the balance coal fired. ENVIRON made the conservative assumption that the same fuel mix that is used in California was used to generate electricity for foreign and Alaskan oils, although the electricity mix in most foreign countries is significantly more carbon intensive.

5.5.3 Crude Recovery And Transport

As explained in Section 5.5.2, the model calculates the energy demands to deliver each crude oil type to California refineries (e.g. marine vessel or pipeline) for the Base and the Project case using the same assumptions that were used in the development of the LCFS regulations. The model then estimates the CO₂ emissions based on the energy demands by fuel type and by geographic source on a g/mmBtu basis (Table C-5 of Appendix C and a g/MJ basis Table C-6 of Appendix C). Since certain details of energy combustion by geographic source used by CARB for their LCFS analysis were not available, the model accounted for this by calculating a fuel specific emission factor from the CARBOB LCFS documents (Table C-4 in the Appendix). These fuel specific factors were then multiplied by the direct energy values calculated in Table C-3 to obtain CO₂ emissions by fuel type and by source of crude oil to California refineries. Emissions from natural gas and coal-fired based electricity were estimated using equations and data provided in Tables C-7 and C-8 in Appendix C. Emissions of other GHGs (CH₄ and N₂O) were scaled proportionately to the model's calculated CO₂ emissions using the information provided in Tables C-9 and C-10 in Appendix C.

Following the above steps, the model calculated the crude recovery GHG intensity at 5.55 g CO₂e/MJ for the Base (no project) case, which is lower than the LCFS crude recovery value determined in the CARBOB pathway analysis (6.93 g CO₂e/MJ). This difference is due to the two conservative assumptions noted above used for the electricity and flaring emissions for foreign and Alaska oils, which understates emissions from foreign and Alaskan crudes.

For transportation emissions, the CARBOB pathway analysis provided a more complete set of details on the GHG intensity components for each crude oil type. However, due to lack of information on the bunker fuel emission factor from the CARBOB document and geographic source specific emission factors, ENVIRON has calculated transportation mode specific emission factors using information provided in tables C-15, C-16 and C-17 (Tables 2.01, 2.04, and 2.05 in the pathway analysis). The model estimated GHG intensity for each crude oil source (Alaska, domestic and foreign) is summarized in Table C-23 in Appendix C for both the Base and Project case. Tables C-19 through C-24 in Appendix C provides more details on the calculations performed here.

5.5.4 Life Cycle Emission Impact Results

The results of the life cycle analysis for the Base and Project case are shown in Table 5. The table shows the GHG intensity values by pollutant for each of the components of the life cycle analyzed (i.e., Crude Transport and Distribution and Crude Recovery). The results show that the Base case (no project) has a higher GHG intensity value for each component compared to the

Project case. Specifically, for the crude transport and distribution component, 1.13 versus 1.12 g CO₂e/MJ for the Base and Project cases was calculated and for the crude recovery component, 5.55 g CO₂e/MJ versus 5.53 g CO₂e/MJ was calculated.⁶ The results of the life cycle analysis indicate that the Project will displace more GHG intensive oils from the refineries, resulting in decreased GHG intensities.

Table 5: Calculated GHG Intensities – Base Case and Project Case (g/MJ)						
Pollutants (CO₂ equivalent)	Crude Oil Transportation to Refinery		Crude Oil Recovery		Total	
	Base Case	Project Case	Base Case	Project Case	Base Case	Project Case
CO ₂	1.07	1.06	4.31	4.29	5.38	5.36
CH ₄	0.04	0.04	1.70	1.70	1.74	1.74
N ₂ O	0.01	0.01	0.02	0.02	0.03	0.03
CO	0.00	0.00	0.02	0.02	0.02	0.02
VOC	0.00	0.00	0.01	0.01	0.01	0.01
Electricity Co-Product Credit	-	-	-0.51	-0.51	-0.51	-0.51
Total GHG Emissions	1.13	1.12	5.55	5.53	6.67	6.65

As shown in Table 6, the displacement of more GHG intensive oils from the refineries will result in decreased emissions of 38,087 MT per year of GHG emissions. This estimate is based on the life cycle analysis results shown in Table 5 and the assumptions that the Project will generate 6,000 BPD of oil and that an average barrel of oil contains 6,100 MJ of energy.⁷ 15,262 MT of this reduction would come from decreased transportation distances and emissions, the remainder 22,825 MT would come from reduced emissions from production. The following table provides a summary of the emissions changes calculated by the model.

⁶ Slight differences in the GHG intensity calculations are due to significant digit rounding.

⁷ Available at: http://bioenergy.ornl.gov/papers/misc/energy_conv.html. Accessed: November, 2011.

Appendix C

OXY USA Inc. – Dominguez Oil Field Production Facility
Greenhouse Gas and Climate Change Technical Report

Table 6: Net Change in Emissions from Project – CA Waterflood Oil in Lieu of Imported Oil to Refineries

	Crude Transport and Distribution Emissions (MT/yr)		Crude Recovery Emissions (MT/yr)		Total Emissions (MT/yr)		Percentage Change
	Base Case	Project Case	Base Case	Project Case	Base Case	Project Case	
Total GHG Emissions	1,620,979	1,605,717	8,711,980	8,689,155	10,332,959	10,294,872	-0.37%
Difference (net emissions reductions)		15,262		22,825		38,087	

It is important to note there that the overall reduction estimate is conservative for two reasons described in Section 5.5.2 namely:

The model assumes equivalent flaring in California wells and foreign wells – typically much higher in foreign countries;

The model assumes that consumed electricity is generated from 95% natural gas and 5% coal – typically more carbon intensive in foreign countries.

A third conservative assumption made is that less GHG intensive Alaskan crudes will remain steady at 2006 Base case levels. Alaskan crudes are less GHG intensive due to the relatively low energy requirements in the crude recovery stage as shown in Table C-6 and Table C-23 respectively in Appendix C. However, there have been recent declines in crude oil shipped from Alaska into California. A CEC study performed in February 2011 showed some statewide decline in ANS imports for the first 11 months of 2010 compared to 2006 (now 13.9% of the total crude to refineries instead of 16.1%) and an increase in foreign imports from 45.0% to 48.2% in the same period. When this updated information on the Alaska and foreign import percentages is loaded into the model, the result is a slight increase of 314 MT in the baseline emission calculations. Since Alaska imports are expected to continue to decline even more over time⁸, this can then be expected to result in even more GHG benefit from Project oil production.

In summary, the model represents global GHG emission reductions and takes into account all GHG and energy inputs involved in producing and transporting oil to a California refinery. This reduction demonstrates that more global GHG emissions are avoided by producing this California waterflood oil than are used to produce the oil. This conclusion is consistent with

⁸ California Energy Commission, 2009 Integrated Energy Policy Report, CEC-100-2009-003-CMF, p.147.

other studies such as one conducted by the National Energy Technology Laboratory (NETL) that have shown higher carbon intensity values with imported crude oils versus a domestic oil like the Dominguez crude oil. Appendix D provides additional information on the NETL study and includes a crude-by-crude evaluation of carbon intensities of the crudes predominantly processed in California refineries, including California oils as well as the Dominguez crude oil.

5.5.5 Project Life Cycle Emissions – Additional Considerations

The above life cycle analysis does not account for the superior refining characteristics of the oil expected to be produced by the Project as the necessary data is not available in the CARB LCFS analysis to make a quantitative assessment. The Dominguez Hills crude is expected to be fairly light (31 API) and sweet (less than 1% sulfur content). Since higher energy inputs are required to remove sulfur and to crack heavy oils at refineries, the Dominguez Hills crude compares equally to or more favorably than the most common crude oil import alternatives. Compared against the largest domestic (Alaska) and three largest foreign (Saudi Arabia, Ecuador, Iraq) crude oil imports into California refineries in 2010, the Dominguez Hills crude is:

1. Very similar to Alaska North Slope in sulfur (0.9%) and API gravity (32);
2. Similar gravity and lower sulfur content than Saudi Arabian crude (28-39 API, 1.1–2.9% sulfur);
3. Better (higher API) gravity and lower sulfur content than Ecuador crude imports (typically 24 API, 1.5% sulfur); and
4. Similar gravity and lower sulfur content than Iraqi crude (30-34 API, 1.6 – 2.9% sulfur⁹).

Thus, a California refiner choosing the most frequently imported alternatives will commonly experience increased energy requirements and associated GHG emissions from additional sulfur removal or heavy oil processing. This is an additional GHG benefit for the Project.

The Project expects to send produced oil to the Conoco Phillips Carson/Wilmington refinery. This refinery processes mostly heavier and higher sulfur crudes. Conoco Phillips 2010 annual report¹⁰ states the following about this refinery:

“The refinery has a crude oil processing capacity of 139 MBD and processes mainly heavy, high-sulfur crude oil. It receives domestic crude oil via pipeline from California and both foreign and domestic crude oil by tanker through a third-party terminal in the Port of Long Beach. The refinery produces a high percentage of transportation fuels, such as gasoline, diesel fuel and jet fuel.”

⁹ http://www.eia.gov/oil_gas/petroleum/data_publications/company_level_imports/cli.html.

¹⁰ Available at:
http://www.conocophillips.com/EN/about/company_reports/fact_book/documents/Refining_Marketing.pdf.
Accessed: September, 2011.

This is further supported by monthly data from the Energy Information Administration (EIA) pertaining to the volumes of foreign imports by refinery.¹¹ In June 2011, the ConocoPhillips Carson/Wilmington refinery used Venezuelan ultra heavy (12.8 API), high sulfur (2.5%) crude (15% of their foreign imports); Canadian heavy (19.1 API), low sulfur (under 1%) oil (22% of their foreign imports); Ecuadorian medium gravity (20-24 API) and higher sulfur (1.3 – 1.4%) crude (45% of their foreign imports); and higher sulfur (2.8%) light Iraqi crude (18% of their foreign imports).

5.6 Climate Change Effects

As was indicated in the Water Resources report, the most recent Federal Emergency Management Agencies (FEMA) Flood Insurance Rate Map (FIRM) (FEMA, Los Angeles County, California, and Unincorporated Areas, Panels 1955 and 1935, 2008) show that the site is outside the 500-year floodplain. Elevations on the property range from a low of about 164 feet mean sea level (msl) to about 178 feet msl. A review of future sea level rise inundation maps (California Climate Change Center, 2009) through year 2100 indicates no apparent risks to the site from future inundation.

5.7 Impacts Summary

Table 7 provides a summary of the impacts of the proposed Project related to GHG emissions. The table provides a description of the emission types, the level of emissions, and the SCAQMD industrial stationary source significance threshold value. As per SCAQMD's interim GHG significance threshold guidelines, construction emissions can be annualized over a 30-year project life period for comparison against the threshold. As shown below, emission impacts are determined by subtracting the GHG emissions from existing baseline operations from the sum of the proposed Project emissions and the annualized construction emissions. Table 7 shows that Project emissions for stationary and mobile sources are approximately the same as for the existing conditions. The calculated increase in emissions from the Project is due to indirect emissions (i.e., the use of electricity). It was noted in Section 4.3.5 that future GHG emissions from electricity use will be reduced through the implementation of the Renewable Portfolio Standard. Furthermore, the GHG emissions due to electrical generators will be regulated by the AB 32 Cap and Trade Requirements. Thus, the Project's GHG emissions, which are due to electricity usage, will be managed at the State level. It should also be noted that the Project's higher electricity usage is primarily due to the Project's Design Feature to reduce diesel engine emissions by using an electrical drill rig instead of a diesel powered drilling rig.

As is summarized in Table 7, the net increase in GHG emissions resulting from the Project construction and operations without life cycle considerations is 24,979MT/year. However, the overall net benefit from California waterflood produced oil is a positive one when considering California's current crude oil mix to its refineries. As noted above, the Project is expected to decrease foreign and Alaskan imports of oil into California refineries by an equivalent amount as

¹¹ Available at: http://www.eia.gov/oil_gas/petroleum/data_publications/company_level_imports/cli.html. Accessed: November, 2011.

Appendix C

OXY USA Inc. – Dominguez Oil Field Production Facility
Greenhouse Gas and Climate Change Technical Report

is produced. In doing so, the Project is expected to result in a net life cycle reduction of global GHG emissions in the amount of 38,087 MT/year, as shown in Table 7. In other words, the direct emissions from the Dominguez Hills Oilfield Development Project will be more than offset by reduced GHG emissions that would otherwise come from imported crude oils. The GHG impacts of imported crude oil produced and transported to California refineries has been ruled to be relevant for significance and mitigation determinations (Communities for a Better Environment, 2010). For this Project, there will be an overall reduction in emissions by displacing more carbon intensive imports.

Table 7: Summary of GHG Emission Impacts from Project				
Emission Source Category	Annual Emissions (MT/year)			
	CO₂	CH₄	N₂O	CO₂e
Operation Emissions				
Stationary Sources	17,710	1	0	17,743
Mobile Sources	715	0	0	715
Indirect Sources	28,030	1	0	28,208
Construction Emissions				
2013-2014 (annualized over 30 years)	39	0	0	39
Total Annual ¹	46,495	2	1	46,706
Baseline Emissions				
Stationary Sources	19,822	29	1	20,742
Mobile Sources	983	0	0	984
Difference	25,690	-26	-1	24,979
SCAQMD Threshold				10,000
Life Cycle Analysis Emissions Benefit ²				-38,087
Notes: 1. Emissions might not add precisely due to rounding. 2. This evaluation in this section shows that the Project creates an overall reduction of 38,087 MT of emissions and is a net GHG benefit when considering that this oil displaces more GHG intensive imports.				

6 Project Design Features

The measures listed below are not required, but are being incorporated into the Project as they represent practices consistent with, but not specifically required by County construction, green building and water conservation policies. The measures are not quantitatively evaluated here, but are considered feasible on-site measures that would reduce GHG emissions from electricity generation or fossil fuel combustion:

Increased Fuel Efficiency for Construction Equipment. Construction equipment idling is to be restricted to a maximum of 5 minutes when not in use and when feasible, and the use of electrified construction equipment where feasible.

Solar Panels. The applicant will review the feasibility of installing solar PV at the site (depending on final site design).

Recycling. The applicant will ensure that a minimum of 40 percent of all waste generated during Project construction is recycled and 60 percent of all waste generated in the future operations building is recycled by the facility opening year of 2014.

Recycled materials shall include:

(a) white and colored paper; (b) post-it notes; (c) magazines; (d) newspaper; (e) file folders; (f) all envelopes including those with plastic windows; (g) all cardboard boxes and cartons; (h) all metal and aluminum cans; (i) glass bottles and jars; and; (j) all plastic bottle

Tree Planting. The applicant will plant trees around the outer wall and will maintain the trees throughout the life of the Project.

Water Conservation. The applicant will install low-flow devices in new buildings and low irrigation landscaping, and maintain these through the life of the Project.

Compact Fluorescent Light Bulbs. New buildings will exclusively use compact fluorescent light bulbs for ambient lighting. Although not quantified in this analysis, implementation of this measure is expected to reduce the Project's GHG emissions by less than 0.1 percent.

7 References

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Appendix C

OXY USA Inc. – Dominguez Oil Field Production Facility
Greenhouse Gas and Climate Change Technical Report

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Appendix C

OXY USA Inc. – Dominguez Oil Field Production Facility
Greenhouse Gas and Climate Change Technical Report

Appendix A

Construction Emission Estimates

Table A-1. Construction Schedule and Equipment Quantity

[illegible]

Table A-1. Construction Schedule and Equipment Quantity

(1) A start date of January 1, 2013, was assumed for purposes of this analysis. Regardless of certification date, the activities, days required for each activity, and total construction days will not change. Thus, the results will not change even if the start date changes.

(2) SCE On-Site Construction shares equipment with the Oxy facility construction. SCE on-site construction emissions are evaluated to estimate SCE emissions only and are not added to the total Oxy construction emissions for CEQA significance determination.

(1) A start date of January 1, 2013, was assumed for purposes of this analysis. Regardless of certification date, the activities, days required for each activity, and total construction days will not change even if the start date changes.

Table A-1. Construction Schedule and Equipment Quantity

[illegible]

Table A-1. Construction Schedule and Equipment Quantity

[illegible]

(1) A start date of January 1, 2013, was assumed for purposes of this analysis. Regardless of certification date, SCE On-Site Construction shares equipment with the Oxy facility construction. SCE on-site construction em

Appendix C

Table A-2(a). Construction Equipment

**Oxy USA Inc. | LA Basin Asset
Proposed Dominguez Production Facility
Construction Equipment**

	Schedule ⁽¹⁾		Onsite			Offsite			Traveled Distance (miles/trip)	Round Trips/Day
	Start (Week #)	Finish (Week #)	Construction Equipment			Construction Equipment				
			Qty	Dur	Hrs/Day	Qty	Dur	Hrs/Day		
Demolition/Site Prep Equipment										
Excavator	1	15	2	10w	8					
Loader	1	15	2	10w	8					
Ram Hoe	1	15	4	10w	8					
Dump Truck (See Table A-3(a))										
Backhoe	1	15	2	10w	8					
Pickup Truck	1	15				2	15w	4	20	2
Water Truck	1	15	1	15w	2					
Well Cellars / Wall										
Trackhoe	16	40	1	5w	8					
Loader	16	40	1	5w	8					
Dozer										
Roller	16	40	1	10w	8					
Backhoe	16	40	1	5w	8					
Dump Truck (See Table A-3(a))										
Water Truck	16	19	1	4w	2					
Plate Compactors	16	40	1	10w	8					
Cranes	16	40	2	24w	8					
Generator	16	40	1	24w	8					
Forklift	16	40	1	24w	8					
Air Compressor	16	40	1	16w	8					
Welding Equipment (Diesel)	16	40	1	10w	8					
Pick-up	16	40				2	25w	4	20	2
Process Equipment Areas										
Trackhoe	20	75	1	40w	8					
Loader	20	75	1	40w	8					
Dozer	20	75	1	4w	8					
Roller	20	75	1	12w	8					
Backhoe	20	75	1	4w	8					
Paver	20	75	1	5w	8					
Dump Truck (See Table A-3(a))										
Water Truck	20	75	1	50w	2					
Plate Compactors	20	75	1	35w	8					
Cranes	20	75	2	50w	8					
Generator	20	75	1	50w	8					
Forklift	20	75	1	50w	8					
Air Compressor	20	75	2	25w	8					
Welding Equipment (Diesel)	20	75	4	30w	8					
Pick-up	20	75				4	55w	4	20	2

Appendix C

Table A-2(a). Construction Equipment

**Oxy USA Inc. | LA Basin Asset
Proposed Dominguez Production Facility
Construction Equipment**

	Schedule ⁽¹⁾		Onsite			Offsite			Traveled Distance (miles/trip)	Round Trips/Day
	Start (Week #)	Finish (Week #)	Construction Equipment			Construction Equipment				
			Qty	Dur	Hrs/Day	Qty	Dur	Hrs/Day		
Tanks (4 x 5,000 Bbls)										
Automatic Floor Welder	25	60	1	32w	8					
Automatic Horizontal Seam Welder	25	60	1	32w	8					
Crane	25	60	1	32w	8					
Manlift	25	60	1	32w	8					
Welding Equipment (Diesel)	25	60	1	32w	8					
Pick-up						2	32w	4	20	2
Pipeline Construction										
Crane	40	50				1	1w	4	40	1
Dump Trucks	40	50				1	2w	6	80	4
Generator set	40	50				2	4w	8	2	1
Sideboom	40	50				2	4w	8	2	6
Tractor/loader/backhoe	40	50				1	2w	8	2	8
Welders	40	50				2	4w	8	2	8
Pipeline Repairs										
Crane	30	38				1	4w	4	40	1
Dump Trucks	30	38				1	8w	6	80	4
Generator set	30	38				2	8w	8	2	1
Sideboom	30	38				2	8w	8	2	6
Tractor/loader/backhoe	30	38				1	4w	8	2	8
Welders	30	38				2	8w	8	2	8

Notes:

(1) Construction schedule for overall site is anticipated to be 18 months. Refer to Table A-1 for detailed breakdown of activities

(2) Construction equipment includes on site and pipeline construction equipment

(3) Well drilling is part of operation activities

Appendix C

Table A-2(b). Construction Equipment

**Oxy USA Inc. | LA Basin Asset
Proposed Dominguez Production Facility
Construction Equipment - SCE 16 KV Power Feed**

	Schedule ⁽¹⁾		Onsite			Offsite			Traveled Distance (miles/trip)	Round Trips/Day
	Start (Week #)	Finish (Week #)	Construction Equipment			Construction Equipment				
			Qty	Dur (Wks)	Hrs/Day	Qty	Dur (Wks)	Hrs/Day		
Off-Site Equipment										
Loader						1	10	8		
Roller						1	11	8		
Backhoe						1	16	8		
Paver						1	3	8		
Dump Truck (See Table A-3(b))										
Plate Compactors						1	11	8		
Cranes						1	8	8		
Boring Machine ⁽²⁾										
Generator						1	8	8		
Air Compressor						1	2	8		
Welding Equipment (Diesel)						1	6	8		
Pick-up						1	16	4	20	2
Off-Site Equipment -HDD Section										
Boring Machine ⁽²⁾						1	4	8		
Water pump						1	4	16		
Slurry Mixing Tank						1	4	16		
Cuttings Separation Equipment						1	4	16		
Slurry Pump						1	4	16		
Cuttings settlement tank						2	4	16		
Backhoe						1	1	3		
Cranes						2	1	8		
On-Site Equipment										
Loader			1	2	8					
Backhoe			1	2	8					
Dump Truck (See Table A-3(b))										
Plate Compactors			1	2	8					
Cranes			1	2	8					
Generator			1	3	8					
Air Compressor			1	3	8					
Welding Equipment (Diesel)			1	4	8					
Pick-up						1	8	4	20	2

Notes:

(1) Construction schedule is assumed to be 4 months offsite and 2 months onsite. Refer to Table A-1 for detailed breakdown of activities

(2) For Boring Machine, 24 hour operation will occur for will last for 1 week. Otherwise 8 hours/day.

Appendix C

Table A-3(a). Equipment Delivery Truck Trips

**Oxy USA Inc. | LA Basin Asset
Proposed Dominguez Production Facility
Vehicle Trip Estimation - Construction Materials**

Item	Quantity	Truck Capacity	Truck Quant	Schedule ⁽⁵⁾		Equipment Type ⁽⁴⁾
				Start (Week #)	Finish (Week #)	
1. Building Demolition ⁽¹⁾						
Building Walls	1,740 Tons	10 Tons/Truck	174	1	10	Dump Truck
Building Floors	3,607 Tons	10 Tons/Truck	361	1	10	Dump Truck
Building Roof	195 Tons	10 Tons/Truck	19	1	10	Dump Truck
Parking Areas	6,583 Tons	10 Tons/Truck	658	1	10	Dump Truck
Misc Materials	10% Additional Trucks		121	1	10	Dump Truck
TOTAL			1,334			
2. Process Area Equipment Delivery ⁽²⁾						
Pipe	400 Tons	13 Tons/Truck	31	30	65	Flatbed Truck & Trailer
Equipment	26 Process Vessels	1 Items/Truck	26	30	65	Flatbed Truck & Trailer
	3 Storage Vessels	1 Items/Truck	3	30	65	Flatbed Truck & Trailer
	2 Compressors & Blowers	1 Items/Truck	2	30	65	Flatbed Truck & Trailer
	46 Pumps	4 Items/Truck	12	30	65	Flatbed Truck & Trailer
	15 Solids Separation Equip.	1 Items/Truck	15	30	65	Flatbed Truck & Trailer
	2 Process Heaters	1 Items/Truck	2	30	65	Flatbed Truck & Trailer
	4 Heat Exchangers	1 Items/Truck	4	30	65	Flatbed Truck & Trailer
	6 Package Units	1 Items/Truck	6	30	65	Flatbed Truck & Trailer
	2 Miscellaneous Equipment	1 Items/Truck	2	30	65	Flatbed Truck & Trailer
Tanks (4)	118 Tons	15 Tons/Truck	16	30	65	Flatbed Truck & Trailer
Electrical Equipment			10	30	65	Flatbed Truck & Trailer
MCC Building			2	30	65	Flatbed Truck & Trailer
Control Room Material			15	30	65	Flatbed Truck & Trailer
Maintenance Building Material			15	30	65	Flatbed Truck & Trailer
Misc Materials	10% Additional Trucks		16	30	65	Flatbed Truck & Trailer
			176			
3. Construction Material ⁽³⁾						
Earth	6,700 CY (Export)	12 CY/Truck	558	1	40	Dump Truck
Concrete	4,700 CY	9 CY/Truck	522	18	60	Cement Mixer Truck
Steel	850 Tons	15 Tons/Truck	57	36	65	Flatbed Truck & Trailer
Paving	2,000 Tons	20 Tons/Truck	100	60	75	Dump Truck
Construction Equipment			66	1	78	Flatbed Truck & Trailer
Misc Materials	10% Additional Trucks		130	1	78	Dump Truck
			1,434			
TOTAL			2,943			

Notes:

- 1 Estimated materials for demolition of a 410' x 190' tilt-up concrete warehouse plus parking areas. Assume concrete will be broken up on site and hauled offsite for crushing and recycling.
- 2 Estimated equipment delivery for construction of oil processing area (does not include well drilling). Assume delivery trucks will be tractor and flatbed trailer arriving full and leaving empty.
- 3 Estimated construction materials delivery for construction of oil processing area plus concrete portion of well cellars. Assumes that all excavated soil is exported.
- 4 Anticipated equipment type shown in table.
- 5 Construction schedule for overall site (excluding well construction) is anticipated to be 18 months.

Appendix C

Table A-3(b). Equipment Delivery Truck Trips

**Oxy USA Inc. | LA Basin Asset
Proposed Dominguez Production Facility
Vehicle Trip Estimation - SCE 16 KV Power Feed**

Item	Quantity	Truck Capacity	Truck Quant	Schedule ⁽⁵⁾		Equipment Type ⁽⁴⁾
				Start (Week #)	Finish (Week #)	
1. Building Demolition ⁽¹⁾						
Building Walls	- Tons	10 Tons/Truck	-			Dump Truck
Building Floors	- Tons	10 Tons/Truck	-			Dump Truck
Building Roof	- Tons	10 Tons/Truck	-			Dump Truck
Parking Areas	- Tons	10 Tons/Truck	-			Dump Truck
Misc Materials	0% Additional Trucks		-			Dump Truck
TOTAL			-			
2. Process Area Equipment Delivery ⁽²⁾						
Pipe	- Tons	13 Tons/Truck	-			Flatbed Truck & Trailer
Equipment	- Process Vessels	1 Items/Truck	-			Flatbed Truck & Trailer
	- Storage Vessels	1 Items/Truck	-			Flatbed Truck & Trailer
	- Compressors & Blowers	1 Items/Truck	-			Flatbed Truck & Trailer
	- Pumps	4 Items/Truck	-			Flatbed Truck & Trailer
	- Solids Separation Equip.	1 Items/Truck	-			Flatbed Truck & Trailer
	- Process Heaters	1 Items/Truck	-			Flatbed Truck & Trailer
	- Heat Exchangers	1 Items/Truck	-			Flatbed Truck & Trailer
	- Package Units	1 Items/Truck	-			Flatbed Truck & Trailer
	- Miscellaneous Equipment	1 Items/Truck	-			Flatbed Truck & Trailer
Tanks (4)	- Tons	15 Tons/Truck	-			Flatbed Truck & Trailer
Electrical Equipment	10 Items	1 Items/Truck	10			Flatbed Truck & Trailer
MCC Building	1 Items	1.0 Items/Truck	1			Flatbed Truck & Trailer
Baker Tanks			8			Flatbed Truck & Trailer
Maintenance Building Material			-			Flatbed Truck & Trailer
Misc Materials	10% Additional Trucks		2			Flatbed Truck & Trailer
			21			
3. Construction Material ⁽³⁾						
Earth	2,173 CY (Export)	12 CY/Truck	181			Dump Truck
Concrete	1,141 CY	9 CY/Truck	127			Cement Mixer Truck
Steel	5 Tons	15 Tons/Truck	0			Flatbed Truck & Trailer
Gravel	65 Tons	20 Tons/Truck	3			Dump Truck
Construction Equipment			25			Flatbed Truck & Trailer
Misc Materials	10% Additional Trucks		34			Dump Truck
			370			
TOTAL			391			

Notes:

- 1 No Demolition
- 2 Estimated equipment delivery for construction of power feed to site and on-site
- 3 Estimated construction materials delivery for construction of power feed to site
- 4 Construction schedule is assumed to be 4 months offsite and 2 months onsite.
- 5 See schedule
- 6 This estimate is very preliminary, based on limited information from SCE.

Table A-4. CalEEMod Input Parameters

ProjectName	Oxy
LocationScope	AB
EMIFAC_ID	SC
WindSpeed	2.2
PrecipitationFrequency	31
ClimateZone	9
UrbanizationLevel	Urban
OperationalYear	2013
UtilityCompany	Southern California Edison
CO2IntensityFactor	641.26
CH4IntensityFactor	0.029
N2OIntensityFactor	0.011
TotalPopulation	0
TotalLotAcreage	6.5
UsingHistoricalEnergyUseData	0
LandUseType	Industrial
LandUseSubType	User Defined Industrial
LandUseUnitAmount	1
LandUseSizeMetric	User Defined Unit
LotAcreage	6.5
LandUseSquareFeet	0
Population	0

Note:

CO₂, CH₄, and N₂O intensity factors were obtained from the Local Government Reporting Protocol (2006) and E-Grid. They do not account for the future effect of the Renewable Portfolio Standards.

Table A-5. CalEEMod Input Parameters

Equipment	OffRoadEquipmentType	NumDaysWeek ⁽¹⁾	Amount ⁽²⁾	UsageHours ⁽²⁾	HorsePower ⁽³⁾	LoadFactor ⁽³⁾
Air Compressor	Air Compressors	5	1	8	78	0.48
Backhoe	Tractors/Loaders/Backhoes	5	1	8	75	0.55
Boring Machine	Bore/Drill Rigs	5	1	8	82	0.75
Crane	Cranes	5	1	8	208	0.43
Cuttings Separation Equipment	Other Material Handling Equipment	5	1	8	50	0.59
Dozer	Rubber Tired Dozers	5	1	8	358	0.59
Excavator	Excavators	5	1	8	157	0.57
Forklift	Forklifts	5	1	8	149	0.3
Generator	Generator Sets	5	1	8	84	0.74
Loader	Tractors/Loaders/Backhoes	5	1	8	75	0.55
Manlift	Aerial Lifts	5	1	8	34	0.46
Paver	Paver	5	1	8	89	0.62
Paving Equipment	Paving Equipment	5	1	8	82	0.53
Pick-up	Tractors/Loaders/Backhoes	5	1	8	75	0.55
Plate Compactor	Plate Compactors	5	1	8	8	0.43
Pump	Pumps	5	1	8	84	0.74
Ram Hoe	Tractors/Loaders/Backhoes	5	1	8	75	0.55
Roller	Rollers	5	1	8	84	0.56
Trackhoe	Tractors/Loaders/Backhoes	5	1	8	75	0.55
Water Truck	Off-Highway Trucks	5	1	8	381	0.57
Welding Equipment	Welders	5	1	8	46	0.45

Notes:

- (1) Number of days per week based on project estimates
(2) Amount based on a unit equipment approach
(3) Horsepower and load factors are based on default CalEEMod assumptions; load factors have not been adjusted per ARB guidance

Table A-6. CalEEMod Input Parameters

WorkerTripLength	10.8
VendorTripLength	7.3
HaulingTripLength	20
WorkerVehicleClass	LD_Mix
VendorVehicleClass	HDT_Mix
HaulingVehicleClass	HDT
WorkerPercentPave	100
VendorPercentPave	100
HaulingPercentPave	100
RoadSiltLoading	0.1
MaterialSiltContent	8.5
MaterialMoistureContent	0.5
AverageVehicleWeight	2.4
MeanVehicleSpeed	40

Notes:

- (1) Trip length, paved road conditions, and speed assumptions are based on CalEEMod default
- (2) Worker commute vehicles trips are assigned to be 18 trips per day and hauling truck trips to be 100 trips per day and then ratio to their actual usage in calculation. This is done to address the CalEEMod's sensitivity to small unit emissions because the output only displays up to two decimal places.

Table A-7. CalEEMod Input Parameters

PhaseName	Demolition	Grading
DemolitionSizeMetric	12125	
DemolitionUnitAmount	Tons	
MaterialImported		0
MaterialExported		1000
GradingSizeMetric		Cubic Yards
ImportExportPhased		0
MeanVehicleSpeed		7.1
AcresOfGrading		0
MaterialMoistureContentBulldozing		7.9
MaterialMoistureContentTruckLoading		12
MaterialSiltContent		6.9

Note:

Demolition and grading size metrics, material conditions, and vehicle speeds based on CalEEMod default assumptions

Table A-8. Workdays and Number of Workers

Work weeks (Facility Construction)
52 wks in 2013
26 wks in 2014

Work weeks (Pipeline Construction)
20 wks in 2013
0 wks in 2014

Work weeks (SCE Construction)
18 wks in 2013
0 wks in 2014

Workers
70 avg day for facility construction
120 peak day for facility construction
10 avg day for pipeline construction
20 peak day for pipeline construction
20 avg day for SCE construction
25 peak day for SCE construction

Note:

Number of work weeks and workers are based on project specific estimates

Demolition
South Coast Air Basin, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric
User Defined Industrial	1	User Defined Unit

1.2 Other Project Characteristics

Urbanization	Urban	Wind Speed (m/s)	2.2	Utility Company	Southern California Edison
Climate Zone	9	Precipitation Freq (days)	31		

1.3 User Entered Comments

Project Characteristics -
Construction Phase - Excavator, Loader, Ram hoe, Backhoe
Demolition -
Trips and VMT - not estimated on-road trips

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day															
2013	0.96	7.13	5.32	0.01	0.00	0.41	0.41	0.00	0.41	0.41	0.00	896.14	0.00	0.09	0.00	897.96
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day															
2013	0.96	7.13	5.32	0.01	0.00	0.41	0.41	0.00	0.41	0.41	0.00	896.14	0.00	0.09	0.00	897.96
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Energy	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00	0.00	0.00
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00	0.00	0.00

C-57

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Energy	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00	0.00	0.00
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00	0.00	0.00

3.0 Construction Detail

3.1 Mitigation Measures Construction

3.2 Excavator - 2013

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.96	7.13	5.32	0.01		0.41	0.41		0.41	0.41		896.14		0.09		897.96
Total	0.96	7.13	5.32	0.01		0.41	0.41		0.41	0.41		896.14		0.09		897.96

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.2 Excavator - 2013

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.96	7.13	5.32	0.01		0.41	0.41		0.41	0.41	0.00	896.14		0.09		897.96
Total	0.96	7.13	5.32	0.01		0.41	0.41		0.41	0.41	0.00	896.14		0.09		897.96

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.3 Loader - 2013

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.55	3.65	2.82	0.00		0.31	0.31		0.31	0.31		413.07		0.05		414.11
Total	0.55	3.65	2.82	0.00		0.31	0.31		0.31	0.31		413.07		0.05		414.11

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.3 Loader - 2013

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.55	3.65	2.82	0.00		0.31	0.31		0.31	0.31	0.00	413.07		0.05		414.11
Total	0.55	3.65	2.82	0.00		0.31	0.31		0.31	0.31	0.00	413.07		0.05		414.11

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.4 Ram Hoe - 2013

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.55	3.65	2.82	0.00		0.31	0.31		0.31	0.31		413.07		0.05		414.11
Total	0.55	3.65	2.82	0.00		0.31	0.31		0.31	0.31		413.07		0.05		414.11

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.4 Ram Hoe - 2013

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.55	3.65	2.82	0.00		0.31	0.31		0.31	0.31	0.00	413.07		0.05		414.11
Total	0.55	3.65	2.82	0.00		0.31	0.31		0.31	0.31	0.00	413.07		0.05		414.11

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.5 Backhoe - 2013

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.55	3.65	2.82	0.00		0.31	0.31		0.31	0.31		413.07		0.05		414.11
Total	0.55	3.65	2.82	0.00		0.31	0.31		0.31	0.31		413.07		0.05		414.11

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.5 Backhoe - 2013

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.55	3.65	2.82	0.00		0.31	0.31		0.31	0.31	0.00	413.07		0.05		414.11
Total	0.55	3.65	2.82	0.00		0.31	0.31		0.31	0.31	0.00	413.07		0.05		414.11

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

4.0 Mobile Detail

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Unmitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

4.2 Trip Summary Information

Land Use	Average Daily Trip Rate			Unmitigated Annual VMT	Mitigated Annual VMT
	Weekday	Saturday	Sunday		
User Defined Industrial	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

Land Use	Miles			Trip %		
	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW
User Defined Industrial	9.50	7.30	7.30	0.00	0.00	0.00

5.0 Energy Detail

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NaturalGas Unmitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	lb/day										lb/day					
User Defined Industrial	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU																
User Defined Industrial	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00	0.00	0.00

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category																
Mitigated	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Unmitigated	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.00					0.00	0.00		0.00	0.00						0.00
Consumer Products	0.00					0.00	0.00		0.00	0.00						0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.00					0.00	0.00		0.00	0.00						0.00
Consumer Products	0.00					0.00	0.00		0.00	0.00						0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Vegetation

WellCells
South Coast Air Basin, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric
User Defined Industrial	1	User Defined Unit

1.2 Other Project Characteristics

Urbanization	Urban	Wind Speed (m/s)	2.2	Utility Company	Southern California Edison
Climate Zone	9	Precipitation Freq (Days)	31		

1.3 User Entered Comments

- Project Characteristics -
- Land Use - Oxy Site Acreage
- Construction Phase - Model Well Cells / Wall as Site Preparation
- Off-road Equipment - Air Compressor
- Off-road Equipment - Backhoe
- Off-road Equipment - Crane
- Off-road Equipment - Forklift

- Off-road Equipment - Generator
- Off-road Equipment - Plate Compactor
- Off-road Equipment - Roller
- Off-road Equipment - Trackhoe
- Off-road Equipment - Welding Equipment
- Trips and VMT - vehicle emissions estimated separately

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day															
2013	0.87	7.94	3.91	0.01	0.00	0.46	0.46	0.00	0.46	0.46	0.00	895.64	0.00	0.08	0.00	897.28
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day															
2013	0.87	7.94	3.91	0.01	0.00	0.46	0.46	0.00	0.46	0.46	0.00	895.64	0.00	0.08	0.00	897.28
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Energy	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00	0.00	0.00
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00	0.00	0.00

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Energy	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00	0.00	0.00
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00	0.00	0.00

3.0 Construction Detail

3.1 Mitigation Measures Construction

3.2 Trackhoe - 2013

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.55	3.65	2.82	0.00		0.31	0.31		0.31	0.31		413.07		0.05		414.11
Total	0.55	3.65	2.82	0.00		0.31	0.31		0.31	0.31		413.07		0.05		414.11

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.2 Trackhoe - 2013

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.55	3.65	2.82	0.00		0.31	0.31		0.31	0.31	0.00	413.07		0.05		414.11
Total	0.55	3.65	2.82	0.00		0.31	0.31		0.31	0.31	0.00	413.07		0.05		414.11

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.3 Roller - 2013

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.79	4.99	3.24	0.00		0.43	0.43		0.43	0.43		471.05		0.07		472.53
Total	0.79	4.99	3.24	0.00		0.43	0.43		0.43	0.43		471.05		0.07		472.53

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.3 Roller - 2013

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.79	4.99	3.24	0.00		0.43	0.43		0.43	0.43	0.00	471.05		0.07		472.53
Total	0.79	4.99	3.24	0.00		0.43	0.43		0.43	0.43	0.00	471.05		0.07		472.53

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.4 Plate Compactor - 2013

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.04	0.25	0.21	0.00		0.01	0.01		0.01	0.01		34.45		0.00		34.52
Total	0.04	0.25	0.21	0.00		0.01	0.01		0.01	0.01		34.45		0.00		34.52

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.4 Plate Compactor - 2013

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.04	0.25	0.21	0.00		0.01	0.01		0.01	0.01	0.00	34.45		0.00		34.52
Total	0.04	0.25	0.21	0.00		0.01	0.01		0.01	0.01	0.00	34.45		0.00		34.52

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.5 Crane - 2013

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.83	7.94	2.35	0.01		0.28	0.28		0.28	0.28		895.64		0.07		897.20
Total	0.83	7.94	2.35	0.01		0.28	0.28		0.28	0.28		895.64		0.07		897.20

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.5 Crane - 2013

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.83	7.94	2.35	0.01		0.28	0.28		0.28	0.28	0.00	895.64		0.07		897.20
Total	0.83	7.94	2.35	0.01		0.28	0.28		0.28	0.28	0.00	895.64		0.07		897.20

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.6 Generator - 2013

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.87	6.00	3.91	0.01		0.46	0.46		0.46	0.46		622.46		0.08		624.10
Total	0.87	6.00	3.91	0.01		0.46	0.46		0.46	0.46		622.46		0.08		624.10

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.6 Generator - 2013

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.87	6.00	3.91	0.01		0.46	0.46		0.46	0.46	0.00	622.46		0.08		624.10
Total	0.87	6.00	3.91	0.01		0.46	0.46		0.46	0.46	0.00	622.46		0.08		624.10

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.7 Forklift - 2013

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.45	3.38	2.64	0.00		0.19	0.19		0.19	0.19		447.62		0.04		448.46
Total	0.45	3.38	2.64	0.00		0.19	0.19		0.19	0.19		447.62		0.04		448.46

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.7 Forklift - 2013

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.45	3.38	2.64	0.00		0.19	0.19		0.19	0.19	0.00	447.62		0.04		448.46
Total	0.45	3.38	2.64	0.00		0.19	0.19		0.19	0.19	0.00	447.62		0.04		448.46

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.8 Air Compressor - 2013

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.65	3.94	2.59	0.00		0.36	0.36		0.36	0.36		374.92		0.06		376.14
Total	0.65	3.94	2.59	0.00		0.36	0.36		0.36	0.36		374.92		0.06		376.14

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.8 Air Compressor - 2013

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.65	3.94	2.59	0.00		0.36	0.36		0.36	0.36	0.00	374.92		0.06		376.14
Total	0.65	3.94	2.59	0.00		0.36	0.36		0.36	0.36	0.00	374.92		0.06		376.14

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.9 Welding Equipment - 2013

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.77	2.02	2.18	0.00		0.19	0.19		0.19	0.19		207.29		0.07		208.74
Total	0.77	2.02	2.18	0.00		0.19	0.19		0.19	0.19		207.29		0.07		208.74

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.9 Welding Equipment - 2013

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.77	2.02	2.18	0.00		0.19	0.19		0.19	0.19	0.00	207.29		0.07		208.74
Total	0.77	2.02	2.18	0.00		0.19	0.19		0.19	0.19	0.00	207.29		0.07		208.74

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

4.0 Mobile Detail

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Unmitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

4.2 Trip Summary Information

Land Use	Average Daily Trip Rate			Unmitigated Annual VMT	Mitigated Annual VMT
	Weekday	Saturday	Sunday		
User Defined Industrial	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

Land Use	Miles			Trip %		
	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW
User Defined Industrial	9.50	7.30	7.30	0.00	0.00	0.00

5.0 Energy Detail

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NaturalGas Unmitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	lb/day															
User Defined Industrial	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	lb/day															
User Defined Industrial	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00	0.00	0.00

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Mitigated	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Unmitigated	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.00					0.00	0.00		0.00	0.00						0.00
Consumer Products	0.00					0.00	0.00		0.00	0.00						0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.00					0.00	0.00		0.00	0.00						0.00
Consumer Products	0.00					0.00	0.00		0.00	0.00						0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Vegetation

Process Equipment
South Coast Air Basin, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric
User Defined Industrial	1	User Defined Unit

1.2 Other Project Characteristics

Urbanization	Urban	Wind Speed (m/s)	2.2	Utility Company	Southern California Edison
Climate Zone	9	Precipitation Freq (days)	31		

1.3 User Entered Comments

- Project Characteristics -
- Land Use - Oxy site acreage
- Construction Phase - Process Equipment Area
- Off-road Equipment - Dozer 2013
- Off-road Equipment - Crane
- Off-road Equipment - Generator
- Off-road Equipment - Forklift

Off-road Equipment - Air Compressor
 Off-road Equipment - Welder
 Off-road Equipment - Paving equipment
 Trips and VMT - no on-road estimated

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

Year	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
2013	2.56	21.80	11.36	0.02	6.02	0.90	6.93	3.31	0.90	4.21	0.00	2,115.13	0.00	0.23	0.00	2,119.98
2014	0.82	7.26	3.87	0.01	0.00	0.43	0.43	0.00	0.43	0.43	0.00	895.64	0.00	0.07	0.00	897.19
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

2.1 Overall Construction (Maximum Daily Emission)

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day											lb/day				
2013	2.56	21.80	11.36	0.02	6.02	0.90	6.93	3.31	0.90	4.21	0.00	2,115.13	0.00	0.23	0.00	2,119.98
2014	0.82	7.26	3.87	0.01	0.00	0.43	0.43	0.00	0.43	0.43	0.00	895.64	0.00	0.07	0.00	897.19
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Energy	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00	0.00	0.00
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00	0.00	0.00

C-99

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Energy	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00	0.00	0.00
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00	0.00	0.00

3.0 Construction Detail

3.1 Mitigation Measures Construction

3.2 Dozer - 2013

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Fugitive Dust					6.02	0.00	6.02	3.31	0.00	3.31						0.00
Off-Road	2.56	21.80	11.36	0.02		0.90	0.90		0.90	0.90		2,115.13		0.23		2,119.98
Total	2.56	21.80	11.36	0.02	6.02	0.90	6.92	3.31	0.90	4.21		2,115.13		0.23		2,119.98

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.2 Dozer - 2013

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Fugitive Dust					6.02	0.00	6.02	3.31	0.00	3.31						0.00
Off-Road	2.56	21.80	11.36	0.02		0.90	0.90		0.90	0.90	0.00	2,115.13		0.23		2,119.98
Total	2.56	21.80	11.36	0.02	6.02	0.90	6.92	3.31	0.90	4.21	0.00	2,115.13		0.23		2,119.98

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.3 Crane - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.78	7.26	2.25	0.01		0.25	0.25		0.25	0.25		895.64		0.07		897.10
Total	0.78	7.26	2.25	0.01		0.25	0.25		0.25	0.25		895.64		0.07		897.10

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.3 Crane - 2014

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.78	7.26	2.25	0.01		0.25	0.25		0.25	0.25	0.00	895.64		0.07		897.10
Total	0.78	7.26	2.25	0.01		0.25	0.25		0.25	0.25	0.00	895.64		0.07		897.10

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.4 Generator - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.79	5.64	3.87	0.01		0.42	0.42		0.42	0.42		622.46		0.07		623.96
Total	0.79	5.64	3.87	0.01		0.42	0.42		0.42	0.42		622.46		0.07		623.96

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.4 Generator - 2014

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.79	5.64	3.87	0.01		0.42	0.42		0.42	0.42	0.00	622.46		0.07		623.96
Total	0.79	5.64	3.87	0.01		0.42	0.42		0.42	0.42	0.00	622.46		0.07		623.96

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.5 Forklift - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.41	3.08	2.64	0.00		0.17	0.17		0.17	0.17		447.62		0.04		448.40
Total	0.41	3.08	2.64	0.00		0.17	0.17		0.17	0.17		447.62		0.04		448.40

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.5 Forklift - 2014

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.41	3.08	2.64	0.00		0.17	0.17		0.17	0.17	0.00	447.62		0.04		448.40
Total	0.41	3.08	2.64	0.00		0.17	0.17		0.17	0.17	0.00	447.62		0.04		448.40

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.6 Air Compressor - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.59	3.70	2.56	0.00		0.33	0.33		0.33	0.33		374.92		0.05		376.04
Total	0.59	3.70	2.56	0.00		0.33	0.33		0.33	0.33		374.92		0.05		376.04

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.6 Air Compressor - 2014

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.59	3.70	2.56	0.00		0.33	0.33		0.33	0.33	0.00	374.92		0.05		376.04
Total	0.59	3.70	2.56	0.00		0.33	0.33		0.33	0.33	0.00	374.92		0.05		376.04

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.7 Welding Equipment - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.69	1.94	2.10	0.00		0.17	0.17		0.17	0.17		207.29		0.06		208.60
Total	0.69	1.94	2.10	0.00		0.17	0.17		0.17	0.17		207.29		0.06		208.60

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.7 Welding Equipment - 2014

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.69	1.94	2.10	0.00		0.17	0.17		0.17	0.17	0.00	207.29		0.06		208.60
Total	0.69	1.94	2.10	0.00		0.17	0.17		0.17	0.17	0.00	207.29		0.06		208.60

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.8 Paving Equipment - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.82	4.98	3.13	0.00		0.43	0.43		0.43	0.43		435.20		0.07		436.75
Total	0.82	4.98	3.13	0.00		0.43	0.43		0.43	0.43		435.20		0.07		436.75

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.8 Paving Equipment - 2014

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.82	4.98	3.13	0.00		0.43	0.43		0.43	0.43	0.00	435.20		0.07		436.75
Total	0.82	4.98	3.13	0.00		0.43	0.43		0.43	0.43	0.00	435.20		0.07		436.75

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

4.0 Mobile Detail

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Unmitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

4.2 Trip Summary Information

Land Use	Average Daily Trip Rate			Unmitigated Annual VMT	Mitigated Annual VMT
	Weekday	Saturday	Sunday		
User Defined Industrial	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

Land Use	Miles			Trip %		
	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW
User Defined Industrial	9.50	7.30	7.30	0.00	0.00	0.00

5.0 Energy Detail

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NaturalGas Unmitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	lb/day															
User Defined Industrial	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	lb/day															
User Defined Industrial	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00	0.00	0.00

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Mitigated	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Unmitigated	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.00					0.00	0.00		0.00	0.00						0.00
Consumer Products	0.00					0.00	0.00		0.00	0.00						0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.00					0.00	0.00		0.00	0.00						0.00
Consumer Products	0.00					0.00	0.00		0.00	0.00						0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Vegetation

Tanks
South Coast Air Basin, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric
User Defined Industrial	1	User Defined Unit

1.2 Other Project Characteristics

Urbanization	Urban	Wind Speed (m/s)	2.2	Utility Company	Southern California Edison
Climate Zone	9	Precipitation Freq (Days)	31		

1.3 User Entered Comments

Project Characteristics -
Land Use - Oxy Site Acreage
Construction Phase - Tanks
Off-road Equipment - Manlift 2013
Off-road Equipment - Manlift 2014
Trips and VMT - no on-road estimated

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day															
2013	0.46	1.46	1.39	0.00	0.00	0.12	0.12	0.00	0.12	0.12	0.00	156.62	0.00	0.04	0.00	157.49
2014	0.42	1.40	1.34	0.00	0.00	0.11	0.11	0.00	0.11	0.11	0.00	156.62	0.00	0.04	0.00	157.40
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day															
2013	0.46	1.46	1.39	0.00	0.00	0.12	0.12	0.00	0.12	0.12	0.00	156.62	0.00	0.04	0.00	157.49
2014	0.42	1.40	1.34	0.00	0.00	0.11	0.11	0.00	0.11	0.11	0.00	156.62	0.00	0.04	0.00	157.40
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Energy	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00	0.00	0.00
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00	0.00	0.00

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Energy	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00	0.00	0.00
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00	0.00	0.00

3.0 Construction Detail

3.1 Mitigation Measures Construction

3.2 Manlift - 2013

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.46	1.46	1.39	0.00		0.12	0.12		0.12	0.12		156.62		0.04		157.49
Total	0.46	1.46	1.39	0.00		0.12	0.12		0.12	0.12		156.62		0.04		157.49

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.2 Manlift - 2013

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.46	1.46	1.39	0.00		0.12	0.12		0.12	0.12	0.00	156.62		0.04		157.49
Total	0.46	1.46	1.39	0.00		0.12	0.12		0.12	0.12	0.00	156.62		0.04		157.49

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.3 Manlift2 - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.42	1.40	1.34	0.00		0.11	0.11		0.11	0.11		156.62		0.04		157.40
Total	0.42	1.40	1.34	0.00		0.11	0.11		0.11	0.11		156.62		0.04		157.40

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.3 Manlift2 - 2014

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Off-Road	0.42	1.40	1.34	0.00		0.11	0.11		0.11	0.11	0.00	156.62		0.04		157.40
Total	0.42	1.40	1.34	0.00		0.11	0.11		0.11	0.11	0.00	156.62		0.04		157.40

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

4.0 Mobile Detail

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Unmitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

4.2 Trip Summary Information

Land Use	Average Daily Trip Rate			Unmitigated Annual VMT	Mitigated Annual VMT
	Weekday	Saturday	Sunday		
User Defined Industrial	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

Land Use	Miles			Trip %		
	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW
User Defined Industrial	9.50	7.30	7.30	0.00	0.00	0.00

5.0 Energy Detail

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NaturalGas Unmitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	lb/day															
User Defined Industrial	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU																
User Defined Industrial	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00	0.00	0.00

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category																
Mitigated	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Unmitigated	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.00					0.00	0.00		0.00	0.00						0.00
Consumer Products	0.00					0.00	0.00		0.00	0.00						0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.00					0.00	0.00		0.00	0.00						0.00
Consumer Products	0.00					0.00	0.00		0.00	0.00						0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Vegetation

SCE
South Coast Air Basin, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric
User Defined Industrial	1	User Defined Unit

1.2 Other Project Characteristics

Urbanization	Urban	Wind Speed (m/s)	2.2	Utility Company	Southern California Edison
Climate Zone	9	Precipitation Freq (Days)	31		

1.3 User Entered Comments

- Project Characteristics -
- Land Use - SCE
- Construction Phase -
- Off-road Equipment - Boring Machine
- Off-road Equipment - Cuttings Separation
- Off-road Equipment - Pavers
- Off-road Equipment - SCE

Off-road Equipment - Slurry Pump
 Off-road Equipment - Water Pump
 Trips and VMT - no on-road estimated

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day															
2013	1.30	6.67	4.04	0.01	0.00	0.58	0.58	0.00	0.58	0.58	0.00	622.46	0.00	0.12	0.00	624.92
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day															
2013	1.30	6.67	4.04	0.01	0.00	0.58	0.58	0.00	0.58	0.58	0.00	622.46	0.00	0.12	0.00	624.92
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Energy	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00	0.00	0.00
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00	0.00	0.00

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Energy	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00	0.00	0.00
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00	0.00	0.00

3.0 Construction Detail

3.1 Mitigation Measures Construction

3.2 Boring Machine - 2013

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Fugitive Dust					0.00	0.00	0.00	0.00	0.00	0.00						0.00
Off-Road	0.36	3.66	3.75	0.01		0.20	0.20		0.20	0.20		615.85		0.03		616.51
Total	0.36	3.66	3.75	0.01	0.00	0.20	0.20	0.00	0.20	0.20		615.85		0.03		616.51

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.2 Boring Machine - 2013

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Fugitive Dust					0.00	0.00	0.00	0.00	0.00	0.00						0.00
Off-Road	0.36	3.66	3.75	0.01		0.20	0.20		0.20	0.20	0.00	615.85		0.03		616.51
Total	0.36	3.66	3.75	0.01	0.00	0.20	0.20	0.00	0.20	0.20	0.00	615.85		0.03		616.51

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.3 Paver - 2013

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Fugitive Dust					0.00	0.00	0.00	0.00	0.00	0.00						0.00
Off-Road	1.11	6.67	4.04	0.01		0.58	0.58		0.58	0.58		552.57		0.10		554.65
Total	1.11	6.67	4.04	0.01	0.00	0.58	0.58	0.00	0.58	0.58		552.57		0.10		554.65

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.3 Paver - 2013

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Fugitive Dust					0.00	0.00	0.00	0.00	0.00	0.00						0.00
Off-Road	1.11	6.67	4.04	0.01		0.58	0.58		0.58	0.58	0.00	552.57		0.10		554.65
Total	1.11	6.67	4.04	0.01	0.00	0.58	0.58	0.00	0.58	0.58	0.00	552.57		0.10		554.65

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.4 Water Pump - 2013

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Fugitive Dust					0.00	0.00	0.00	0.00	0.00	0.00						0.00
Off-Road	0.90	6.09	3.97	0.01		0.49	0.49		0.49	0.49		622.46		0.08		624.17
Total	0.90	6.09	3.97	0.01	0.00	0.49	0.49	0.00	0.49	0.49		622.46		0.08		624.17

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.4 Water Pump - 2013

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Fugitive Dust					0.00	0.00	0.00	0.00	0.00	0.00						0.00
Off-Road	0.90	6.09	3.97	0.01		0.49	0.49		0.49	0.49	0.00	622.46		0.08		624.17
Total	0.90	6.09	3.97	0.01	0.00	0.49	0.49	0.00	0.49	0.49	0.00	622.46		0.08		624.17

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.5 Cutting Separation Equipment - 2013

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Fugitive Dust					0.00	0.00	0.00	0.00	0.00	0.00						0.00
Off-Road	1.30	3.02	3.65	0.00		0.31	0.31		0.31	0.31		295.41		0.12		297.87
Total	1.30	3.02	3.65	0.00	0.00	0.31	0.31	0.00	0.31	0.31		295.41		0.12		297.87

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.5 Cutting Separation Equipment - 2013

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Fugitive Dust					0.00	0.00	0.00	0.00	0.00	0.00						0.00
Off-Road	1.30	3.02	3.65	0.00		0.31	0.31		0.31	0.31	0.00	295.41		0.12		297.87
Total	1.30	3.02	3.65	0.00	0.00	0.31	0.31	0.00	0.31	0.31	0.00	295.41		0.12		297.87

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.6 Slurry Pump - 2013

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Fugitive Dust					0.00	0.00	0.00	0.00	0.00	0.00						0.00
Off-Road	0.90	6.09	3.97	0.01		0.49	0.49		0.49	0.49		622.46		0.08		624.17
Total	0.90	6.09	3.97	0.01	0.00	0.49	0.49	0.00	0.49	0.49		622.46		0.08		624.17

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

3.6 Slurry Pump - 2013

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Fugitive Dust					0.00	0.00	0.00	0.00	0.00	0.00						0.00
Off-Road	0.90	6.09	3.97	0.01		0.49	0.49		0.49	0.49	0.00	622.46		0.08		624.17
Total	0.90	6.09	3.97	0.01	0.00	0.49	0.49	0.00	0.49	0.49	0.00	622.46		0.08		624.17

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

4.0 Mobile Detail

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unmitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

4.2 Trip Summary Information

Land Use	Average Daily Trip Rate			Unmitigated	Mitigated
	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
User Defined Industrial	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

Land Use	Miles			Trip %	
	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C
User Defined Industrial	9.50	7.30	7.30	0.00	0.00

5.0 Energy Detail

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NaturalGas Unmitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	lb/day															
User Defined Industrial	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00	0.00	0.00

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	lb/day															
User Defined Industrial	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00	0.00	0.00

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Mitigated	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Unmitigated	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.00					0.00	0.00		0.00	0.00						0.00
Consumer Products	0.00					0.00	0.00		0.00	0.00						0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.00					0.00	0.00		0.00	0.00						0.00
Consumer Products	0.00					0.00	0.00		0.00	0.00						0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Vegetation

Dust
South Coast Air Basin, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric
User Defined Industrial	1	User Defined Unit

1.2 Other Project Characteristics

Urbanization	Urban	Wind Speed (m/s)	2.2	Utility Company	Southern California Edison
Climate Zone	9	Precipitation Freq (Days)	31		

1.3 User Entered Comments

Project Characteristics -
Land Use - Oxy site acreage
Construction Phase - Demolition dust; period is define by trucks needed to haul material
Off-road Equipment - Dumy default
Trips and VMT - no on-road estimated
Demolition -
Off-road Equipment - one dozer

Construction Off-road Equipment Mitigation -

2.0 Emissions Summary**2.1 Overall Construction (Maximum Daily Emission)****Unmitigated Construction**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day															
2013	2.56	21.80	11.36	0.02	6.02	0.90	6.93	3.31	0.90	4.21	0.00	2,115.13	0.00	0.23	0.00	2,119.98
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day															
2013	2.56	21.80	11.36	0.02	2.35	0.90	3.25	1.29	0.90	2.20	0.00	2,115.13	0.00	0.23	0.00	2,119.98
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Energy	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00	0.00	0.00
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00	0.00	0.00

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Energy	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00	0.00	0.00
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00	0.00	0.00

3.0 Construction Detail

3.1 Mitigation Measures Construction

Water Exposed Area

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling					0.00	0.00	0.00	0.00	0.00	0.00						0.00
Vendor					0.00	0.00	0.00	0.00	0.00	0.00						0.00
Worker					0.00	0.00	0.00	0.00	0.00	0.00						0.00
Total					0.00	0.00	0.00	0.00	0.00	0.00						0.00

3.2 Demo Dust - 2013

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					5.19	0.00	5.19	0.00	0.00	0.00						0.00
Total					5.19	0.00	5.19	0.00	0.00	0.00						0.00

3.2 Demo Dust - 2013

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Fugitive Dust					2.02	0.00	2.02	0.00	0.00	0.00						0.00
Total					2.02	0.00	2.02	0.00	0.00	0.00						0.00

3.3 Rubber Tired Dozers - 2013

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Fugitive Dust					6.02	0.00	6.02	3.31	0.00	3.31						0.00
Off-Road	2.56	21.80	11.36	0.02		0.90	0.90		0.90	0.90		2,115.13		0.23		2,119.98
Total	2.56	21.80	11.36	0.02	6.02	0.90	6.92	3.31	0.90	4.21		2,115.13		0.23		2,119.98

3.3 Rubber Tired Dozers - 2013

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day											lb/day				
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day											lb/day				
Fugitive Dust					2.35	0.00	2.35	1.29	0.00	1.29						0.00
Off-Road	2.56	21.80	11.36	0.02		0.90	0.90		0.90	0.90	0.00	2,115.13		0.23		2,119.98
Total	2.56	21.80	11.36	0.02	2.35	0.90	3.25	1.29	0.90	2.19	0.00	2,115.13		0.23		2,119.98

3.3 Rubber Tired Dozers - 2013

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day											lb/day				
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

4.0 Mobile Detail

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Unmitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

4.2 Trip Summary Information

Land Use	Average Daily Trip Rate			Unmitigated Annual VMT	Mitigated Annual VMT
	Weekday	Saturday	Sunday		
User Defined Industrial	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

Land Use	Miles			Trip %		
	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW
User Defined Industrial	9.50	7.30	7.30	0.00	0.00	0.00

5.0 Energy Detail

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NaturalGas Unmitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	lb/day										lb/day					
User Defined Industrial	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.2 Energy by Land Use - NaturalGas

Mitigated

Land Use	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	kBTU																
User Defined Industrial	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00	0.00	0.00

6.0 Area Detail

6.1 Mitigation Measures Area

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Mitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unmitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.00					0.00	0.00		0.00	0.00						0.00
Consumer Products	0.00					0.00	0.00		0.00	0.00						0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.00					0.00	0.00		0.00	0.00						0.00
Consumer Products	0.00					0.00	0.00		0.00	0.00						0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Vegetation

Vehicles
South Coast Air Basin, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric
User Defined Industrial	1	User Defined Unit

1.2 Other Project Characteristics

Urbanization	Urban	Wind Speed (m/s)	2.2	Utility Company	Southern California Edison
Climate Zone	9	Precipitation Freq (Days)	31		

1.3 User Entered Comments

- Project Characteristics -
- Land Use - Oxy acreage
- Construction Phase -
- Trips and VMT - vehicle trips
- Off-road Equipment - no on-road estimated

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day															
2013	0.62	5.44	4.05	0.01	2.59	0.24	2.83	0.01	0.22	0.23	0.00	1,024.71	0.00	0.04	0.00	1,025.48
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day															
2013	0.62	5.44	4.05	0.01	0.04	0.24	0.28	0.01	0.22	0.23	0.00	1,024.71	0.00	0.04	0.00	1,025.48
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Energy	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00	0.00	0.00
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00	0.00	0.00

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Energy	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00	0.00	0.00
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00	0.00	0.00

3.0 Construction Detail

3.1 Mitigation Measures Construction

3.2 Vehicles - 2013

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Fugitive Dust					0.00	0.00	0.00	0.00	0.00	0.00						0.00
Off-Road	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.52	5.34	2.89	0.01	2.35	0.23	2.59	0.01	0.21	0.22		831.63		0.03		832.17
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.10	0.10	1.16	0.00	0.23	0.01	0.24	0.00	0.01	0.01		193.08		0.01		193.31
Total	0.62	5.44	4.05	0.01	2.58	0.24	2.83	0.01	0.22	0.23		1,024.71		0.04		1,025.48

3.2 Vehicles - 2013

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Fugitive Dust					0.00	0.00	0.00	0.00	0.00	0.00						0.00
Off-Road	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.52	5.34	2.89	0.01	0.03	0.23	0.26	0.01	0.21	0.22		831.63		0.03		832.17
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.10	0.10	1.16	0.00	0.01	0.01	0.02	0.00	0.01	0.01		193.08		0.01		193.31
Total	0.62	5.44	4.05	0.01	0.04	0.24	0.28	0.01	0.22	0.23		1,024.71		0.04		1,025.48

4.0 Mobile Detail

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unmitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

4.2 Trip Summary Information

Land Use	Average Daily Trip Rate			Unmitigated	Mitigated
	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
User Defined Industrial	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

Land Use	Miles			Trip %	
	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C
User Defined Industrial	9.50	7.30	7.30	0.00	0.00

5.0 Energy Detail

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NaturalGas Unmitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	lb/day															
User Defined Industrial	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00	0.00	0.00

5.2 Energy by Land Use - NaturalGas

Mitigated

Land Use	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	kBTU																
User Defined Industrial	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00	0.00	0.00

6.0 Area Detail

6.1 Mitigation Measures Area

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Mitigated	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Unmitigated	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.00					0.00	0.00		0.00	0.00						0.00
Consumer Products	0.00					0.00	0.00		0.00	0.00						0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.00					0.00	0.00		0.00	0.00						0.00
Consumer Products	0.00					0.00	0.00		0.00	0.00						0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Vegetation

Vehicles 2014
South Coast Air Basin, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric
User Defined Industrial	1	User Defined Unit

1.2 Other Project Characteristics

Urbanization	Urban	Wind Speed (m/s)	2.2	Utility Company	Southern California Edison
Climate Zone	9	Precipitation Freq (Days)	31		

1.3 User Entered Comments

- Project Characteristics -
- Land Use - Oxy acreage
- Construction Phase -
- Trips and VMT - vehicle trips
- Off-road Equipment - no off-road estimated

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day															
2014	0.56	4.86	3.67	0.01	2.59	0.21	2.80	0.01	0.19	0.21	0.00	1,024.09	0.00	0.03	0.00	1,024.79
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day															
2014	0.56	4.86	3.67	0.01	0.04	0.21	0.25	0.01	0.19	0.21	0.00	1,024.09	0.00	0.03	0.00	1,024.79
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Energy	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00	0.00	0.00
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00	0.00	0.00

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Energy	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00	0.00	0.00
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00	0.00	0.00

3.0 Construction Detail

3.1 Mitigation Measures Construction

3.2 Vehicles - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Fugitive Dust					0.00	0.00	0.00	0.00	0.00	0.00						0.00
Off-Road	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.47	4.77	2.60	0.01	2.35	0.20	2.56	0.01	0.19	0.20		834.36		0.02		834.84
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.09	0.09	1.07	0.00	0.23	0.01	0.24	0.00	0.01	0.01		189.72		0.01		189.94
Total	0.56	4.86	3.67	0.01	2.58	0.21	2.80	0.01	0.20	0.21		1,024.08		0.03		1,024.78

3.2 Vehicles - 2014

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Fugitive Dust					0.00	0.00	0.00	0.00	0.00	0.00						0.00
Off-Road	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Hauling	0.47	4.77	2.60	0.01	0.03	0.20	0.23	0.01	0.19	0.20		834.36		0.02		834.84
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00
Worker	0.09	0.09	1.07	0.00	0.01	0.01	0.02	0.00	0.01	0.01		189.72		0.01		189.94
Total	0.56	4.86	3.67	0.01	0.04	0.21	0.25	0.01	0.20	0.21		1,024.08		0.03		1,024.78

4.0 Mobile Detail

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unmitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
User Defined Industrial	0.00	0.00	0.00	-	-
Total	0.00	0.00	0.00		

4.3 Trip Type Information

Land Use	Miles			Trip %		
	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW
User Defined Industrial	9.50	7.30	7.30	0.00	0.00	0.00

5.0 Energy Detail

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NaturalGas Unmitigated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	lb/day															
User Defined Industrial	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	lb/day															
User Defined Industrial	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00	0.00	0.00

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day															
Mitigated	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Unmitigated	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.00					0.00	0.00		0.00	0.00						0.00
Consumer Products	0.00					0.00	0.00		0.00	0.00						0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.00					0.00	0.00		0.00	0.00						0.00
Consumer Products	0.00					0.00	0.00		0.00	0.00						0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00
Total	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00		0.00		0.00		0.00

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Vegetation

On-site water truck emissions

CY	Emissions (lb/day)									
	ROG	CO	NOx	CO2	SO2	PM10exh	PM10tire	PM10brk	PM10dust	CH4
2013	0.041	0.067	0.129	17.442	0.000	0.008	0.000	0.000	0.438	0.002
2014	0.036	0.060	0.113	17.442	0.000	0.006	0.000	0.000	0.438	0.002

Unpaved Road Dust (AP-42, Chapter 13.2.2)

$$E = k * (s/12)^a * (W/3)^b$$

E = size-specific emission factor (lb/VMT)

s = sfc material silt content (%)

W = mean vehicle weight (tons)

For industrial roads,

PM10 PM2.5

k = 1.5 0.15 (lb/VMT)

a = 0.9 0.9

b = 0.45 0.45

For construction sites,

s = 8.50%

For Class 8 HHD,

W = 23.25

Assume on-site travel for water trucks is at 5mph

2 hours/day of operation

2204.6 grams/lb (conversion factor)

MPH	Emission Factors (g/mile)									
	ROG	CO	NOx	CO2	SO2	PM10exh	PM10tire	PM10brk	CH4	
0	10.794	45.978	114.9	6,617	0.063	1.292	0	0	0.501	
5	8.935	14.76	28.358	3,845	0.037	1.674	0.036	0.028	0.415	
10	4.945	10.392	19.767	3,165	0.03	1.145	0.036	0.028	0.23	
15	2.358	7.22	14.38	2,596	0.025	0.757	0.036	0.028	0.11	
20	1.272	5.358	12.182	2,183	0.021	0.535	0.036	0.028	0.059	
25	1.036	4.602	11.533	2,043	0.02	0.453	0.036	0.028	0.048	
30	0.847	3.972	11.009	1,924	0.018	0.395	0.036	0.028	0.039	
35	0.705	3.467	10.609	1,828	0.017	0.359	0.036	0.028	0.033	
40	0.61	3.088	10.334	1,753	0.017	0.347	0.036	0.028	0.028	
45	0.562	2.834	10.183	1,701	0.016	0.358	0.036	0.028	0.026	
50	0.56	2.706	10.158	1,671	0.016	0.392	0.036	0.028	0.026	
55	0.605	2.704	10.257	1,662	0.016	0.449	0.036	0.028	0.028	
60	0.697	2.827	10.48	1,676	0.016	0.529	0.036	0.028	0.032	
65	0.836	3.077	10.829	1,712	0.016	0.633	0.036	0.028	0.039	

MPH	Emission Factors (g/mile)									
	ROG	CO	NOx	CO2	SO2	PM10exh	PM10tire	PM10brk	CH4	
0	10.314	45.306	116.22	6,617	0.063	1.14	0	0	0.479	
5	7.951	13.294	24.929	3,845	0.037	1.392	0.036	0.028	0.369	
10	4.391	9.224	17.465	3,165	0.03	0.957	0.036	0.028	0.204	
15	2.091	6.309	12.745	2,596	0.025	0.637	0.036	0.028	0.097	
20	1.135	4.653	10.764	2,183	0.021	0.453	0.036	0.028	0.053	
25	0.929	4.021	10.151	2,043	0.02	0.386	0.036	0.028	0.043	
30	0.763	3.496	9.653	1,924	0.018	0.339	0.036	0.028	0.035	
35	0.637	3.08	9.27	1,828	0.017	0.311	0.036	0.028	0.03	
40	0.552	2.772	9.002	1,753	0.017	0.304	0.036	0.028	0.026	
45	0.506	2.571	8.849	1,701	0.016	0.316	0.036	0.028	0.024	
50	0.501	2.479	8.81	1,671	0.016	0.347	0.036	0.028	0.023	
55	0.536	2.495	8.887	1,662	0.016	0.399	0.036	0.028	0.025	
60	0.61	2.618	9.079	1,676	0.016	0.47	0.036	0.028	0.028	
65	0.725	2.849	9.386	1,712	0.016	0.561	0.036	0.028	0.034	

Table A-9(a). Unit emissions for construction equipment

Off-Road Equipment	Bio- CO2	NBio- CO2	CH4	N2O	CO2e	HP	Modeled As...
2013 lb/day/unit Emissions ⁽¹⁾							
Excavator	0.00	600.41	0.06	0.00	601.63	157	Excavators
Loader	0.00	276.76	0.03	0.00	277.45	75	Tractors/Loaders/Backhoes
Ram Hoe	0.00	276.76	0.03	0.00	277.45	75	Tractors/Loaders/Backhoes
Backhoe	0.00	276.76	0.03	0.00	277.45	75	Tractors/Loaders/Backhoes
Pump	0.00	417.05	0.05	0.00	418.19	84	Pumps
Boring Machine	0.00	412.62	0.02	0.00	413.06	82	Bore/Drill Rigs
Trackhoe	0.00	276.76	0.03	0.00	277.45	75	Tractors/Loaders/Backhoes
Roller	0.00	315.60	0.05	0.00	316.60	84	Rollers
Water Truck ⁽²⁾	0.00	17.44	0.00	0.00	17.48	N/A	EMFAC HHDT at 5mph
Plate Compactor	0.00	23.08	0.00	0.00	23.13	8	Plate Compactors
Crane	0.00	600.08	0.05	0.00	601.12	208	Cranes
Generator	0.00	417.05	0.05	0.00	418.15	84	Generator Sets
Forklift	0.00	299.91	0.03	0.00	300.47	149	Forklifts
Air Compressor	0.00	251.20	0.04	0.00	252.01	78	Air Compressors
Welder	0.00	138.88	0.05	0.00	139.86	46	Welders
Paver	0.00	370.22	0.07	0.00	371.62	89	Paver
Dozer	0.00	1,417.14	0.15	0.00	1,420.39	358	Rubber Tired Dozers
Cuttings Separation	0.00	197.92	0.08	0.00	199.57	50	Other Material Handling Equipment
Manlift	0.00	104.94	0.03	0.00	105.52	34	Aerial Lifts
2014							
Water Truck ⁽²⁾	0.00	17.44	0.00	0.00	17.48	N/A	EMFAC HHDT at 5mph
Crane	0.00	600.08	0.05	0.00	601.06	208	Cranes
Generator	0.00	417.05	0.05	0.00	418.05	84	Generator Sets
Forklift	0.00	299.91	0.03	0.00	300.43	149	Forklifts
Air Compressor	0.00	251.20	0.03	0.00	251.95	78	Air Compressors
Welder	0.00	138.88	0.04	0.00	139.76	46	Welders
Paving Equipment	0.00	291.58	0.05	0.00	292.62	82	Paving Equipment
Manlift	0.00	104.94	0.03	0.00	105.46	34	Aerial Lifts

Notes:

- (1) Exhaust emissions (i.e. excluding dust) are reduced by 33% to correct for a load factor overestimate in CalEEMod
 (2) EMFAC 2007, v2.3, SCAB average for 2013 and 2014, 70F and 40% RH; water trucks are modeled as HHDT traveling at 5mph on-site

Table A-9(b). Unit emissions for vehicles

Off-site Hauler / HHD	Bio- CO2	NBio- CO2	CH4	N2O	CO2e
2013	lb/10-trips Emissions ⁽¹⁾				
Pick up (10 trips)	0.00	166.33	0.01	0.00	166.43
2014					
Pick up (10 trips)	0.00	166.87	0.00	0.00	166.97

Off-site Worker Commute / Gas LDA	Bio- CO2	NBio- CO2	CH4	N2O	CO2e
2013	lb/trip Emissions ⁽¹⁾				
Off-Site Commute	0.00	21.45	0.00	0.00	21.48
2014					
Off-Site Commute	0.00	21.08	0.00	0.00	21.10

Notes:

(1) On-road vehicle emissions are scaled according to the number of trips modeled: (a) Emissions for delivery / hauling trucks were estimated for 100 trips to address CalEEMod's insensitivity to small unit emissions; note that hauling truck emissions are presented for 10 trips. (b) Emissions for workers commute were estimated for 18 trips by CalEEMod default. Vehicle emissions are also multiplied by 2 to account for round-trips

Appendix C

Table A-10. Oxy Construction On-Site GHG Emissions

Location & Activities	2013 Annual Emissions (lb/yr)					2014 Annual Emissions (lb/yr)				
	Bio- CO2	NBio- CO2	CH4	N2O	CO2e	Bio- CO2	NBio- CO2	CH4	N2O	CO2e
Demolition / Site Preparation										
On Excavator	0	60,041	6.03	0.00	60,163	0	0	0.00	0.00	0
On Loader	0	27,676	3.35	0.00	27,745	0	0	0.00	0.00	0
On Ram Hoe	0	55,351	6.70	0.00	55,491	0	0	0.00	0.00	0
On Backhoe	0	27,676	3.35	0.00	27,745	0	0	0.00	0.00	0
Off Pickup Truck	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Water Truck	0	1,308	0.14	0.00	1,311	0	0	0.00	0.00	0
Delivery Trucks										
Off Building Walls - Dump Truck	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Building Floors - Dump Truck	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Building Roof - Dump Truck	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Parking Areas - Dump Truck	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Misc Materials - Dump Truck	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Well Cellars / Wall										
On Trackhoe	0	6,919	0.84	0.00	6,936	0	0	0.00	0.00	0
On Loader	0	6,919	0.84	0.00	6,936	0	0	0.00	0.00	0
On Dozer (not used)	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Roller	0	15,780	2.35	0.00	15,830	0	0	0.00	0.00	0
On Backhoe	0	6,919	0.84	0.00	6,936	0	0	0.00	0.00	0
On Water Truck	0	349	0.04	0.00	350	0	0	0.00	0.00	0
On Plate Compactors	0	1,154	0.00	0.00	1,156	0	0	0.00	0.00	0
On Cranes	0	144,019	11.26	0.00	144,270	0	0	0.00	0.00	0
On Generator	0	50,046	6.43	0.00	50,178	0	0	0.00	0.00	0
On Forklift	0	35,989	3.22	0.00	36,056	0	0	0.00	0.00	0
On Air Compressor	0	20,096	3.22	0.00	20,161	0	0	0.00	0.00	0
On Welding Equipment (Diesel)	0	6,944	2.35	0.00	6,993	0	0	0.00	0.00	0
Off Pick-up	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Process Equipment Areas										
On Trackhoe	0	55,351	6.70	0.00	55,491	0	0	0.00	0.00	0
On Loader	0	55,351	6.70	0.00	55,491	0	0	0.00	0.00	0
On Dozer	0	28,343	3.08	0.00	28,408	0	0	0.00	0.00	0
On Roller	0	18,936	2.81	0.00	18,996	0	0	0.00	0.00	0
On Backhoe	0	5,535	0.67	0.00	5,549	0	0	0.00	0.00	0
On Paving Equipment	0	0	0.00	0.00	0	0	7,290	1.17	0.00	7,316
On Water Truck	0	2,965	0.32	0.00	2,972	0	1,395	0.13	0.00	1,398
On Plate Compactors	0	4,039	0.00	0.00	4,047	0	0	0.00	0.00	0
On Cranes	0	174,023	13.60	0.00	174,326	0	126,017	9.85	0.00	126,222
On Generator	0	60,472	7.77	0.00	60,631	0	43,790	4.92	0.00	43,896
On Forklift	0	43,486	3.89	0.00	43,568	0	31,490	2.81	0.00	31,545
On Air Compressor	0	20,096	3.22	0.00	20,161	0	11,304	1.51	0.00	11,338
On Welding Equipment (Diesel)	0	5,555	1.88	0.00	5,594	0	15,277	4.42	0.00	15,374
Off Pick-up	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Delivery Trucks										
Off Pipe - Flatbed	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Process Vessels - Flatbed	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Storage Vessels - Flatbed	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Compressors & Blowers - Flatbed	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Pumps - Flatbed	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Solids Separation Equip. - Flatbed	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Process Heaters - Flatbed	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Heat Exchangers - Flatbed	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Package Units - Flatbed	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Miscellaneous Equipment - Flatbed	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Tanks (4) - Flatbed	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Electrical Equipment - Flatbed	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off MCC Building - Flatbed	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Control Room Material - Flatbed	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Maintenance Building Material - Flatbed	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Misc Materials - Flatbed	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Tanks										
On Automatic Floor Welder	0	16,666	5.63	0.00	16,783	0	5,555	1.61	0.00	5,590
On Automatic Horizontal Seam Welder	0	16,666	5.63	0.00	16,783	0	5,555	1.61	0.00	5,590
On Crane	0	72,009	5.63	0.00	72,135	0	24,003	1.88	0.00	24,042
On Manlift	0	12,592	3.22	0.00	12,662	0	4,197	1.07	0.00	4,218
On Welding Equipment (Diesel)	0	16,666	5.63	0.00	16,783	0	5,555	1.61	0.00	5,590
Off Pick-up	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Construction Matieral Delivery Trucks										
Off Earth - Dump Truck	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Concrete - Cement Mixer Truck	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Steel - Flatbed	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Paving - Dump Truck	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Construction Equipment - Flatbed	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Misc Materials - Dump Truck	0	0	0.00	0.00	0	0	0	0.00	0.00	0

Appendix C

Table A-10. Oxy Construction On-Site GHG Emissions

Location & Activities	2013 Annual Emissions (lb/yr)					2014 Annual Emissions (lb/yr)				
	Bio- CO2	NBio- CO2	CH4	N2O	CO2e	Bio- CO2	NBio- CO2	CH4	N2O	CO2e
Pipeline Construction										
On Crane	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Dump Trucks	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Generator set	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Sideboom	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Tractor/loader/backhoe	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Welders	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Delivery Trucks	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Crane - Truck	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Generator set - pickup	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Sideboom - pickup	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Tractor/loader/backhoe - pickup	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Welders - pickup	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Pipeline Repairs										
On Crane	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Dump Trucks	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Generator set	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Sideboom	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Tractor/loader/backhoe	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Welders	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Delivery Trucks	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Crane - Truck	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Generator set - pickup	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Sideboom - pickup	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Tractor/loader/backhoe - pickup	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Welders - pickup	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off-Site SCE Construction										
Off Loader	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Roller	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Backhoe	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Paver	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Plate Compactors	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Cranes	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Boring Machine (not used)	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Generator	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Air Compressor	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Welding Equipment (Diesel)	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Pick-up	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off-Site Equipment -HDD Section										
Off Boring Machine	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Water pump	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Slurry Mixing Tank	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Cuttings Separation Equipment	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Slurry Pump	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Cuttings settlement tank	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Backhoe	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Cranes	0	0	0.00	0.00	0	0	0	0.00	0.00	0
SCE Construction Delivery Trucks										
Off Electrical Equipment - Flatbed	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off MCC Building - Flatbed	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Baker Tanks	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Misc Materials - Flatbed	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Earth	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Concrete	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Steel	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Gravel	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Construction Equipment	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Misc Materials	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On-Site SCE Construction										
On Loader	0	2,768	0.34	0.00	2,775	0	0	0.00	0.00	0
On Backhoe	0	2,768	0.34	0.00	2,775	0	0	0.00	0.00	0
On Plate Compactors	0	231	0.00	0.00	231	0	0	0.00	0.00	0
On Cranes	0	6,001	0.47	0.00	6,011	0	0	0.00	0.00	0
On Generator	0	6,256	0.80	0.00	6,272	0	0	0.00	0.00	0
On Air Compressor	0	3,768	0.60	0.00	3,780	0	0	0.00	0.00	0
On Welding Equipment (Diesel)	0	2,778	0.94	0.00	2,797	0	0	0.00	0.00	0
Off Pick-up	0	0	0.00	0.00	0	0	0	0.00	0.00	0

Appendix C

Table A-11. Oxy Construction Off-Site GHG Emissions

Location & Activities	2013 Annual Emissions (lb/yr)					2014 Annual Emissions (lb/yr)				
	Bio- CO2	NBio- CO2	CH4	N2O	CO2e	Bio- CO2	NBio- CO2	CH4	N2O	CO2e
Demolition / Site Preparation										
On Excavator	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Loader	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Ram Hoe	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Backhoe	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Pickup Truck	0	2,495	0.09	0.00	2,497	0	0	0.00	0.00	0
On Water Truck	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Delivery Trucks										
Off Building Walls - Dump Truck	0	14,470	0.52	0.00	14,480	0	0	0.00	0.00	0
Off Building Floors - Dump Truck	0	30,022	1.08	0.00	30,041	0	0	0.00	0.00	0
Off Building Roof - Dump Truck	0	1,580	0.06	0.00	1,581	0	0	0.00	0.00	0
Off Parking Areas - Dump Truck	0	54,721	1.97	0.00	54,757	0	0	0.00	0.00	0
Off Misc Materials - Dump Truck	0	10,063	0.36	0.00	10,069	0	0	0.00	0.00	0
Well Cellars / Wall										
On Trackhoe	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Loader	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Dozer (not used)	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Roller	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Backhoe	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Water Truck	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Plate Compactors	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Cranes	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Generator	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Forklift	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Air Compressor	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Welding Equipment (Diesel)	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Pick-up	0	4,158	0.15	0.00	4,161	0	0	0.00	0.00	0
Process Equipment Areas										
On Trackhoe	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Loader	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Dozer	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Roller	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Backhoe	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Paving Equipment	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Water Truck	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Plate Compactors	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Cranes	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Generator	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Forklift	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Air Compressor	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Welding Equipment (Diesel)	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Pick-up	0	11,144	0.40	0.00	11,151	0	7,175	0.17	0.00	7,180
Delivery Trucks										
Off Pipe - Flatbed	0	2,578	0.09	0.00	2,580	0	0	0.00	0.00	0
Off Process Vessels - Flatbed	0	2,162	0.08	0.00	2,164	0	0	0.00	0.00	0
Off Storage Vessels - Flatbed	0	249	0.01	0.00	250	0	0	0.00	0.00	0
Off Compressors & Blowers - Flatbed	0	166	0.01	0.00	166	0	0	0.00	0.00	0
Off Pumps - Flatbed	0	998	0.04	0.00	999	0	0	0.00	0.00	0
Off Solids Separation Equip. - Flatbed	0	1,247	0.05	0.00	1,248	0	0	0.00	0.00	0
Off Process Heaters - Flatbed	0	166	0.01	0.00	166	0	0	0.00	0.00	0
Off Heat Exchangers - Flatbed	0	333	0.01	0.00	333	0	0	0.00	0.00	0
Off Package Units - Flatbed	0	499	0.02	0.00	499	0	0	0.00	0.00	0
Off Miscellaneous Equipment - Flatbed	0	0	0.00	0.00	0	0	167	0.00	0.00	167
Off Tanks (4) - Flatbed	0	998	0.04	0.00	999	0	334	0.01	0.00	334
Off Electrical Equipment - Flatbed	0	832	0.03	0.00	832	0	0	0.00	0.00	0
Off MCC Building - Flatbed	0	166	0.01	0.00	166	0	0	0.00	0.00	0
Off Control Room Material - Flatbed	0	1,247	0.05	0.00	1,248	0	0	0.00	0.00	0
Off Maintenance Building Material - Flatbed	0	998	0.04	0.00	999	0	250	0.01	0.00	250
Off Misc Materials - Flatbed	0	333	0.01	0.00	333	0	1,001	0.02	0.00	1,002
Tanks										
On Automatic Floor Welder	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Automatic Horizontal Seam Welder	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Crane	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Manlift	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Welding Equipment (Diesel)	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Pick-up	0	3,992	0.14	0.00	3,994	0	1,335	0.03	0.00	1,336
Construction Material Delivery Trucks										
Off Earth - Dump Truck	0	46,405	1.67	0.00	46,435	0	0	0.00	0.00	0
Off Concrete - Cement Mixer Truck	0	36,425	1.31	0.00	36,449	0	7,009	0.17	0.00	7,013
Off Steel - Flatbed	0	2,994	0.11	0.00	2,996	0	1,752	0.04	0.00	1,753
Off Paving - Dump Truck	0	0	0.00	0.00	0	0	8,344	0.20	0.00	8,348
Off Construction Equipment - Flatbed	0	5,489	0.20	0.00	5,492	0	5,507	0.13	0.00	5,510
Off Misc Materials - Dump Truck	0	6,653	0.24	0.00	6,657	0	4,172	0.10	0.00	4,174

Appendix C

Table A-11. Oxy Construction Off-Site GHG Emissions

Location & Activities	2013 Annual Emissions (lb/yr)					2014 Annual Emissions (lb/yr)				
	Bio- CO2	NBio- CO2	CH4	N2O	CO2e	Bio- CO2	NBio- CO2	CH4	N2O	CO2e
Pipeline Construction										
On Crane	0	1,500	0.12	0.00	1,503	0	0	0.00	0.00	0
Off Dump Trucks	0	333	0.01	0.00	333	0	0	0.00	0.00	0
On Generator set	0	16,682	2.14	0.00	16,726	0	0	0.00	0.00	0
On Sideboom	0	24,003	1.88	0.00	24,045	0	0	0.00	0.00	0
On Tractor/loader/backhoe	0	2,768	0.34	0.00	2,775	0	0	0.00	0.00	0
On Welders	0	5,555	1.88	0.00	5,594	0	0	0.00	0.00	0
Delivery Trucks	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Crane - Truck	0	199	0.01	0.00	199	0	0	0.00	0.00	0
Off Generator set - pickup	0	60	0.00	0.00	60	0	0	0.00	0.00	0
Off Sideboom - pickup	0	358	0.02	0.00	358	0	0	0.00	0.00	0
Off Tractor/loader/backhoe - pickup	0	159	0.01	0.00	159	0	0	0.00	0.00	0
Off Welders - pickup	0	477	0.02	0.00	477	0	0	0.00	0.00	0
Pipeline Repairs										
On Crane	0	6,001	0.47	0.00	6,011	0	0	0.00	0.00	0
Off Dump Trucks	0	1,331	0.05	0.00	1,331	0	0	0.00	0.00	0
On Generator set	0	33,364	4.29	0.00	33,452	0	0	0.00	0.00	0
On Sideboom	0	48,006	3.75	0.00	48,090	0	0	0.00	0.00	0
On Tractor/loader/backhoe	0	5,535	0.67	0.00	5,549	0	0	0.00	0.00	0
On Welders	0	11,111	3.75	0.00	11,188	0	0	0.00	0.00	0
Delivery Trucks	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Crane - Truck	0	795	0.04	0.00	796	0	0	0.00	0.00	0
Off Generator set - pickup	0	79	0.00	0.00	80	0	0	0.00	0.00	0
Off Sideboom - pickup	0	477	0.02	0.00	477	0	0	0.00	0.00	0
Off Tractor/loader/backhoe - pickup	0	318	0.02	0.00	318	0	0	0.00	0.00	0
Off Welders - pickup	0	636	0.03	0.00	636	0	0	0.00	0.00	0
Off-Site SCE Construction										
Off Loader	0	5,535	0.67	0.00	5,549	0	0	0.00	0.00	0
Off Roller	0	4,734	0.70	0.00	4,749	0	0	0.00	0.00	0
Off Backhoe	0	5,535	0.67	0.00	5,549	0	0	0.00	0.00	0
Off Paver	0	5,553	1.01	0.00	5,574	0	0	0.00	0.00	0
Off Plate Compactors	0	692	0.00	0.00	694	0	0	0.00	0.00	0
Off Cranes	0	18,002	1.41	0.00	18,034	0	0	0.00	0.00	0
Off Boring Machine (not used)	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Generator	0	12,511	1.61	0.00	12,544	0	0	0.00	0.00	0
Off Air Compressor	0	7,536	1.21	0.00	7,560	0	0	0.00	0.00	0
Off Welding Equipment (Diesel)	0	4,167	1.41	0.00	4,196	0	0	0.00	0.00	0
Off Pick-up	0	998	0.04	0.00	999	0	0	0.00	0.00	0
Off-Site Equipment -HDD Section										
Off Boring Machine	0	12,379	0.60	0.00	12,392	0	0	0.00	0.00	0
Off Water pump	0	16,682	2.14	0.00	16,728	0	0	0.00	0.00	0
Off Slurry Mixing Tank	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Cuttings Separation Equipment	0	7,917	3.22	0.00	7,983	0	0	0.00	0.00	0
Off Slurry Pump	0	16,682	2.14	0.00	16,728	0	0	0.00	0.00	0
Off Cuttings settlement tank	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Backhoe	0	519	0.06	0.00	520	0	0	0.00	0.00	0
Off Cranes	0	6,001	0.47	0.00	6,011	0	0	0.00	0.00	0
SCE Construction Delivery Trucks										
Off Electrical Equipment - Flatbed	0	832	0.03	0.00	832	0	0	0.00	0.00	0
Off MCC Building - Flatbed	0	83	0.00	0.00	83	0	0	0.00	0.00	0
Off Baker Tanks	0	665	0.02	0.00	666	0	0	0.00	0.00	0
Off Misc Materials - Flatbed	0	166	0.01	0.00	166	0	0	0.00	0.00	0
Off Earth	0	15,053	0.54	0.00	15,062	0	0	0.00	0.00	0
Off Concrete	0	10,562	0.38	0.00	10,569	0	0	0.00	0.00	0
Off Steel	0	83	0.00	0.00	83	0	0	0.00	0.00	0
Off Gravel	0	249	0.01	0.00	250	0	0	0.00	0.00	0
Off Construction Equipment	0	2,079	0.08	0.00	2,080	0	0	0.00	0.00	0
Off Misc Materials	0	2,828	0.10	0.00	2,829	0	0	0.00	0.10	0
On-Site SCE Construction										
On Loader	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Backhoe	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Plate Compactors	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Cranes	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Generator	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Air Compressor	0	0	0.00	0.00	0	0	0	0.00	0.00	0
On Welding Equipment (Diesel)	0	0	0.00	0.00	0	0	0	0.00	0.00	0
Off Pick-up	0	665	0.02	0.00	666	0	0	0.00	0.00	0

Table A-12. Oxy Construction Summary of GHG Emissions

Summary of Emissions by Phase		2013 Annual Emissions (metric tons/yr)					2014 Annual Emissions (metric tons/yr)				
		Bio- CO2	NBio- CO2	CH4	N2O	CO2e	Bio- CO2	NBio- CO2	CH4	N2O	CO2e
Facility	Demolition / Site Preparation	0	129	0.01	0.00	130	0	0	0.00	0.00	0
	Well Cellars / Wall	0	136	0.01	0.00	136	0	0	0.00	0.00	0
	Process Equipment Areas	0	226	0.02	0.00	227	0	111	0.01	0.00	112
	Tanks	0	63	0.01	0.00	63	0	21	0.00	0.00	21
	Construction Material Delivery Trucks	0	44	0.00	0.00	44	0	12	0.00	0.00	12
	Facility Workers Commute	0	177	0.01	0.00	177	0	87	0.00	0.00	87
Facility Total		0	776	0.07	0.00	777	0	231	0.02	0.00	232
Pipeline	Pipeline Construction	0	24	0.00	0.00	24	0	0	0.00	0.00	0
	Pipeline Repairs	0	49	0.01	0.00	49	0	0	0.00	0.00	0
	Pipeline Workers Commute	0	10	0.00	0.00	10	0	0	0.00	0.00	0
	Pipeline Total	0	82	0.01	0.00	82	0	0	0.00	0.00	0
SCE	SCE Offsite Construction	0	57	0.01	0.00	57	0	0	0.00	0.00	0
	SCE Delivery	0	15	0.00	0.00	15	0	0	0.00	0.00	0
	SCE Onsite Construction	0	11	0.00	0.00	11	0	0	0.00	0.00	0
	SCE Workers Commute	0	18	0.00	0.00	18	0	0	0.00	0.00	0
SCE Total		0	101	0.01	0.00	101	0	0	0.00	0.00	0

Appendix C

OXY USA Inc. – Dominguez Oil Field Production Facility
Greenhouse Gas and Climate Change Technical Report

Appendix B

Baseline and Project Emission Estimates

Table B-1. Baseline GHG Emissions - Oil Well Workover Rig

Number of well workovers (no./yr)		Emissions (tonne/yr)
		CO ₂
2		7.35

<u>Input Data</u>	<u>Unit</u>	<u>Source</u>
Engine Size	450 hp	Engine data provided by Oxy
# of engines per rig	1 --	Engine data provided by Oxy
Engine load factor	0.19 --	The engine typically runs at approximately 100% load for 10 percent of the time and 10% load for 90% of the time, as estimated by Oxy.
Time per workover	84 hr	Estimate provided by Oxy
# of workovers per year	2 no./yr	Estimate provided by Oxy
Fuel usage	27,745 lb fuel/yr	(0.367 lb/bhp-hr)x(84 hr)x(2 event/yr)x(450 hp)
fuel usage	3,880 gallon/yr	(27,745 lb/yr)/(lb/gal)
<u>CO₂ EFs</u>		
	9.96 kg CO ₂ /gallon	CARB Regulation for the Mandatory Reporting of Greenhouse Gas Emissions- Appendix A- Table 7.
<u>Conversion data</u>		
	0.367 lb of fuel /bhp-hr	BSFC: HHDT, 300<HP<600. Ref: NONROAD Model
	7.15 lb diesel/US gallon	
	0.92 PM _{2.5} /PM ₁₀	
	907,185 gram/ton	

Table B-2. Baseline GHG Emissions - Oil Well Workover Fugitive Emissions

Number of well workovers (no./yr)	Emission Factors (tonne/ workover)			Annual Emissions (tonne/yr)		
	CH ₄	CO ₂	N ₂ O	CH ₄ ^{1,2}	CO ₂ ³	N ₂ O
2	0.0018	7.88E-05	-	0.0036	0.00016	0
<u>Input Data</u>						
<u>Unit</u>						
Available online at:						
tonnes/						
0.0018 workover						
2 no./year						
Estimate provided by Oxy						
Mass ratio (CO ₂ /CH ₄)						
0.04						
Calculated from composition data for raw produced gas provided by Oxy						
Time per workover						
84 hr						
Estimate provided by Oxy						

Notes:

1. Calculation of CH₄ emissions uses the 2009 API Compendium of GHG Estimation Methodologies for the Oil and Natural Gas Industry, Table 5-23, page 5-91.
2. CH₄ emissions use the per oil well workover EF directly, although it is noted that the assumed CH₄ mass fraction of the gas for oil well workovers is not provided in the API Compendium.
3. CO₂ emissions are calculated as a fraction of CH₄ emissions using the ratio of mass fractions of CO₂ to CH₄, respectively.

Table B-3. Baseline GHG Emissions - Process Flare

Pollutant		Emissions ^{1,2}	
		lb/year	tonne/year
Process Flare			
	CO ₂	27,854,897	12,638
	CH ₄	469	0.2
	N ₂ O	52	0.02

Flare Rating

CARB Emissions factor³

Operating Schedule

27 MMBtu/hr

53.42 kg CO2/MMBtu natural gas

0.9 g CH4/MMBtu natural gas

0.1 g N2O/MMBtu natural gas

24 hours/day

365 days/year

Notes:

1. CO₂ emissions were calculated from the equation listed in 95125(a)(1) of the CARB Regulation for the Mandatory Reporting of Greenhouse Gas Emissions.
2. CH₄ and N₂O emissions were calculated from the equation listed in 95125(b)(3) of the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions.
3. CO₂ and CH₄/N₂O emission factor based on Table 4 and Table 6 of the Appendix A in CARB Regulation for the Mandatory Reporting of Greenhouse Gas Emissions available at <http://www.arb.ca.gov/regact/2007/ghg2007/froghg.pdf>. Accessed: Oct 17, 2011.

Table B-4. Baseline GHG Emissions - Emergency Flare (Pilot)

Pollutant	Emissions ^{1,2}	
	lb/year	tonne/year
From Pilot Flare		
CO ₂	919,169	417
CH ₄	14,585	6.6
N ₂ O	1,458.5	0.7

Flare Rating

0.76 MMBtu/hr, Maximum Firing Rate (piloting based on propane combustion)⁴
 5 scfm; Maximum flow rate to flare (based on average natural gas flow)

CARB Emissions factor³

63.02 kg CO₂/MMBtu propane
 1 g CH₄/MMBtu propane
 0.1 g N₂O/MMBtu propane
 60 min/hr
 24 hours/day
 365 days/year

Operating Schedule

Notes:

1. CO₂ emissions were calculated from the equation listed in 95125(a)(1) of the CARB Regulation for the Mandatory Reporting of Greenhouse Gas Emissions.
2. CH₄ and N₂O emissions were calculated from the equation listed in 95125(b)(3) of the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions.
3. CO₂ and CH₄/N₂O emission factor based on Table 4 and Table 6 of the Appendix A in CARB Regulation for the Mandatory Reporting of Greenhouse Gas Emissions available at <http://www.arb.ca.gov/regact/2007/ghg2007/froghg.pdf>. Accessed: Oct 17, 2011.
4. Calculated using the maximum flow rate to flare during piloting and higher heating value of propane gas.
5. From The John Zink Combustion Handbook (Table 5.7)

Table B-5. Baseline GHG Emissions - Drilling Rig Generators

Pollutant	Emissions	
	lb/year	tonne/year
CO ₂ ¹	6,555,168	2,974
CH ₄ ²	269	0.12
N ₂ O ²	54	0.02

Parameters 0.07 mgal/hr; Fuel consumption³

0.137 MMBtu/gal (HHV of diesel)⁴

CARB Emissions factor⁵ 73.1 kg CO₂/MMBtu

0.003 kg CH₄/MMBtu

0.0006 kg N₂O/MMBtu

2.2046 lb/kg

Operating Schedule

24 hours/day

4272 hour/year

Note:

1. CO₂ emissions were calculated from the equation listed in 95125(a)(2) of the CARB Regulation for the Mandatory Reporting of Greenhouse Gas Emissions.
2. CH₄ and N₂O emissions were calculated from the equation listed in 95125(b)(3) of the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions.
3. Based on engine performance data for Caterpillar Model 3512CDITA provided by Oxy.
4. Based on SCAQMD Rule 2012 A-3, Table 3-D.
5. CO₂ and CH₄/N₂O emission factor based on Table 4 and Table 6 of the Appendix A in CARB Regulation for the Mandatory Reporting of Greenhouse Gas Emissions available at <http://www.arb.ca.gov/regact/2007/ghg2007/froghg.pdf>. Accessed: October 17, 2011.

Table B-6. Baseline GHG Emissions - Electrical Generators

Pollutant	Emissions	
	lb/year	tonne/year
Maintenance Only		
CO ₂ ¹	1,400,157	635
CH ₄ ²	57	0.03
N ₂ O ²	11	0.01

Parameters

2 number of engines³0.007 1000 gal/hr; Fuel Flow Rate at 50% load⁴0.137 MMBtu/gal (HHV of diesel)⁵73.1 kg CO₂/MMBtu0.003 kg CH₄/MMBtu0.0006 kg N₂O/MMBtu

2.2046 lb/kg

4380 hour/year

CARB Emissions factor⁶Operation Schedule³**Notes:**

1. CO₂ emissions were calculated from the equation listed in 95125(a)(2) of the CARB Regulation for the Mandatory Reporting of Greenhouse Gas Emissions.
2. CH₄ and N₂O emissions were calculated from the equation listed in 95125(b)(3) of the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions.
3. Provided by Oxy.
4. Fuel consumption is based on specifications for John Deere Model 6068HF485.
5. Based on SCAQMD Rule 2012 A-3, Table 3-D.
6. CO₂ and CH₄/N₂O emission factor based on Table 4 and Table 6 of the Appendix A in CARB Regulation for the Mandatory Reporting of Greenhouse Gas Emissions available at <http://www.arb.ca.gov/regact/2007/ghg2007/frogghg.pdf>. Accessed: Oct 17, 2011.

Table B-7. Baseline GHG Offsite Emissions - CalEEMod Input Assumptions for Well Drilling

Number of Trips per Day During Baseline Oxy Well Drilling

Vehicle Type	Trips/day ¹
Workers and contractors	85
Slurry Removal Trucks	4

Trip Parameters During Baseline (CalEEMod Input)

	Land Use Type	Land Size	Unit	Land Size in 1000 sf	Daily Trip	Trip Generation Rate	Trip %	Trip Length (miles)
Warehouse Haul Truck	Unrefrigerated warehouse-no retail	77,360	sf	77	167	2.16	41% (CalEEMod default)	7.4 (CalEEMod default)
Oil and gas testing facility								
Commercial - Nonwork ²	General Heavy Industry	283,140	sf	283	85	0.30	59% (CalEEMod default)	7.4 (CalEEMod default)
Commercial Nonwork Hauling ^{2,3,4}					10			

Notes:

1. The workers and contractors trips were calculated based on the total number of truck trips based on traffic counts and the CalEEMod percent of commercial-work (C-W, assumed to be worker/contractors commuting trips) and commercial-customer (C-C, assumed to be delivery trucks). Slurry removal trucks were estimated based on the amount of slurry generated during Project well drilling. One truck is required to transfer slurry offsite when slurry wells are not in operation during Project well production. The warehouse haul trucks were calculated based on CalEEMod default trip purpose percent of 13% (Commercial-Nonwork) and total trips of 256 based on a trip count. Note that all trips (workers and contractors, warehouse haul trucks, and slurry removal trucks) add up to 256.
2. Represents worker and contractor trips.
2. Hauling is modeled separately in CalEEMod due to different CalEEMOD assumptions in trip generation rate, trip %, and trip length than those for workers and contractors commute.
3. Two trucks, for a total of four round trips, are required to transfer the slurry during the well drilling. Since trip generation rate for two trucks is very small and the model is not sensitive enough, we assumed 10 trucks for the purpose of modeling. The output results are divided by 10 and multiplied by 4 to represent 4 round trips (i.e., 2 trucks).
4. For the GHG estimate, the trip length is assumed to be 150 miles to transfer the slurry to Buttonwillow, CA.

Table B-8. Baseline Input Assumptions - Offsite Emissions (CalEEMod Runs)
Number of Trips per Day During Baseline (Oxy Operation + Warehouse)

Vehicle Type	Round Trips/day ¹
Worker	83
Contractors	
Delivery Trucks	
Workover Rig Truck	2
Oil Haul Trucks	4

Trip Parameters During Baseline -CalEEMod Input

	Land Use Type	Land Size	Unit	Land Size in 1000 sf	Daily Trip	Trip Generation Rate	Trip %	Trip Length (miles)
Warehouse Haul Truck	Unrefrigerated warehouse-no retail	77,360	sf	77	167	2.16	41% (CalEEMod default)	7.4 (CalEEMod default)
Oil and gas testing facility								
Commercial - Work	General heavy industry	283,140	sf	283	83	0.29	40%	8.9 (CalEEMod default)
Commercial - Nonwork							60%	7.4 (CalEEMod default)
Commercial Nonwork Hauling ^{2,3}					4	0.01	100	15
Commercial - Nonwork Workover Rig ^{2,4}					10	0.04	100	7.4 (CalEEMod default)

Notes:

1. The workers and contractors trips were calculated based on the total number of truck trips based on traffic counts and the CalEEMod percent of commercial-work (C-W, assumed to be worker/contractors commuting trips) and commercial-customer (C-C, assumed to be delivery trucks). Oil haul trucks were estimated based on the amount of oil generated during baseline well production. One truck is required to transfer the workover rig during well production. The warehouse haul trucks were calculated based on CalEEMod default trip purpose percent of 13% (Commercial-Nonwork) and total trips of 256 based on a trip count. Note that all trips (workers and contractors, warehouse haul trucks, and oil haul trucks) add up to 256.
2. Hauling is modeled separately in CalEEMod.
3. For hauling natural gas liquids to the City of Commerce.
4. One truck is required to carry the workover rig to the site during the well maintenance. Since trip generation rate for one truck, i.e., 2 round trips, is very small and the model is not sensitive enough, we assumed 10 round trips for the purpose of modeling. The output results are multiplied by (2/10) to represent only 2 round trips.

Appendix C

CalEEMod Version: CalEEMod.2011.1.1

Date: 6/19/2012

Table B-9 Oxy Onsite Operational Emission Estimation-Baseline Warehouse
Los Angeles-South Coast County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric
Unrefrigerated Warehouse-No Rail	77.36	1000sqft

1.2 Other Project Characteristics

Urbanization	Urban	Wind Speed (m/s)	2.2	Utility Company	Los Angeles Department of Water & Power
Climate Zone	9	Precipitation Freq (Days)	33		

1.3 User Entered Comments

Project Characteristics -
Land Use - Project description
Construction Phase - No Construction Phase
Off-road Equipment - No Construction emissions
Trips and VMT - No Construction emissions
On-road Fugitive Dust - No construction emission
Grading - No Construction Phase
Vehicle Trips - Based on the information provided by Mark
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Road Dust -
Energy Use -
Water And Wastewater - User Defined Commercial default values are assumed to be equal to General Office Buildings.
Solid Waste - User Defined Commercial default values are assumed to be equal to General Office Buildings.
Construction Off-road Equipment Mitigation -

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2011	0.06	0.44	0.27	0.00	0.00	0.03	0.03	0.00	0.03	0.03	0.00	37.29	37.29	0.00	0.00	37.39
Total	0.06	0.44	0.27	0.00	0.00	0.03	0.03	0.00	0.03	0.03	0.00	37.29	37.29	0.00	0.00	37.39

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2011	0.06	0.44	0.27	0.00	0.00	0.03	0.03	0.00	0.03	0.03	0.00	37.29	37.29	0.00	0.00	37.39
Total	0.06	0.44	0.27	0.00	0.00	0.03	0.03	0.00	0.03	0.03	0.00	37.29	37.29	0.00	0.00	37.39

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.37	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	193.24	193.24	0.00	0.00	193.88
Mobile	0.17	0.42	1.67	0.00	0.27	0.02	0.29	0.01	0.02	0.03	0.00	253.35	253.35	0.01	0.00	253.56
Waste						0.00	0.00		0.00	0.00	169.60	0.00	169.60	10.02	0.00	380.08

Appendix C

Water						0.00	0.00		0.00	0.00	2,786.70	2,786.70	11.68	0.31	3,128.81	
Total	0.54	0.42	1.67	0.00	0.27	0.02	0.29	0.01	0.02	0.03	169.60	3,233.29	3,402.89	21.71	0.31	3,956.33

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.37	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	193.24	193.24	0.00	0.00	193.88
Mobile	0.17	0.42	1.67	0.00	0.27	0.02	0.29	0.01	0.02	0.03	0.00	253.35	253.35	0.01	0.00	253.56
Waste						0.00	0.00		0.00	0.00	169.60	0.00	169.60	10.02	0.00	380.08
Water						0.00	0.00		0.00	0.00	0.00	2,786.70	2,786.70	11.68	0.31	3,128.81
Total	0.54	0.42	1.67	0.00	0.27	0.02	0.29	0.01	0.02	0.03	169.60	3,233.29	3,402.89	21.71	0.31	3,956.33

3.0 Construction Detail

3.1 Mitigation Measures Construction

3.2 Demolition - 2011

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.06	0.43	0.26	0.00		0.03	0.03		0.03	0.03	0.00	35.79	35.79	0.00	0.00	35.89
Total	0.06	0.43	0.26	0.00		0.03	0.03		0.03	0.03	0.00	35.79	35.79	0.00	0.00	35.89

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.49	1.49	0.00	0.00	1.50
Total	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.49	1.49	0.00	0.00	1.50

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.06	0.43	0.26	0.00		0.03	0.03		0.03	0.03	0.00	35.79	35.79	0.00	0.00	35.89
Total	0.06	0.43	0.26	0.00		0.03	0.03		0.03	0.03	0.00	35.79	35.79	0.00	0.00	35.89

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix C

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.49	1.49	0.00	0.00	1.50
Total	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.49	1.49	0.00	0.00	1.50

4.0 Mobile Detail

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.17	0.42	1.67	0.00	0.27	0.02	0.29	0.01	0.02	0.03	0.00	253.35	253.35	0.01	0.00	253.56
Unmitigated	0.17	0.42	1.67	0.00	0.27	0.02	0.29	0.01	0.02	0.03	0.00	253.35	253.35	0.01	0.00	253.56
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

4.2 Trip Summary Information

Land Use	Average Daily Trip Rate			Unmitigated Annual VMT	Mitigated Annual VMT
	Weekday	Saturday	Sunday		
Unrefrigerated Warehouse-No Rail	167.10	167.10	167.10	503,923	503,923
Total	167.10	167.10	167.10	503,923	503,923

4.3 Trip Type Information

Land Use	Miles			Trip %		
	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW
Unrefrigerated Warehouse-No Rail	8.90	13.30	7.40	59.00	0.00	41.00

5.0 Energy Detail

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.00	0.00		0.00	0.00	0.00	189.48	189.48	0.00	0.00	190.10
Electricity Unmitigated						0.00	0.00		0.00	0.00	0.00	189.48	189.48	0.00	0.00	190.10
NaturalGas Mitigated	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	3.76	3.76	0.00	0.00	3.78
NaturalGas Unmitigated	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	3.76	3.76	0.00	0.00	3.78
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
Unrefrigerated Warehouse-No Rail	70397.6	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	3.76	3.76	0.00	0.00	3.78
Total		0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	3.76	3.76	0.00	0.00	3.78

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
Unrefrigerated Warehouse-No Rail	70397.6	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	3.76	3.76	0.00	0.00	3.78

Appendix C

Total		0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	3.76	3.76	0.00	0.00	3.78

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
Unrefrigerated Warehouse-No Rail	337290					189.48	0.00	0.00	190.10
Total						189.48	0.00	0.00	190.10

Mitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
Unrefrigerated Warehouse-No Rail	337290					189.48	0.00	0.00	190.10
Total						189.48	0.00	0.00	190.10

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.37	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unmitigated	0.37	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.09					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	0.28					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.37	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.09					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	0.28					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.37	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

7.0 Water Detail

7.1 Mitigation Measures Water

Appendix C

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr				MT/yr			
Mitigated					2,786.70	11.68	0.31	3,128.81
Unmitigated					2,786.70	11.68	0.31	3,128.81
Total	NA	NA	NA	NA	NA	NA	NA	NA

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			
Unrefrigerated Warehouse-No Rail	380.374 / 0					2,786.70	11.68	0.31	3,128.81
Total						2,786.70	11.68	0.31	3,128.81

Mitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			
Unrefrigerated Warehouse-No Rail	380.374 / 0					2,786.70	11.68	0.31	3,128.81
Total						2,786.70	11.68	0.31	3,128.81

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
	tons/yr				MT/yr			
Mitigated					169.60	10.02	0.00	380.08
Unmitigated					169.60	10.02	0.00	380.08
Total	NA	NA	NA	NA	NA	NA	NA	NA

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
Unrefrigerated Warehouse-No Rail	835.49					169.60	10.02	0.00	380.08
Total						169.60	10.02	0.00	380.08

Mitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
Unrefrigerated Warehouse-No Rail	835.49					169.60	10.02	0.00	380.08
Total						169.60	10.02	0.00	380.08

9.0 Vegetation

Appendix C

CalEEMod Version: CalEEMod.2011.1.1

Date: 6/13/2012

**Table B-10. Oxy Offsite Operational Emission Estimation- Baseline Well Drilling Workers and Contractors Commute
Los Angeles-South Coast County, Annual**

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric
General Heavy Industry	283.14	1000sqft

1.2 Other Project Characteristics

Urbanization	Urban	Wind Speed (m/s)	2.2	Utility Company	Los Angeles Department of Water & Power
Climate Zone	9	Precipitation Freq (Days)	33		

1.3 User Entered Comments

Project Characteristics -
Land Use - Project description
Construction Phase - No Construction Phase
Off-road Equipment - No Construction emissions
Trips and VMT - No Construction emissions
On-road Fugitive Dust - No construction emission
Grading - No Construction Phase
Vehicle Trips - Based on the information provided by Mark
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Road Dust -
Energy Use -
Water And Wastewater - User Defined Commercial default values are assumed to be equal to General Office Buildings.
Hazardous Waste - User Defined Commercial default values are assumed to be equal to General Office Buildings.
Solid Waste - User Defined Commercial default values are assumed to be equal to General Office Buildings.
Construction Off-road Equipment Mitigation -

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2011	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01
Total	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2011	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01
Total	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	2,200.92	2,200.92	0.05	0.02	2,208.87
Mobile	0.10	0.24	0.98	0.00	0.12	0.01	0.13	0.00	0.01	0.01	0.00	120.97	120.97	0.01	0.00	121.11
Waste						0.00	0.00		0.00	0.00	353.83	0.00	353.83	20.91	0.00	792.95

Appendix C

Water						0.00	0.00		0.00	0.00	0.00	10,199.40	10,199.40	42.73	1.14	11,451.56
Total	1.48	0.50	1.20	0.00	0.12	0.01	0.15	0.00	0.01	0.03	353.83	12,521.29	12,875.12	63.70	1.16	14,574.49

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	2,200.92	2,200.92	0.05	0.02	2,208.87
Mobile	0.10	0.24	0.98	0.00	0.12	0.01	0.13	0.00	0.01	0.01	0.00	120.97	120.97	0.01	0.00	121.11
Waste						0.00	0.00		0.00	0.00	353.83	0.00	353.83	20.91	0.00	792.95
Water						0.00	0.00		0.00	0.00	0.00	10,199.40	10,199.40	42.73	1.14	11,451.56
Total	1.48	0.50	1.20	0.00	0.12	0.01	0.15	0.00	0.01	0.03	353.83	12,521.29	12,875.12	63.70	1.16	14,574.49

3.0 Construction Detail

3.1 Mitigation Measures Construction

3.2 Demolition - 2011

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29
Total	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73
Total	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29
Total	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix C

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73
Total	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73

4.0 Mobile Detail

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.10	0.24	0.98	0.00	0.12	0.01	0.13	0.00	0.01	0.01	0.00	120.97	120.97	0.01	0.00	121.11
Unmitigated	0.10	0.24	0.98	0.00	0.12	0.01	0.13	0.00	0.01	0.01	0.00	120.97	120.97	0.01	0.00	121.11
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

4.2 Trip Summary Information

Land Use	Average Daily Trip Rate			Unmitigated Annual VMT	Mitigated Annual VMT
	Weekday	Saturday	Sunday		
General Heavy Industry	84.94	84.94	84.94	228,800	228,800
Total	84.94	84.94	84.94	228,800	228,800

4.3 Trip Type Information

Land Use	Miles			Trip %		
	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW
General Heavy Industry	8.90	13.30	7.40	0.00	0.00	100.00

5.0 Energy Detail

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.00	0.00		0.00	0.00	0.00	1,916.71	1,916.71	0.04	0.02	1,922.93
Electricity Unmitigated						0.00	0.00		0.00	0.00	0.00	1,916.71	1,916.71	0.04	0.02	1,922.93
NaturalGas Mitigated	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
NaturalGas Unmitigated	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
General Heavy Industry	5.32586e+006	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total		0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
General Heavy Industry	5.32586e+006	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94

Appendix C

Total		0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
General Heavy Industry	3.41184e+006					1,916.71	0.04	0.02	1,922.93
Total						1,916.71	0.04	0.02	1,922.93

Mitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
General Heavy Industry	3.41184e+006					1,916.71	0.04	0.02	1,922.93
Total						1,916.71	0.04	0.02	1,922.93

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unmitigated	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.33					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	1.02					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.33					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	1.02					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

7.0 Water Detail

7.1 Mitigation Measures Water

Appendix C

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr				MT/yr			
Mitigated					10,199.40	42.73	1.14	11,451.56
Unmitigated					10,199.40	42.73	1.14	11,451.56
Total	NA	NA	NA	NA	NA	NA	NA	NA

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			
General Heavy Industry	1392.18 / 0					10,199.40	42.73	1.14	11,451.56
Total						10,199.40	42.73	1.14	11,451.56

Mitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			
General Heavy Industry	1392.18 / 0					10,199.40	42.73	1.14	11,451.56
Total						10,199.40	42.73	1.14	11,451.56

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
	tons/yr				MT/yr			
Mitigated					353.83	20.91	0.00	792.95
Unmitigated					353.83	20.91	0.00	792.95
Total	NA	NA	NA	NA	NA	NA	NA	NA

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
General Heavy Industry	1743.08					353.83	20.91	0.00	792.95
Total						353.83	20.91	0.00	792.95

Mitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
General Heavy Industry	1743.08					353.83	20.91	0.00	792.95
Total						353.83	20.91	0.00	792.95

9.0 Vegetation

Appendix C

CalEEMod Version: CalEEMod.2011.1.1

Date: 10/13/2011

Table B-11. Oxy Offsite Operational Emission Estimation-Baseline Slurry Hauling
Los Angeles-South Coast County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric
General Heavy Industry	283.14	1000sqft

1.2 Other Project Characteristics

Urbanization	Urban	Wind Speed (m/s)		Utility Company	Los Angeles Department of Water & Power
Climate Zone	9		2.2		
		Precipitation Freq (Days)			
			33		

1.3 User Entered Comments

Project Characteristics -
Land Use - Project description
Construction Phase - No Construction Phase
Off-road Equipment - No Construction emissions
Trips and VMT - No Construction emissions
On-road Fugitive Dust - No construction emission
Grading - No Construction Phase
Vehicle Trips - Based on the information provided by Mark
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Road Dust -
Energy Use -
Water And Wastewater - User Defined Commercial default values are assumed to be equal to General Office Buildings.
User Defined Recreational default values are assumed to be equal to Strip Mall.
Solid Waste - User Defined Commercial default values are assumed to be equal to General Office Buildings.
User Defined Recreational default values are assumed to be equal to Strip Mall.
Construction Off-road Equipment Mitigation -

Appendix C

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2011	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01
Total	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2011	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01
Total	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	2,200.92	2,200.92	0.05	0.02	2,208.87
Mobile	0.97	9.71	5.07	0.01	0.35	0.46	0.82	0.03	0.46	0.50	0.00	1,133.43	1,133.43	0.04	0.00	1,134.23
Waste						0.00	0.00		0.00	0.00	353.83	0.00	353.83	20.91	0.00	792.95
Water						0.00	0.00		0.00	0.00	0.00	10,199.40	10,199.40	42.73	1.14	11,451.56
Total	2.35	9.97	5.29	0.01	0.35	0.46	0.84	0.03	0.46	0.52	353.83	13,533.75	13,887.58	63.73	1.16	15,587.61

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	2,200.92	2,200.92	0.05	0.02	2,208.87
Mobile	0.97	9.71	5.07	0.01	0.35	0.46	0.82	0.03	0.46	0.50	0.00	1,133.43	1,133.43	0.04	0.00	1,134.23
Waste						0.00	0.00		0.00	0.00	353.83	0.00	353.83	20.91	0.00	792.95
Water						0.00	0.00		0.00	0.00	0.00	10,199.40	10,199.40	42.73	1.14	11,451.56
Total	2.35	9.97	5.29	0.01	0.35	0.46	0.84	0.03	0.46	0.52	353.83	13,533.75	13,887.58	63.73	1.16	15,587.61

Appendix C

3.0 Construction Detail

3.1 Mitigation Measures Construction

3.2 Demolition - 2011

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29
Total	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73
Total	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29
Total	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73
Total	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73

Appendix C

4.0 Mobile Detail

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.97	9.71	5.07	0.01	0.35	0.46	0.82	0.03	0.46	0.50	0.00	1,133.43	1,133.43	0.04	0.00	1,134.23
Unmitigated	0.97	9.71	5.07	0.01	0.35	0.46	0.82	0.03	0.46	0.50	0.00	1,133.43	1,133.43	0.04	0.00	1,134.23
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

4.2 Trip Summary Information

Land Use	Average Daily Trip Rate			Unmitigated	Mitigated
	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Heavy Industry	11.33	11.33	11.33	618,378	618,378
Total	11.33	11.33	11.33	618,378	618,378

4.3 Trip Type Information

Land Use	Miles			Trip %		
	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW
General Heavy Industry	8.90	13.30	150.00	0.00	0.00	100.00

Appendix C

5.0 Energy Detail

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.00	0.00		0.00	0.00	0.00	1,916.71	1,916.71	0.04	0.02	1,922.93
Electricity Unmitigated						0.00	0.00		0.00	0.00	0.00	1,916.71	1,916.71	0.04	0.02	1,922.93
NaturalGas Mitigated	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
NaturalGas Unmitigated	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
General Heavy Industry	5.32586e+006	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total		0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
General Heavy Industry	5.32586e+006	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total		0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
General Heavy Industry	3.41184e+006					1,916.71	0.04	0.02	1,922.93
Total						1,916.71	0.04	0.02	1,922.93

Mitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
General Heavy Industry	3.41184e+006					1,916.71	0.04	0.02	1,922.93
Total						1,916.71	0.04	0.02	1,922.93

Appendix C

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unmitigated	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.33					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	1.02					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.33					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	1.02					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix C

7.0 Water Detail

7.1 Mitigation Measures Water

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr				MT/yr			
Mitigated					10,199.40	42.73	1.14	11,451.56
Unmitigated					10,199.40	42.73	1.14	11,451.56
Total	NA	NA	NA	NA	NA	NA	NA	NA

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			
General Heavy Industry	1392.18 / 0					10,199.40	42.73	1.14	11,451.56
Total						10,199.40	42.73	1.14	11,451.56

Mitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			
General Heavy Industry	1392.18 / 0					10,199.40	42.73	1.14	11,451.56
Total						10,199.40	42.73	1.14	11,451.56

Appendix C

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
	tons/yr				MT/yr			
Mitigated					353.83	20.91	0.00	792.95
Unmitigated					353.83	20.91	0.00	792.95
Total	NA	NA	NA	NA	NA	NA	NA	NA

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
General Heavy Industry	1743.08					353.83	20.91	0.00	792.95
Total						353.83	20.91	0.00	792.95

Mitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
General Heavy Industry	1743.08					353.83	20.91	0.00	792.95
Total						353.83	20.91	0.00	792.95

9.0 Vegetation

Appendix C

CalEEMod Version: CalEEMod.2011.1.1

Date: 6/19/2012

**Table B.12. Oxy Offsite Operational Emission Estimation-Baseline Well Production Workers and Contractors Commute
Los Angeles-South Coast County, Annual**

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric
General Heavy Industry	283.14	1000sqft

1.2 Other Project Characteristics

Urbanization	Urban	Wind Speed (m/s)		Utility Company	Los Angeles Department of Water & Power
Climate Zone	9		2.2		
		Precipitation Freq (Days)	33		

1.3 User Entered Comments

Project Characteristics -
Land Use - Project description
Construction Phase - No Construction Phase
Off-road Equipment - No Construction emissions
Trips and VMT - No Construction emissions
On-road Fugitive Dust - No construction emission
Grading - No Construction Phase
Vehicle Trips - Based on the information provided by Mark
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Road Dust -
Energy Use -
Water And Wastewater - User Defined Commercial default values are assumed to be equal to General Office Buildings.
Hazardous Waste - User Defined Commercial default values are assumed to be equal to General Office Buildings.
Solid Waste - User Defined Commercial default values are assumed to be equal to General Office Buildings.
Construction Off-road Equipment Mitigation -

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2011	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01
Total	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2011	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01
Total	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	2,200.92	2,200.92	0.05	0.02	2,208.87
Mobile	0.10	0.25	1.01	0.00	0.13	0.01	0.14	0.00	0.01	0.01	0.00	126.15	126.15	0.01	0.00	126.31
Waste						0.00	0.00		0.00	0.00	353.83	0.00	353.83	20.91	0.00	792.95

Appendix C

Water						0.00	0.00		0.00	0.00	0.00	10,199.40	10,199.40	42.73	1.14	11,451.56
Total	1.48	0.51	1.23	0.00	0.13	0.01	0.16	0.00	0.01	0.03	353.83	12,526.47	12,880.30	63.70	1.16	14,579.69

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	2,200.92	2,200.92	0.05	0.02	2,208.87
Mobile	0.10	0.25	1.01	0.00	0.13	0.01	0.14	0.00	0.01	0.01	0.00	126.15	126.15	0.01	0.00	126.31
Waste						0.00	0.00		0.00	0.00	353.83	0.00	353.83	20.91	0.00	792.95
Water						0.00	0.00		0.00	0.00	0.00	10,199.40	10,199.40	42.73	1.14	11,451.56
Total	1.48	0.51	1.23	0.00	0.13	0.01	0.16	0.00	0.01	0.03	353.83	12,526.47	12,880.30	63.70	1.16	14,579.69

3.0 Construction Detail

3.1 Mitigation Measures Construction

3.2 Demolition - 2011

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29
Total	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73
Total	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29
Total	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix C

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73
Total	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73

4.0 Mobile Detail

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.10	0.25	1.01	0.00	0.13	0.01	0.14	0.00	0.01	0.01	0.00	126.15	126.15	0.01	0.00	126.31
Unmitigated	0.10	0.25	1.01	0.00	0.13	0.01	0.14	0.00	0.01	0.01	0.00	126.15	126.15	0.01	0.00	126.31
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

4.2 Trip Summary Information

Land Use	Average Daily Trip Rate			Unmitigated Annual VMT	Mitigated Annual VMT
	Weekday	Saturday	Sunday		
General Heavy Industry	82.11	82.11	82.11	239,106	239,106
Total	82.11	82.11	82.11	239,106	239,106

4.3 Trip Type Information

Land Use	Miles			Trip %		
	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW
General Heavy Industry	8.90	13.30	7.40	40.00	0.00	60.00

5.0 Energy Detail

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.00	0.00		0.00	0.00	0.00	1,916.71	1,916.71	0.04	0.02	1,922.93
Electricity Unmitigated						0.00	0.00		0.00	0.00	0.00	1,916.71	1,916.71	0.04	0.02	1,922.93
NaturalGas Mitigated	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
NaturalGas Unmitigated	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
General Heavy Industry	5.32586e+006	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total		0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
General Heavy Industry	5.32586e+006	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94

Appendix C

Total		0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
General Heavy Industry	3.41184e+006					1,916.71	0.04	0.02	1,922.93
Total						1,916.71	0.04	0.02	1,922.93

Mitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
General Heavy Industry	3.41184e+006					1,916.71	0.04	0.02	1,922.93
Total						1,916.71	0.04	0.02	1,922.93

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unmitigated	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.33					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	1.02					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.33					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	1.02					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

7.0 Water Detail

7.1 Mitigation Measures Water

Appendix C

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr				MT/yr			
Mitigated					10,199.40	42.73	1.14	11,451.56
Unmitigated					10,199.40	42.73	1.14	11,451.56
Total	NA	NA	NA	NA	NA	NA	NA	NA

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			
General Heavy Industry	1392.18 / 0					10,199.40	42.73	1.14	11,451.56
Total						10,199.40	42.73	1.14	11,451.56

Mitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			
General Heavy Industry	1392.18 / 0					10,199.40	42.73	1.14	11,451.56
Total						10,199.40	42.73	1.14	11,451.56

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
	tons/yr				MT/yr			
Mitigated					353.83	20.91	0.00	792.95
Unmitigated					353.83	20.91	0.00	792.95
Total	NA	NA	NA	NA	NA	NA	NA	NA

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
General Heavy Industry	1743.08					353.83	20.91	0.00	792.95
Total						353.83	20.91	0.00	792.95

Mitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
General Heavy Industry	1743.08					353.83	20.91	0.00	792.95
Total						353.83	20.91	0.00	792.95

9.0 Vegetation

Appendix C

CalEEMod Version: CalEEMod.2011.1.1

Date: 10/13/2011

Table B-13. Oxy Offsite Operational Emission Estimation-Baseline Oil Hauling
Los Angeles-South Coast County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric
General Heavy Industry	283.14	1000sqft

1.2 Other Project Characteristics

Urbanization	Urban	Wind Speed (m/s)		Utility Company	Los Angeles Department of Water & Power
Climate Zone	9		2.2		
		Precipitation Freq (Days)			
			33		

1.3 User Entered Comments

Project Characteristics -
Land Use - Project description
Construction Phase - No Construction Phase
Off-road Equipment - No Construction emissions
Trips and VMT - No Construction emissions
On-road Fugitive Dust - No construction emission
Grading - No Construction Phase
Vehicle Trips - Based on the information provided by Mark
Vehicle Emission Factors - Haul trucks
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Road Dust -
Energy Use -
Water And Wastewater - User Defined Commercial default values are assumed to be equal to General Office Buildings.
User Defined Recreational default values are assumed to be equal to Strip Mall.
Solid Waste - User Defined Commercial default values are assumed to be equal to General Office Buildings.
User Defined Recreational default values are assumed to be equal to Strip Mall.
Construction Off-road Equipment Mitigation -

Appendix C

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2011	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01
Total	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2011	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01
Total	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	2,200.92	2,200.92	0.05	0.02	2,208.87
Mobile	0.03	0.27	0.18	0.00	0.01	0.01	0.02	0.00	0.01	0.01	0.00	29.47	29.47	0.00	0.00	29.50
Waste						0.00	0.00		0.00	0.00	353.83	0.00	353.83	20.91	0.00	792.95
Water						0.00	0.00		0.00	0.00	0.00	10,199.40	10,199.40	42.73	1.14	11,451.56
Total	1.41	0.53	0.40	0.00	0.01	0.01	0.04	0.00	0.01	0.03	353.83	12,429.79	12,783.62	63.69	1.16	14,482.88

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	2,200.92	2,200.92	0.05	0.02	2,208.87
Mobile	0.03	0.27	0.18	0.00	0.01	0.01	0.02	0.00	0.01	0.01	0.00	29.47	29.47	0.00	0.00	29.50
Waste						0.00	0.00		0.00	0.00	353.83	0.00	353.83	20.91	0.00	792.95
Water						0.00	0.00		0.00	0.00	0.00	10,199.40	10,199.40	42.73	1.14	11,451.56
Total	1.41	0.53	0.40	0.00	0.01	0.01	0.04	0.00	0.01	0.03	353.83	12,429.79	12,783.62	63.69	1.16	14,482.88

Appendix C

3.0 Construction Detail

3.1 Mitigation Measures Construction

3.2 Demolition - 2011

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29
Total	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73
Total	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29
Total	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73
Total	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73

Appendix C

4.0 Mobile Detail

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.03	0.27	0.18	0.00	0.01	0.01	0.02	0.00	0.01	0.01	0.00	29.47	29.47	0.00	0.00	29.50
Unmitigated	0.03	0.27	0.18	0.00	0.01	0.01	0.02	0.00	0.01	0.01	0.00	29.47	29.47	0.00	0.00	29.50
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

4.2 Trip Summary Information

Land Use	Average Daily Trip Rate			Unmitigated	Mitigated
	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Heavy Industry	2.83	2.83	2.83	15,459	15,459
Total	2.83	2.83	2.83	15,459	15,459

4.3 Trip Type Information

Land Use	Miles			Trip %		
	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW
General Heavy Industry	8.90	13.30	15.00	0.00	0.00	100.00

Appendix C

5.0 Energy Detail

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.00	0.00		0.00	0.00	0.00	1,916.71	1,916.71	0.04	0.02	1,922.93
Electricity Unmitigated						0.00	0.00		0.00	0.00	0.00	1,916.71	1,916.71	0.04	0.02	1,922.93
NaturalGas Mitigated	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
NaturalGas Unmitigated	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
General Heavy Industry	5.32586e+006	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total		0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
General Heavy Industry	5.32586e+006	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total		0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
General Heavy Industry	3.41184e+006					1,916.71	0.04	0.02	1,922.93
Total						1,916.71	0.04	0.02	1,922.93

Mitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
General Heavy Industry	3.41184e+006					1,916.71	0.04	0.02	1,922.93
Total						1,916.71	0.04	0.02	1,922.93

Appendix C

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unmitigated	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.33					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	1.02					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.33					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	1.02					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix C

7.0 Water Detail

7.1 Mitigation Measures Water

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr				MT/yr			
Mitigated					10,199.40	42.73	1.14	11,451.56
Unmitigated					10,199.40	42.73	1.14	11,451.56
Total	NA	NA	NA	NA	NA	NA	NA	NA

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			
General Heavy Industry	1392.18 / 0					10,199.40	42.73	1.14	11,451.56
Total						10,199.40	42.73	1.14	11,451.56

Mitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			
General Heavy Industry	1392.18 / 0					10,199.40	42.73	1.14	11,451.56
Total						10,199.40	42.73	1.14	11,451.56

Appendix C

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
	tons/yr				MT/yr			
Mitigated					353.83	20.91	0.00	792.95
Unmitigated					353.83	20.91	0.00	792.95
Total	NA	NA	NA	NA	NA	NA	NA	NA

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
General Heavy Industry	1743.08					353.83	20.91	0.00	792.95
Total						353.83	20.91	0.00	792.95

Mitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
General Heavy Industry	1743.08					353.83	20.91	0.00	792.95
Total						353.83	20.91	0.00	792.95

9.0 Vegetation

Appendix C

CalEEMod Version: CalEEMod.2011.1.1

Date: 10/13/2011

Table B-14. Oxy Offsite Operational Emission Estimation-Baseline Workover Rig
Los Angeles-South Coast County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric
General Heavy Industry	283.14	1000sqft

1.2 Other Project Characteristics

Urbanization	Urban	Wind Speed (m/s)		Utility Company	Los Angeles Department of Water & Power
Climate Zone	9		2.2		
		Precipitation Freq (Days)			
			33		

1.3 User Entered Comments

Project Characteristics -
Land Use - Project description
Construction Phase - No Construction Phase
Off-road Equipment - No Construction emissions
Trips and VMT - No Construction emissions
On-road Fugitive Dust - No construction emission
Grading - No Construction Phase
Vehicle Trips - Based on the information provided by Mark
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Road Dust -
Energy Use -
Water And Wastewater - User Defined Commercial default values are assumed to be equal to General Office Buildings.
User Defined Recreational default values are assumed to be equal to Strip Mall
Solid Waste - User Defined Commercial default values are assumed to be equal to General Office Buildings.
User Defined Recreational default values are assumed to be equal to Strip Mall
Construction Off-Road Equipment Mitigation -

Appendix C

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2011	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01
Total	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2011	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01
Total	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	2,200.92	2,200.92	0.05	0.02	2,208.87
Mobile	0.07	0.58	0.46	0.00	0.02	0.02	0.04	0.00	0.02	0.03	0.00	60.72	60.72	0.00	0.00	60.78
Waste						0.00	0.00		0.00	0.00	353.83	0.00	353.83	20.91	0.00	792.95
Water						0.00	0.00		0.00	0.00	0.00	10,199.40	10,199.40	42.73	1.14	11,451.56
Total	1.45	0.84	0.68	0.00	0.02	0.02	0.06	0.00	0.02	0.05	353.83	12,461.04	12,814.87	63.69	1.16	14,514.16

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	2,200.92	2,200.92	0.05	0.02	2,208.87
Mobile	0.07	0.58	0.46	0.00	0.02	0.02	0.04	0.00	0.02	0.03	0.00	60.72	60.72	0.00	0.00	60.78
Waste						0.00	0.00		0.00	0.00	353.83	0.00	353.83	20.91	0.00	792.95
Water						0.00	0.00		0.00	0.00	0.00	10,199.40	10,199.40	42.73	1.14	11,451.56
Total	1.45	0.84	0.68	0.00	0.02	0.02	0.06	0.00	0.02	0.05	353.83	12,461.04	12,814.87	63.69	1.16	14,514.16

Appendix C

3.0 Construction Detail

3.1 Mitigation Measures Construction

3.2 Demolition - 2011

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29
Total	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73
Total	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29
Total	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73
Total	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73

Appendix C

4.0 Mobile Detail

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.07	0.58	0.46	0.00	0.02	0.02	0.04	0.00	0.02	0.03	0.00	60.72	60.72	0.00	0.00	60.78
Unmitigated	0.07	0.58	0.46	0.00	0.02	0.02	0.04	0.00	0.02	0.03	0.00	60.72	60.72	0.00	0.00	60.78
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

4.2 Trip Summary Information

Land Use	Average Daily Trip Rate			Unmitigated	Mitigated
	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Heavy Industry	11.33	11.33	11.33	30,507	30,507
Total	11.33	11.33	11.33	30,507	30,507

4.3 Trip Type Information

Land Use	Miles			Trip %		
	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW
General Heavy Industry	8.90	13.30	7.40	0.00	0.00	100.00

Appendix C

5.0 Energy Detail

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.00	0.00		0.00	0.00	0.00	1,916.71	1,916.71	0.04	0.02	1,922.93
Electricity Unmitigated						0.00	0.00		0.00	0.00	0.00	1,916.71	1,916.71	0.04	0.02	1,922.93
NaturalGas Mitigated	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
NaturalGas Unmitigated	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
General Heavy Industry	5.32586e+006	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total		0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
General Heavy Industry	5.32586e+006	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total		0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
General Heavy Industry	3.41184e+006					1,916.71	0.04	0.02	1,922.93
Total						1,916.71	0.04	0.02	1,922.93

Mitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
General Heavy Industry	3.41184e+006					1,916.71	0.04	0.02	1,922.93
Total						1,916.71	0.04	0.02	1,922.93

Appendix C

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unmitigated	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.33					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	1.02					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.33					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	1.02					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix C

7.0 Water Detail

7.1 Mitigation Measures Water

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr				MT/yr			
Mitigated					10,199.40	42.73	1.14	11,451.56
Unmitigated					10,199.40	42.73	1.14	11,451.56
Total	NA	NA	NA	NA	NA	NA	NA	NA

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			
General Heavy Industry	1392.18 / 0					10,199.40	42.73	1.14	11,451.56
Total						10,199.40	42.73	1.14	11,451.56

Mitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			
General Heavy Industry	1392.18 / 0					10,199.40	42.73	1.14	11,451.56
Total						10,199.40	42.73	1.14	11,451.56

Appendix C

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
	tons/yr				MT/yr			
Mitigated					353.83	20.91	0.00	792.95
Unmitigated					353.83	20.91	0.00	792.95
Total	NA	NA	NA	NA	NA	NA	NA	NA

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
General Heavy Industry	1743.08					353.83	20.91	0.00	792.95
Total						353.83	20.91	0.00	792.95

Mitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
General Heavy Industry	1743.08					353.83	20.91	0.00	792.95
Total						353.83	20.91	0.00	792.95

9.0 Vegetation

Table B-15. Baseline Greenhouse Gas Emissions - Summary

Emission Source	Daily Emissions (MT/yr)		
	CO ₂	CH ₄	N ₂ O
Onsite Emissions²			
<i>Well Drilling</i>			
Warehouse ³	3,150	22	0.3
Drilling Rig Generators	2,974	0.12	0.02
<i>Well Production Testing</i>			
Electrical Generators	635	0.03	0.01
Well Workover ⁴	7	0.004	0
Process Flare	12,638	0.2	0.02
Emergency Flare	417	6.6	0.66
Offsite Emissions^{3,5}			
<i>Well Drilling</i>			
Warehouse Workers & Contractors ⁶	253	0.01	0
Drilling Workers & Contractors ⁷	121	0.01	0
Drilling Slurry Trucks ⁸	453	0.02	0
<i>Well Production Testing</i>			
Workers & Contractors	126	0.01	0
Oil Trucks	29	0	0
Workover Rig	0.07	0	0

Notes:

1. CO₂ equivalents (CO₂eq) calculated using GWPs obtained from IPCC, 1996: IPCC Second Assessment Climate Change 1995. A Report of the Intergovernmental Panel on Climate Change. IPCC, Geneva, Switzerland, 73 pp. (GWPs: CH₄ = 21; N₂O = 310)
2. Detailed calculations and assumptions are found in Table 1 - 6.
3. Estimated using CalEEMOD. Input assumptions are found in Table 7 and Table 8 for well drilling and well production. Warehouse included GHG emissions associated with energy, water, and wastewater.
4. This include workover exhaust and fugitive GHG emissions.
5. CalEEMod output emissions are multiplied by two to account for round trips.
6. This includes worker, contractor, and pickup trucks related to the existing warehouse.
7. This includes worker, contractor, and pickup trucks related to the drilling activities.
8. Represents emissions for haul trucks to transfer produced offsite.
9. Annual emissions estimated by CalEEMod are based on 365 day/yr activity. Since some of the activities (e.g. well drilling) occurs less than a year, emissions have to be adjusted based on the actual annual schedule and added to be accounted for the total annual emission.

Appendix C

Table B-16. Project GHG Emissions - Emergency Flare (Pilot)

Pollutant		Emissions ^{1,2}	
		lb/year	tonne/year
From Pilot Lighting			
	CO ₂	324,974	147
	CH ₄	5.48	0.002
	N ₂ O	0.61	0.0003

Flare Rating³

300 scfh; Estimated Pilot Fuel Flow Rate
1,050 MMBtu/MMscf HHV Natural Gas
0.32 MMBtu/hr

CARB Emissions factor⁴

53.42 kg CO₂/MMBtu natural gas
0.9 g CH₄/MMBtu natural gas
0.1 g N₂O/MMBtu natural gas

Maximum Operating Schedule

24 hours/day
365 days/year

Notes:

1. CO₂ emissions were calculated from the equation listed in 95125(a)(1) of the CARB Regulation for the Mandatory Reporting of Greenhouse Gas Emissions.
2. CH₄ and N₂O emissions were calculated from the equation listed in 95125(b)(3) of the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions.
3. Pilot flaring rate assumed to be 300 scfh.
4. CO₂ and CH₄/N₂O emission factor based on Table 4 and Table 6 of the Appendix A in CARB Regulation for the Mandatory Reporting of Greenhouse Gas Emissions available at <http://www.arb.ca.gov/regact/2007/ghg2007/froghg.pdf>, accessed on October 17, 2011.

Table B-17. Project GHG Emissions - Carbon Adsorber Unit For Slurry System

Pollutant	Emissions	
	lb/year	tonne/year
CO ₂	3.57E-01	1.62E-04
CH ₄	8.16E+00	3.70E-03
N ₂ O	--	--

Notes:

1. Emission factors based on raw produced gas compositions provided by SPEC Services.
2. Additional information is included in the Air Quality Technical Appendix.

Table B-18 Project GHG Emissions - Process Heater

Pollutant	Emissions ^{1,2}	
	lb/year	tonne/year
CO ₂	10,316,629	4,680
CH ₄	174	0.08
N ₂ O	19	0.01

Process Heater Rating³

10 MMBtu/hr

CARB Emissions factor⁴53.42 kg CO₂/MMBtu natural gas0.9 g CH₄/MMBtu natural gas0.1 g N₂O/MMBtu natural gas

Operating Schedule

24 hours/day

365 days/year

Notes:

1. CO₂ emissions were calculated from the equation listed in 95125(a)(1) of the CARB Regulation for the Mandatory Reporting of Greenhouse Gas Emissions.
2. CH₄ and N₂O emissions were calculated from the equation listed in 95125(b)(3) of the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions.
3. Heater Rating was provided by SPEC
4. CO₂ and CH₄/N₂O emission factor based on Table 4 and Table 6 of the Appendix A in CARB Regulation for the Mandatory Reporting of Greenhouse Gas Emissions available at <http://www.arb.ca.gov/regact/2007/ghg2007/froghg.pdf>, accessed on October 17, 2011.

Table B-19. Project GHG Emissions - Truck Loading

Pollutant	Emissions	
	lb/year	tonne/year
CO ₂ ³	7.52E-05	3.41E-08
CH ₄ ³	1.23E-07	5.57E-11
N ₂ O ³	--	--

Notes:

1. Emission factors based on raw produced gas compositions provided by SPEC Services.
2. Additional information is included in the Air Quality Technical Appendix.

Table B-20. Project GHG Emissions - Emergency Generator (Maintenance Only)

Pollutant	Emissions ¹	
	lb/day	metric tonnes/year
Maintenance Only		
CO ₂	641	32,928
CH ₄	0.03	1.35
N ₂ O	0.01	0.27

Firing Rate	Drilling Rig 500 KW Engine	137 MMBtu/mgal (HHV of diesel) 0.072 Mgal/hr 0.0374 Mgal/hr	Emissions factor 73.1 kg CO2/MMBtu 0.003 kg CH4/MMBtu 0.0006 kg N2O/MMBtu 2.2046 lb/kg

Maintenance Schedule	Drilling Rig 500 KW Engine	0.32 hours/day 15 hour/year 0.17 hours/day 11.00 hour/year

Notes:

- 1. CO₂ emissions were calculated from the equation listed in 95125(a)(2) of the CARB Regulation for the Mandatory Reporting of Greenhouse Gas Emissions.
- 2. CH₄ and N₂O emissions were calculated from the equation listed in 95125(b)(3) of the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions.
- 3. Sum of emissions from Drill Rig engine and 500 kW engine.

Table B-21. Project GHG Emissions - Carbon Adsorber Unit For Sump Water

Pollutant	Emissions	
	lb/year	tonne/year
CO ₂	3.57E-01	1.62E-04
CH ₄	8.16E+00	3.70E-03
N ₂ O	--	--

Notes:

1. Emission factors based on raw produced gas compositions provided by SPEC Services.
2. Additional information is included in the Air Quality Technical Appendix.

Table B-22A. Project GHG Emissions - Fugitives (Crude Oil Tank)

Type	Service	Number ¹	CH ₄ Emissions (lb/year)	CO ₂ Emissions (lb/year)	CH ₄ Emissions (tonne/year)	CO ₂ Emissions (tonne/year)
Valves	Heavy Hydrocarbon	14	1.6E-14	1.6E-10	7.2E-18	7.3E-14
Valves	Light Hydrocarbon	409	5.2E-07	3.2E-04	2.4E-10	1.4E-07
	Gas	180	9.7E+01	3.3E+00	4.4E-02	1.5E-03
	Total		9.7E+01	3.3E+00	4.4E-02	1.5E-03
Pumps Seals	Light Hydrocarbon	24	4.2E-07	2.6E-04	1.9E-10	1.2E-07
	Total		4.2E-07	2.6E-04	1.9E-10	1.2E-07
Threaded Conn	Heavy Hydrocarbon	28	1.8E-14	1.9E-10	8.4E-18	8.5E-14
Threaded Conn	Light Hydrocarbon	818	5.5E-07	3.3E-04	2.5E-10	1.5E-07
	Gas	360	6.6E+01	2.2E+00	3.0E-02	1.0E-03
	Total		6.6E+01	2.2E+00	3.0E-02	1.0E-03
Flanges	Heavy Hydrocarbon	70	1.3E-13	1.3E-09	5.9E-17	6.0E-13
Flanges	Light Hydrocarbon	657	1.1E-06	6.5E-04	4.8E-10	2.9E-07
	Gas	307	1.3E+02	4.5E+00	6.1E-02	2.0E-03
	Total		1.3E+02	4.5E+00	6.1E-02	2.0E-03
Other	Heavy Hydrocarbon	14	6.7E-14	6.7E-10	3.0E-17	3.1E-13
	Light Hydrocarbon	30	2.6E-07	1.6E-04	1.2E-10	7.3E-08
	Gas	35	7.9E+01	2.6E+00	3.6E-02	1.2E-03
	Total		7.9E+01	2.6E+00	3.6E-02	1.2E-03
Grand Total			3.75E+02	1.25E+01	1.70E-01	5.69E-03

Composition ³	VOC, %wt	CH ₄ , %wt	CO ₂ , %wt	Maximum Operating Schedule:
Gas Stream	7.41%	80.04%	2.68%	24
Light Hydrocarbon	94.52%	0.00%	0.00%	365
Heavy Hydrocarbon	100.00%	0.00%	0.00%	

Notes:

- The number of components is based on estimates from SPEC Services.
- The VOC emission factors are based on the <10,000 ppmv emission factor in Table IV-2c (Method 3) of the SCAQMD's "Guidelines for Fugitive Emissions Calculations", June 2003, for Oil and Gas Production.
- Gas compositions for gas stream, light hydrocarbon, and heavy hydrocarbon are based on compositions of produced gas, NGL to truck and NGL to pipeline from SPEC Services.

Table B-22B. Project GHG Emissions - Fugitives (Wet Oil Tank)

Type	Service	Number ¹	CH ₄ Emissions (lb/year)	CO ₂ Emissions (lb/year)	CH ₄ Emissions (tonne/year)	CO ₂ Emissions (tonne/year)
Valves	Light Hydrocarbon	41	5.22E-08	3.20E-05	2.37E-11	1.45E-08
	Gas	25	1.35E+01	4.52E-01	6.12E-03	2.05E-04
	Total		1.35E+01	4.52E-01	6.12E-03	2.05E-04
Pumps Seals	Light Hydrocarbon	4	7.03E-08	4.31E-05	3.19E-11	1.95E-08
	Total		7.03E-08	4.31E-05	3.19E-11	1.95E-08
Threaded Conn	Light Hydrocarbon	82	5.47E-08	3.35E-05	2.48E-11	1.52E-08
	Gas	50	9.12E+00	3.05E-01	4.13E-03	1.38E-04
	Total		9.12E+00	3.05E-01	4.13E-03	1.38E-04
Flanges	Light Hydrocarbon	65	1.04E-07	6.39E-05	4.74E-11	2.90E-08
	Gas	25	1.09E+01	3.64E-01	4.93E-03	1.65E-04
	Total		1.09E+01	3.64E-01	4.93E-03	1.65E-04
Other	Light Hydrocarbon	2	1.76E-08	1.08E-05	7.97E-12	4.88E-09
	Gas	3	6.73E+00	2.25E-01	3.05E-03	1.02E-04
	Total		6.73E+00	2.25E-01	3.05E-03	1.02E-04
Grand Total			4.02E+01	1.35E+00	1.82E-02	6.10E-04

Composition ³	VOC, %wt	CH ₄ , %wt	CO ₂ , %wt
Gas Stream	7.41%	80.04%	2.68%
Light Hydrocarbon	94.52%	0.00%	0.00%
Heavy Hydrocarbon	100.00%	0.00%	0.00%

Maximum Operating Schedule:

24

365

Notes:

1. The number of components is based on estimates from SPEC Services.
2. The VOC emission factors are based on the <10,000 ppmv emission factor in Table IV-2c (Method 3) of the SCAQMD's "Guidelines for Fugitive Emissions Calculations", June 2003, for Oil and Gas Production.
3. Gas compositions for gas stream, light hydrocarbon, and heavy hydrocarbon are based on compositions of produced gas, NGL to truck and NGL to pipeline from SPEC Services.

Table B-22C. Project GHG Emissions- Fugitives (Swing Tank)

Type	Service	Number ¹	CH ₄ Emissions (lb/year)	CO ₂ Emissions (lb/year)	CH ₄ Emissions (tonne/year)	CO ₂ Emissions (tonne/year)
Valves	Light Hydrocarbon	25	3.2E-08	1.9E-05	1.4E-11	8.8E-09
	Gas	25	1.3E+01	4.5E-01	6.1E-03	2.0E-04
		Total	1.3E+01	4.5E-01	6.1E-03	2.0E-04
Threaded Conn	Light Hydrocarbon	50	3.3E-08	2.0E-05	1.5E-11	9.3E-09
	Gas	50	9.1E+00	3.1E-01	4.1E-03	1.4E-04
		Total	9.1E+00	3.1E-01	4.1E-03	1.4E-04
Flanges	Light Hydrocarbon	25	4.0E-08	2.5E-05	1.8E-11	1.1E-08
	Gas	25	1.1E+01	3.6E-01	4.9E-03	1.6E-04
		Total	1.1E+01	3.6E-01	4.9E-03	1.6E-04
Other	Gas	3	6.7E+00	2.3E-01	3.1E-03	1.0E-04
		Total	6.7E+00	2.3E-01	3.1E-03	1.0E-04
Grand Total			4.02E+01	1.35E+00	1.82E-02	6.10E-04

Composition ³	VOC, %wt	CH ₄ , %wt	CO ₂ , %wt	Maximum Operating Schedule:
Gas Stream	7.41%	80.04%	2.68%	24
Light Hydrocarbon	94.52%	0.00%	0.00%	365
Heavy Hydrocarbon	100.00%	0.00%	0.00%	

Notes:

1. The number of components is based on estimates from SPEC Services.
2. The VOC emission factors are based on the <10,000 ppmv emission factor in Table IV-2c (Method 3) of the SCAQMD's "Guidelines for Fugitive Emissions Calculations", June 2003, for Oil and Gas Production.
3. Gas compositions for gas stream, light hydrocarbon, and heavy hydrocarbon are based on compositions of produced gas, NGL to truck and NGL to pipeline from SPEC Services.

Table B-22D. Project GHG Emissions - Fugitives (Vapor Recovery)

Type	Service	Number ¹	CH ₄ Emissions (lb/year)	CO ₂ Emissions (lb/year)	CH ₄ Emissions (tonne/year)	CO ₂ Emissions (tonne/year)
Valves	Light Hydrocarbon	96	1.2E-07	7.5E-05	5.5E-11	3.4E-08
	Gas	96	5.2E+01	1.7E+00	2.4E-02	7.9E-04
	Total		5.2E+01	1.7E+00	2.4E-02	7.9E-04
Pumps Seals	Light Hydrocarbon	4	7.0E-08	4.3E-05	3.2E-11	2.0E-08
	Total		7.0E-08	4.3E-05	3.2E-11	2.0E-08
Threaded Conn	Light Hydrocarbon	192	1.3E-07	7.8E-05	5.8E-11	3.6E-08
	Gas	192	3.5E+01	1.2E+00	1.6E-02	5.3E-04
	Total		3.5E+01	1.2E+00	1.6E-02	5.3E-04
Flanges	Light Hydrocarbon	116	1.9E-07	1.1E-04	8.5E-11	5.2E-08
	Gas	96	4.2E+01	1.4E+00	1.9E-02	6.3E-04
	Total		4.2E+01	1.4E+00	1.9E-02	6.3E-04
Other	Light Hydrocarbon	14	1.2E-07	7.5E-05	5.6E-11	3.4E-08
	Gas	16	3.6E+01	1.2E+00	1.6E-02	5.4E-04
	Total		3.6E+01	1.2E+00	1.6E-02	5.4E-04
Grand Total			1.64E+02	5.50E+00	7.46E-02	2.50E-03

Composition ³	VOC, %wt	CH ₄ , %wt	CO ₂ , %wt
Gas Stream	7.41%	80.04%	2.68%
Light Hydrocarbon	94.52%	0.00%	0.00%
Heavy Hydrocarbon	100.00%	0.00%	0.00%

Maximum Operating Schedule:

24

365

Notes:

1. The number of components is based on estimates from SPEC Services.
2. The VOC emission factors are based on the <10,000 ppmv emission factor in Table IV-2c (Method 3) of the SCAQMD's "Guidelines for Fugitive Emissions Calculations", June 2003, for Oil and Gas Production.
3. Gas compositions for gas stream, light hydrocarbon, and heavy hydrocarbon are based on compositions of produced gas, NGL to truck and NGL to pipeline from SPEC Services.

Table B-22E. Project GHG Emissions- Fugitives (Gas Processing)

Type	Service	Number ¹	CH ₄ Emissions (lb/year)	CO ₂ Emissions (lb/year)	CH ₄ Emissions (tonne/year)	CO ₂ Emissions (tonne/year)
Valves	Light Hydrocarbon	142	1.8E-07	1.1E-04	8.2E-11	5.0E-08
	Gas	254	1.4E+02	4.6E+00	6.2E-02	2.1E-03
Total			1.4E+02	4.6E+00	6.2E-02	2.1E-03
Threaded Conn	Light Hydrocarbon	284	1.9E-07	1.2E-04	8.6E-11	5.3E-08
	Gas	508	9.3E+01	3.1E+00	4.2E-02	1.4E-03
Total			9.3E+01	3.1E+00	4.2E-02	1.4E-03
Flanges	Light Hydrocarbon	154	2.5E-07	1.5E-04	1.1E-10	6.9E-08
	Gas	340	1.5E+02	4.9E+00	6.7E-02	2.2E-03
Total			1.5E+02	4.9E+00	6.7E-02	2.2E-03
Other	Light Hydrocarbon	9	7.9E-08	4.8E-05	3.6E-11	2.2E-08
	Gas	11	2.5E+01	8.3E-01	1.1E-02	3.7E-04
Total			2.5E+01	8.3E-01	1.1E-02	3.7E-04
Grand Total			4.02E+02	1.35E+01	1.82E-01	6.11E-03

Composition ³	VOC, %wt	CH ₄ , %wt	CO ₂ , %wt	Maximum Operating Schedule:
Gas Stream	7.41%	80.04%	2.68%	24
Light Hydrocarbon	94.52%	0.00%	0.00%	365
Heavy Hydrocarbon	100.00%	0.00%	0.00%	

Notes:

1. The number of components is based on estimates from SPEC Services.
2. The VOC emission factors are based on the <10,000 ppmv emission factor in Table IV-2c (Method 3) of the SCAQMD's "Guidelines for Fugitive Emissions Calculations", June 2003, for Oil and Gas Production.
3. Gas compositions for gas stream, light hydrocarbon, and heavy hydrocarbon are based on compositions of produced gas, NGL to truck and NGL to pipeline from SPEC Services.

Table B-22F. Project GHG Emissions - Fugitives (NGL Tank #1)

Type	Service	Number ¹	CH ₄ Emissions (lb/year)	CO ₂ Emissions (lb/year)	CH ₄ Emissions (tonne/year)	CO ₂ Emissions (tonne/year)
Valves	Light Hydrocarbon	18	2.3E-08	1.4E-05	1.0E-11	6.4E-09
	Gas	10	5.4E+00	1.8E-01	2.4E-03	8.2E-05
		Total	5.4E+00	1.8E-01	2.4E-03	8.2E-05
Pumps Seals	Light Hydrocarbon	2	3.5E-08	2.2E-05	1.6E-11	9.8E-09
	Gas	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00
		Total	3.5E-08	2.2E-05	1.6E-11	9.8E-09
Threaded Conn	Light Hydrocarbon	36	2.4E-08	1.5E-05	1.1E-11	6.7E-09
	Gas	20	3.6E+00	1.2E-01	1.7E-03	5.5E-05
		Total	3.6E+00	1.2E-01	1.7E-03	5.5E-05
Flanges	Light Hydrocarbon	30	4.8E-08	3.0E-05	2.2E-11	1.3E-08
	Gas	10	4.3E+00	1.5E-01	2.0E-03	6.6E-05
		Total	4.3E+00	1.5E-01	2.0E-03	6.6E-05
Other	Light Hydrocarbon	2	1.8E-08	1.1E-05	8.0E-12	4.9E-09
	Gas	1	2.2E+00	7.5E-02	1.0E-03	3.4E-05
		Total	2.2E+00	7.5E-02	1.0E-03	3.4E-05
Grand Total			1.56E+01	5.23E-01	7.09E-03	2.37E-04

Composition ³	VOC, %wt	CH ₄ , %wt	CO ₂ , %wt
Gas Stream	7.41%	80.04%	2.68%
Light Hydrocarbon	94.52%	0.00%	0.00%
Heavy Hydrocarbon	100.00%	0.00%	0.00%

Maximum Operating Schedule:

24

365

Notes:

1. The number of components is based on estimates from SPEC Services.
2. The VOC emission factors are based on the <10,000 ppmv emission factor in Table IV-2c (Method 3) of the SCAQMD's "Guidelines for Fugitive Emissions Calculations", June 2003, for Oil and Gas Production.
3. Gas compositions for gas stream, light hydrocarbon, and heavy hydrocarbon are based on compositions of produced gas, NGL to truck and NGL to pipeline from SPEC Services.

Table B-22G. Project GHG Emissions - Fugitives (NGL Tank #2)

Type	Service	Number ¹	CH ₄ Emissions (lb/year)	CO ₂ Emissions (lb/year)	CH ₄ Emissions (tonne/year)	CO ₂ Emissions (tonne/year)
Valves	Light Hydrocarbon	18	2.3E-08	1.4E-05	1.0E-11	6.4E-09
	Gas	10	5.4E+00	1.8E-01	2.4E-03	8.2E-05
Total			5.4E+00	1.8E-01	2.4E-03	8.2E-05
Pumps Seals	Light Hydrocarbon	2	3.5E-08	2.2E-05	1.6E-11	9.8E-09
		Total	3.5E-08	2.2E-05	1.6E-11	9.8E-09
Threaded Conn	Light Hydrocarbon	36	2.4E-08	1.5E-05	1.1E-11	6.7E-09
	Gas	20	3.6E+00	1.2E-01	1.7E-03	5.5E-05
Total			3.6E+00	1.2E-01	1.7E-03	5.5E-05
Flanges	Light Hydrocarbon	30	4.8E-08	3.0E-05	2.2E-11	1.3E-08
	Gas	10	4.3E+00	1.5E-01	2.0E-03	6.6E-05
Total			4.3E+00	1.5E-01	2.0E-03	6.6E-05
Other	Light Hydrocarbon	2	1.8E-08	1.1E-05	8.0E-12	4.9E-09
	Gas	1	2.2E+00	7.5E-02	1.0E-03	3.4E-05
Total			2.2E+00	7.5E-02	1.0E-03	3.4E-05
Grand Total			1.56E+01	5.23E-01	7.09E-03	2.37E-04

Composition ³	VOC, %wt	CH ₄ , %wt	CO ₂ , %wt
Gas Stream	7.41%	80.04%	2.68%
Light Hydrocarbon	94.52%	0.00%	0.00%
Heavy Hydrocarbon	100.00%	0.00%	0.00%

Maximum Operating Schedule:

24

365

Notes:

1. The number of components is based on estimates from SPEC Services.
2. The VOC emission factors are based on the <10,000 ppmv emission factor in Table IV-2c (Method 3) of the SCAQMD's "Guidelines for Fugitive Emissions Calculations", June 2003, for Oil and Gas Production.
3. Gas compositions for gas stream, light hydrocarbon, and heavy hydrocarbon are based on compositions of produced gas, NGL to truck and NGL to pipeline from SPEC Services.

Table B-22H. Project GHG Emissions - Fugitives (Emergency Flare)

Type	Service	Number ¹	CH ₄ Emissions (lb/year)	CO ₂ Emissions (lb/year)	CH ₄ Emissions (tonne/year)	CO ₂ Emissions (tonne/year)
Valves	Light Hydrocarbon	5	6.4E-09	3.9E-06	2.9E-12	1.8E-09
	Gas	36	1.9E+01	6.5E-01	8.8E-03	2.9E-04
Total			1.9E+01	6.5E-01	8.8E-03	2.9E-04
Threaded Conn	Light Hydrocarbon	10	6.7E-09	4.1E-06	3.0E-12	1.9E-09
	Gas	72	1.3E+01	4.4E-01	6.0E-03	2.0E-04
Total			1.3E+01	4.4E-01	6.0E-03	2.0E-04
Flanges	Light Hydrocarbon	5	8.0E-09	4.9E-06	3.6E-12	2.2E-09
	Gas	23	1.0E+01	3.3E-01	4.5E-03	1.5E-04
Total			1.0E+01	3.3E-01	4.5E-03	1.5E-04
Grand Total			4.26E+01	1.42E+00	1.93E-02	6.46E-04

Composition ³	VOC, %wt	CH ₄ , %wt	CO ₂ , %wt
Gas Stream	7.41%	80.04%	2.68%
Light Hydrocarbon	94.52%	0.00%	0.00%
Heavy Hydrocarbon	100.00%	0.00%	0.00%

Maximum Operating Schedule:

24
365**Notes:**

1. The number of components is based on estimates from SPEC Services.
2. The VOC emission factors are based on the <10,000 ppmv emission factor in Table IV-2c (Method 3) of the SCAQMD's "Guidelines for Fugitive Emissions Calculations", June 2003, for Oil and Gas Production.
3. Gas compositions for gas stream, light hydrocarbon, and heavy hydrocarbon are based on compositions of produced gas, NGL to truck and NGL to pipeline from SPEC Services.

Table B-22l. Project GHG Emissions - Fugitives (Carbon Adsorber - Slurry System)

Type	Service	Number ¹	CH ₄ Emissions (lb/year)	CO ₂ Emissions (lb/year)	CH ₄ Emissions (tonne/year)	CO ₂ Emissions (tonne/year)
Valves	Gas	4	2.2E+00	7.2E-02	9.8E-04	3.3E-05
		Total	2.2E+00	7.2E-02	9.8E-04	3.3E-05
Threaded Conn	Gas	8	1.5E+00	4.9E-02	6.6E-04	2.2E-05
		Total	1.5E+00	4.9E-02	6.6E-04	2.2E-05
Flanges	Gas	4	1.7E+00	5.8E-02	7.9E-04	2.6E-05
		Total	1.7E+00	5.8E-02	7.9E-04	2.6E-05
Grand Total			5.36E+00	1.79E-01	2.43E-03	8.13E-05

Composition ³	VOC, %wt	CH ₄ , %wt	CO ₂ , %wt
Gas Stream	7.41%	80.04%	2.68%
Light Hydrocarbon	94.52%	0.00%	0.00%
Heavy Hydrocarbon	100.00%	0.00%	0.00%

Maximum Operating Schedule:

24
365**Notes:**

1. The number of components is based on estimates from SPEC Services.
2. The VOC emission factors are based on the <10,000 ppmv emission factor in Table IV-2c (Method 3) of the SCAQMD's "Guidelines for Fugitive Emissions Calculations", June 2003, for Oil and Gas Production.
3. Gas compositions for gas stream, light hydrocarbon, and heavy hydrocarbon are based on compositions of produced gas, NGL to truck and NGL to pipeline from SPEC Services.

Table B-22J. Project GHG Emissions - Fugitives (Process Heater)

Type	Service	Number ¹	CH ₄ Emissions (lb/year)	CO ₂ Emissions (lb/year)	CH ₄ Emissions (tonne/year)	CO ₂ Emissions (tonne/year)
Valves	Heavy Hydrocarbon	28	3.2E-14	3.2E-10	1.4E-17	1.5E-13
	Gas	20	1.1E+01	3.6E-01	4.9E-03	1.6E-04
	Total		1.1E+01	3.6E-01	4.9E-03	1.6E-04
Pumps Seals	Heavy Hydrocarbon	2	--	--	--	--
	Total		0.0E+00	0.0E+00	0.0E+00	0.0E+00
Threaded Conn	Heavy Hydrocarbon	56	3.7E-14	3.7E-10	1.7E-17	1.7E-13
	Gas	40	7.3E+00	2.4E-01	3.3E-03	1.1E-04
	Total		7.3E+00	2.4E-01	3.3E-03	1.1E-04
Flanges	Heavy Hydrocarbon	30	5.6E-14	5.7E-10	2.5E-17	2.6E-13
	Total		5.6E-14	5.7E-10	2.5E-17	2.6E-13
Other	Heavy Hydrocarbon	4	1.9E-14	1.9E-10	8.7E-18	8.7E-14
	Total		1.9E-14	1.9E-10	8.7E-18	8.7E-14
Grand Total			1.81E+01	6.05E-01	8.21E-03	2.75E-04

Composition ³	VOC, %wt	CH ₄ , %wt	CO ₂ , %wt
Gas Stream	7.41%	80.04%	2.68%
Light Hydrocarbon	94.52%	0.00%	0.00%
Heavy Hydrocarbon	100.00%	0.00%	0.00%

Maximum Operating Schedule:

24

365

Notes:

1. The number of components is based on estimates from SPEC Services.
2. The VOC emission factors are based on the <10,000 ppmv emission factor in Table IV-2c (Method 3) of the SCAQMD's "Guidelines for Fugitive Emissions Calculations", June 2003, for Oil and Gas Production.
3. Gas compositions for gas stream, light hydrocarbon, and heavy hydrocarbon are based on compositions of produced gas, NGL to truck and NGL to pipeline from SPEC Services.

Table B-22K. Project GHG Emissions - Fugitives (Truck Loading Rack)

Type	Service	Number ¹	CH ₄ Emissions (lb/year)	CO ₂ Emissions (lb/year)	CH ₄ Emissions (tonne/year)	CO ₂ Emissions (tonne/year)
Valves	Light Hydrocarbon	13	1.7E-08	1.0E-05	7.5E-12	4.6E-09
	Gas	4	2.2E+00	7.2E-02	9.8E-04	3.3E-05
		Total	2.2E+00	7.2E-02	9.8E-04	3.3E-05
Pumps Seals	Light Hydrocarbon	2	3.5E-08	2.2E-05	1.6E-11	9.8E-09
		Total	3.5E-08	2.2E-05	1.6E-11	9.8E-09
Threaded Conn	Light Hydrocarbon	26	1.7E-08	1.1E-05	7.9E-12	4.8E-09
	Gas	18	3.3E+00	1.1E-01	1.5E-03	5.0E-05
		Total	3.3E+00	1.1E-01	1.5E-03	5.0E-05
Flanges	Light Hydrocarbon	15	2.4E-08	1.5E-05	1.1E-11	6.7E-09
	Gas	5	2.2E+00	7.3E-02	9.9E-04	3.3E-05
		Total	2.2E+00	7.3E-02	9.9E-04	3.3E-05
Other	Light Hydrocarbon	3	2.6E-08	1.6E-05	1.2E-11	7.3E-09
	Gas	1	2.2E+00	7.5E-02	1.0E-03	3.4E-05
		Total	2.2E+00	7.5E-02	1.0E-03	3.4E-05
Grand Total			9.86E+00	3.30E-01	4.47E-03	1.50E-04

Composition ³	VOC, %wt	CH ₄ , %wt	CO ₂ , %wt
Gas Stream	7.41%	80.04%	2.68%
Light Hydrocarbon	94.52%	0.00%	0.00%
Heavy Hydrocarbon	100.00%	0.00%	0.00%

Maximum Operating Schedule:

24

365

Notes:

1. The number of components is based on estimates from SPEC Services.
2. The VOC emission factors are based on the <10,000 ppmv emission factor in Table IV-2c (Method 3) of the SCAQMD's "Guidelines for Fugitive Emissions Calculations", June 2003, for Oil and Gas Production.
3. Gas compositions for gas stream, light hydrocarbon, and heavy hydrocarbon are based on compositions of produced gas, NGL to truck and NGL to pipeline from SPEC Services.

Table B-22L. Project GHG Emissions - Fugitives (Carbon Adsorber - Sump Water)

Type	Service	Number ¹	CH ₄ Emissions (lb/year)	CO ₂ Emissions (lb/year)	CH ₄ Emissions (tonne/year)	CO ₂ Emissions (tonne/year)
	Gas	4	2.2E+00	7.2E-02	9.8E-04	3.3E-05
		Total	2.2E+00	7.2E-02	9.8E-04	3.3E-05
Threaded Conn	Gas	8	1.5E+00	4.9E-02	6.6E-04	2.2E-05
		Total	1.5E+00	4.9E-02	6.6E-04	2.2E-05
Flanges	Gas	4	1.7E+00	5.8E-02	7.9E-04	2.6E-05
		Total	1.7E+00	5.8E-02	7.9E-04	2.6E-05
Grand Total			5.36E+00	1.79E-01	2.43E-03	8.13E-05

Composition ³	VOC, %wt	CH ₄ , %wt	CO ₂ , %wt
Gas Stream	7.41%	80.04%	2.68%
Light Hydrocarbon	94.52%	0.00%	0.00%
Heavy Hydrocarbon	100.00%	0.00%	0.00%

Maximum Operating Schedule:

24

365

Notes:

1. The number of components is based on estimates from SPEC Services.
2. The VOC emission factors are based on the <10,000 ppmv emission factor in Table IV-2c (Method 3) of the SCAQMD's "Guidelines for Fugitive Emissions Calculations", June 2003, for Oil and Gas Production.
3. Gas compositions for gas stream, light hydrocarbon, and heavy hydrocarbon are based on compositions of produced gas, NGL to truck and NGL to pipeline from SPEC Services.

Appendix C

Table B-H0A. Operational GHG Emissions - Oil Well Workover Rig Emissions

Number of well workovers (no./yr)	Emissions	
	CO ₂ (lb/yr)	CO ₂ (tonne/day)
60	485,680	220

Input Data

Engine Size

Unit

450 hp

of engines per rig

1 --

Engine load factor

0.19 --

Time per workover

84.00 hr

of workovers per year

60 no./yr

Fuel usage

832,356 lb fuel/yr

116,413 gallon/yr

Source

Engine data provided by Oxy

Engine data provided by Oxy

The engine typically runs at approximately 100% load for 10 percent of the time and 10% load for 90% of the time, as estimated by Oxy.

Estimate provided by Oxy

Estimate provided by Oxy

(0.367 lb/bhp-hr)x(84 hr)x(60 event/yr)x(450 hp)

(27,745 lb/yr)/(lb/gal)

CO₂ EFs

9.96 kg CO₂/gallon

CARB Regulation for the Mandatory Reporting of Greenhouse Gas Emissions- Appendix A- Table 7.

Conversion data

0.367 lb of fuel /bhp-hr

BSFC: HHDT, 300<HP<600. Ref: NONROAD Model

7.15 lb diesel/US gallon

Table B-23B. Operational GHG Emissions - Oil Well Workover Fugitive Emissions

Number of well workovers (no./yr)	CH ₄ EF (tonne/workover) ^{1,2}	CO ₂ EF (tonne/workover) ³	Emissions		
			CH ₄ (lb/day)	CO ₂ (lb/day)	CO ₂ ³ (tonne/yr)
60	0.0018	7.88E-05	1.1	0.05	0.108
				0.05	0.005

Input DataUnit Source

Available at

CH₄ EF 0.0018 tonnes/workover http://www.api.org/ehs/climate/new/upload/2009_GHG_COMPENDIUM.pdf.

Accessed on October 17, 2011

of workovers 60 no./year Estimate provided by Oxy

Mass ratio (VOC/CH₄) 0.64 Calculated from composition data for raw produced gas provided by OxyMass ratio (CO₂/CH₄) 0.04 Calculated from composition data for raw produced gas provided by Oxy

Time per workover 84.00 hr Estimate provided by Oxy

Notes:

1. Calculation of CH₄ emissions uses the 2009 API Compendium of GHG Estimation Methodologies for the Oil and Natural Gas Industry, Table 5-23, page 5-91.

2. CH₄ emissions use the per oil well workover EF directly, although it is noted that the assumed CH₄ mass fraction of the gas for oil well workovers is not provided in the API Compendium.

3. CO₂ and VOC emissions are calculated as a fraction of CH₄ emissions using the ratio of mass fractions of CO₂ and VOC to CH₄, respectively.

Appendix C

Table B-24. Project GHG Emissions - Process Flare

Pollutant		Emissions ^{1,2}	
		lb/year	tonne/year
Process Flare			
	CO ₂	27,854,897	12,638
	CH ₄	469	0.21
	N ₂ O	52	0.02

Flare Rating ³	27 MMBtu/hr
CARB Emissions factor	53.42 kg CO ₂ /MMBtu natural gas
	0.9 g CH ₄ /MMBtu natural gas
	0.1 g N ₂ O/MMBtu natural gas
Operating Schedule	24 hours/day
	365 days/year

Notes:

1. CO₂ emissions were calculated from the equation listed in 95125(a)(1) of the CARB Regulation for the Mandatory Reporting of Greenhouse Gas Emissions.
2. CH₄ and N₂O emissions were calculated from the equation listed in 95125(b)(3) of the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions.
3. Flare burner rating was adjusted assuming natural gas HHV of 1050 and using the permit condition limit on gas flow of 464,000 scf per day (~322 scfm).

Table B-25A Project GHG Offsite Emissions - CalEEMod Input Assumptions for Well Drilling

Number of Trips per Day During Well Drilling

Vehicle Type ¹	One-Way Trip Per Day
Worker	10
Contractors	5
Initial Mud and wet cutting Trucks	2

Trip Parameters During Well Drilling-CalEEMod Input

	Land Use Type	Land Size	Unit	Land Size in 1000 sf	Daily One-Way Trip	Trip Generation Rate ⁵ (trips /1,000 sq. ft)	Trip %	One-Way Trip Length (miles)
Commercial - Work ²	General heavy industry	283,140	sf	283	15	0.05	66.67	model default
Commercial - Nonwork ²							33.33	model default
Commercial Nonwork Hauling ^{3,4}					2	0.01	100	150

Notes:

1. Estimated by Oxy.
2. Represent Oxy's worker and contractor trips.
3. Hauling is modeled separately in CalEEMod due to different CalEEMOD assumptions in trip generation rate, trip %, and trip length than those for worker and contractor commute.
4. For the GHG estimate, the trip length is assumed to be 150 miles to transfer the slurry to Buttonwillow, CA.
5. Calculated as daily one-way trip divided by land size in 1000 sf.

Table B-25B. Project GHG Offsite Emissions - CalEEMod Input Assumptions for Well Production

Number of Trips per Day During Well Production

Vehicle Type ¹	One-Way Trip Per Day
Worker	10
Contractors	5
Workover Rig Truck	1
NGL Haul Trucks	2
Slurry Truck	1

Trip Parameters During Well Production-CalEEMod Input

	Land Use Type	Land Size	Unit	Land Size in 1000 sf	Daily One-Way Trip	Trip Generation Rate ⁹ (trips /1,000 sq. ft)	Trip %	One-Way Trip Length (miles)
Commercial - Work ²	General heavy industry	283,140	sf	283	15	0.05	66.67	model default
Commercial - Nonwork ³							33.33	model default
Commercial Nonwork Hauling ^{4,5}					2	0.01	100	130
NGL Trucks					10	0.04	100	150
Commercial Nonwork Hauling ^{6,7}								
Slurry Truck					10	0.04	100	model default
Commercial - Nonwork Workover Rig ⁸								

Notes:

1. Estimated by Oxy.
2. Represents worker commute trips.
3. Represents contractor commute trips.
4. Hauling is modeled separately in CalEEMod due to different CalEEMOD assumptions in trip generation rate, trip %, and trip length than those for workers and contractors commute.
5. For the GHG estimate, the trip length is assumed to be 130 miles to transfer NGL's to Bakersfield.
6. One truck per day is required to transfer slurry offsite when the slurry injection wells are not in operation. Since trip generation rate for one truck is very small and the model is not sensitive enough, we assumed 10 trucks for the purpose of modeling. The output results are divided by 10 to represent only 1 truck.
7. For the GHG estimate, the trip length is assumed to be 150 miles to transfer the slurry to Buttonwillow, CA.
8. One truck is required to carry the workover rig to the site during the well maintenance. Since trip generation rate for one truck is very small and the model is not sensitive enough, we assumed 10 trucks for the purpose of modeling. The output results are divided by 10 to represent only 1 truck.
9. Calculated as daily one-way trip divided by land size in 1000 sf.

Appendix C

CalEEMod Version: CalEEMod.2011.1.1

Date: 6/10/2011

Table B-26. Oxy Offsite Operational Emission Estimation- Future Project Well Drilling-Well Production Workers and Contractors Commute

Los Angeles-South Coast County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric
General Heavy Industry	283.14	1000sqft

1.2 Other Project Characteristics

Urbanization	Urban	Wind Speed (m/s)		Utility Company	Los Angeles Department of Water & Power
Climate Zone	9		2.2		
		Precipitation Freq (Days)			

1.3 User Entered Comments

33

Project Characteristics -
Land Use - Project description
Construction Phase - No Construction Phase
Off-road Equipment - No Construction emissions
Trips and VMT - No Construction emissions
On-road Fugitive Dust - No construction emission
Grading - No Construction Phase
Vehicle Trips - Based on the information provided by Mark
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Road Dust -
Energy Use -
Water And Wastewater - User Defined Commercial default values are assumed to be equal to General Office Buildings.
Solid Waste - User Defined Commercial default values are assumed to be equal to General Office Buildings.
Construction Off-road Equipment Mitigation -

Appendix C

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2011	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01
Total	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2011	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01
Total	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	2,200.92	2,200.92	0.05	0.02	2,208.87
Mobile	0.01	0.04	0.14	0.00	0.02	0.00	0.02	0.00	0.00	0.00	0.00	21.75	21.75	0.00	0.00	21.77
Waste						0.00	0.00		0.00	0.00	353.83	0.00	353.83	20.93	0.00	792.95
Water						0.00	0.00		0.00	0.00	0.00	10,199.40	10,199.40	42.73	1.14	11,451.56
Total	1.39	0.30	0.36	0.00	0.02	0.00	0.04	0.00	0.00	0.02	353.83	12,422.07	12,775.90	63.69	1.16	14,475.15

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	2,200.92	2,200.92	0.05	0.02	2,208.87
Mobile	0.01	0.04	0.14	0.00	0.02	0.00	0.02	0.00	0.00	0.00	0.00	21.75	21.75	0.00	0.00	21.77
Waste						0.00	0.00		0.00	0.00	353.83	0.00	353.83	20.93	0.00	792.95
Water						0.00	0.00		0.00	0.00	0.00	10,199.40	10,199.40	42.73	1.14	11,451.56
Total	1.39	0.30	0.36	0.00	0.02	0.00	0.04	0.00	0.00	0.02	353.83	12,422.07	12,775.90	63.69	1.16	14,475.15

Appendix C

3.0 Construction Detail

3.1 Mitigation Measures Construction

3.2 Demolition - 2011

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29
Total	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73
Total	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29
Total	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73
Total	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73

Appendix C

4.0 Mobile Detail

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.01	0.04	0.14	0.00	0.02	0.00	0.02	0.00	0.00	0.00	0.00	21.75	21.75	0.00	0.00	21.77
Unmitigated	0.01	0.04	0.14	0.00	0.02	0.00	0.02	0.00	0.00	0.00	0.00	21.75	21.75	0.00	0.00	21.77
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

4.2 Trip Summary Information

Land Use	Average Daily Trip Rate			Unmitigated	Mitigated
	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Heavy Industry	14.16	14.16	14.16	43,287	43,287
Total	14.16	14.16	14.16	43,287	43,287

4.3 Trip Type Information

Land Use	Miles			Trip %		
	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW
General Heavy Industry	8.90	13.30	7.40	66.67	0.00	33.33

Appendix C

5.0 Energy Detail

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.00	0.00		0.00	0.00	0.00	1,916.71	1,916.71	0.04	0.02	1,922.93
Electricity Unmitigated						0.00	0.00		0.00	0.00	0.00	1,916.71	1,916.71	0.04	0.02	1,922.93
NaturalGas Mitigated	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
NaturalGas Unmitigated	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
General Heavy Industry	5.32586e+006	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total		0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
General Heavy Industry	5.32586e+006	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total		0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
General Heavy Industry	3.41184e+006					1,916.71	0.04	0.02	1,922.93
Total						1,916.71	0.04	0.02	1,922.93

Mitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
General Heavy Industry	3.41184e+006					1,916.71	0.04	0.02	1,922.93
Total						1,916.71	0.04	0.02	1,922.93

Appendix C

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unmitigated	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.33					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	1.02					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.33					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	1.02					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix C

7.0 Water Detail

7.1 Mitigation Measures Water

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr				MT/yr			
Mitigated					10,199.40	42.73	1.14	11,451.56
Unmitigated					10,199.40	42.73	1.14	11,451.56
Total	NA	NA	NA	NA	NA	NA	NA	NA

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			
General Heavy Industry	1392.18 / 0					10,199.40	42.73	1.14	11,451.56
Total						10,199.40	42.73	1.14	11,451.56

Mitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			
General Heavy Industry	1392.18 / 0					10,199.40	42.73	1.14	11,451.56
Total						10,199.40	42.73	1.14	11,451.56

Appendix C

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
	tons/yr				MT/yr			
Mitigated					353.83	20.91	0.00	792.95
Unmitigated					353.83	20.91	0.00	792.95
Total	NA	NA	NA	NA	NA	NA	NA	NA

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
General Heavy Industry	1743.08					353.83	20.91	0.00	792.95
Total						353.83	20.91	0.00	792.95

Mitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
General Heavy Industry	1743.08					353.83	20.91	0.00	792.95
Total						353.83	20.91	0.00	792.95

9.0 Vegetation

Appendix C

CalEEMod Version: CalEEMod.2011.1.1

Date: 9/7/2011

**Table B-27. Oxy Offsite Operational Emission Estimation-Future Project Slurry Hauling
Los Angeles-South Coast County, Annual**

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric
General Heavy Industry	283.14	1000sqft

1.2 Other Project Characteristics

Urbanization	Urban	Wind Speed (m/s)		Utility Company	Los Angeles Department of Water & Power
Climate Zone	9		2.2		
		Precipitation Freq (Days)			
			33		

1.3 User Entered Comments

Project Characteristics -
Land Use - Project description
Construction Phase - No Construction Phase
Off-road Equipment - No Construction emissions
Trips and VMT - No Construction emissions
On-road Fugitive Dust - No construction emission
Grading - No Construction Phase
Vehicle Trips - Based on the information provided by Mark
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Road Dust -
Energy Use -
Water And Wastewater - User Defined Commercial default values are assumed to be equal to General Office Buildings.
User Defined Recreational default values are assumed to be equal to Strip Mall
Solid Waste - User Defined Commercial default values are assumed to be equal to General Office Buildings.
User Defined Recreational default values are assumed to be equal to Strip Mall
Construction Off-Road Equipment Mitigation -

Appendix C

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2011	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01
Total	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2011	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01
Total	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	2,200.92	2,200.92	0.05	0.02	2,208.87
Mobile	0.69	6.76	3.56	0.01	0.35	0.32	0.68	0.03	0.32	0.36	0.00	1,126.94	1,126.94	0.03	0.00	1,127.48
Waste						0.00	0.00		0.00	0.00	353.83	0.00	353.83	20.91	0.00	792.95
Water						0.00	0.00		0.00	0.00	0.00	10,199.40	10,199.40	42.73	1.14	11,451.56
Total	2.07	7.02	3.78	0.01	0.35	0.32	0.70	0.03	0.32	0.38	353.83	13,527.26	13,881.09	63.72	1.16	15,580.86

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	2,200.92	2,200.92	0.05	0.02	2,208.87
Mobile	0.69	6.76	3.56	0.01	0.35	0.32	0.68	0.03	0.32	0.36	0.00	1,126.94	1,126.94	0.03	0.00	1,127.48
Waste						0.00	0.00		0.00	0.00	353.83	0.00	353.83	20.91	0.00	792.95
Water						0.00	0.00		0.00	0.00	0.00	10,199.40	10,199.40	42.73	1.14	11,451.56
Total	2.07	7.02	3.78	0.01	0.35	0.32	0.70	0.03	0.32	0.38	353.83	13,527.26	13,881.09	63.72	1.16	15,580.86

Appendix C

3.0 Construction Detail

3.1 Mitigation Measures Construction

3.2 Demolition - 2011

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29
Total	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73
Total	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29
Total	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73
Total	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73

Appendix C

4.0 Mobile Detail

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.69	6.76	3.56	0.01	0.35	0.32	0.68	0.03	0.32	0.36	0.00	1,126.94	1,126.94	0.03	0.00	1,127.48
Unmitigated	0.69	6.76	3.56	0.01	0.35	0.32	0.68	0.03	0.32	0.36	0.00	1,126.94	1,126.94	0.03	0.00	1,127.48
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

4.2 Trip Summary Information

Land Use	Average Daily Trip Rate			Unmitigated Annual VMT	Mitigated Annual VMT
	Weekday	Saturday	Sunday		
General Heavy Industry	11.33	11.33	11.33	618,378	618,378
Total	11.33	11.33	11.33	618,378	618,378

4.3 Trip Type Information

Land Use	Miles			Trip %		
	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW
General Heavy Industry	8.90	13.30	150.00	0.00	0.00	100.00

Appendix C

5.0 Energy Detail

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.00	0.00		0.00	0.00	0.00	1,916.71	1,916.71	0.04	0.02	1,922.93
Electricity Unmitigated						0.00	0.00		0.00	0.00	0.00	1,916.71	1,916.71	0.04	0.02	1,922.93
NaturalGas Mitigated	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
NaturalGas Unmitigated	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
General Heavy Industry	5.32586e+006	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total		0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
General Heavy Industry	5.32586e+006	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total		0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
General Heavy Industry	3.41184e+006					1,916.71	0.04	0.02	1,922.93
Total						1,916.71	0.04	0.02	1,922.93

Mitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
General Heavy Industry	3.41184e+006					1,916.71	0.04	0.02	1,922.93
Total						1,916.71	0.04	0.02	1,922.93

Appendix C

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unmitigated	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.33					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	1.02					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.33					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	1.02					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix C

7.0 Water Detail

7.1 Mitigation Measures Water

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr				MT/yr			
Mitigated					10,199.40	42.73	1.14	11,451.56
Unmitigated					10,199.40	42.73	1.14	11,451.56
Total	NA	NA	NA	NA	NA	NA	NA	NA

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			
General Heavy Industry	1392.18 / 0					10,199.40	42.73	1.14	11,451.56
Total						10,199.40	42.73	1.14	11,451.56

Mitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			
General Heavy Industry	1392.18 / 0					10,199.40	42.73	1.14	11,451.56
Total						10,199.40	42.73	1.14	11,451.56

Appendix C

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
	tons/yr				MT/yr			
Mitigated					353.83	20.91	0.00	792.95
Unmitigated					353.83	20.91	0.00	792.95
Total	NA	NA	NA	NA	NA	NA	NA	NA

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
General Heavy Industry	1743.08					353.83	20.91	0.00	792.95
Total						353.83	20.91	0.00	792.95

Mitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
General Heavy Industry	1743.08					353.83	20.91	0.00	792.95
Total						353.83	20.91	0.00	792.95

9.0 Vegetation

Appendix C

CalEEMod Version: CalEEMod.2011.1.1

Date: 6/23/2011

Table B-28. Oxy Offsite Operational Emission Estimation- Future Project Workover Rig
Los Angeles-South Coast County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric
General Heavy Industry	283.14	1000sqft

1.2 Other Project Characteristics

Urbanization	Urban	Wind Speed (m/s)	Utility Company	Los Angeles Department of Water & Power
Climate Zone	9	2.2		
		Precipitation Freq (Days)		

1.3 User Entered Comments

Project Characteristics -
Land Use - Project description
Construction Phase - No Construction Phase
Off-road Equipment - No Construction emissions
Trips and VMT - No Construction emissions
On-road Fugitive Dust - No construction emission
Grading - No Construction Phase
Vehicle Trips - Based on the information provided by Mark
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Road Dust -
Energy Use -
Water And Wastewater - User Defined Commercial default values are assumed to be equal to General Office Buildings.
Solid Waste - User Defined Commercial default values are assumed to be equal to Strip Mall.
User Defined Recreational default values are assumed to be equal to General Office Buildings.
Construction Off-road Equipment Mitigation -

Appendix C

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2011	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01
Total	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2011	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01
Total	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.03	0.26	0.22	0.00			0.02		0.00	0.02	0.00	2,200.92	2,200.92	0.05	0.02	2,208.87
Mobile	0.05	0.45	0.33	0.00	0.02	0.02	0.03	0.00	0.02	0.02	0.00	60.82	60.82	0.00	0.00	60.86
Waste						0.00	0.00		0.00	0.00	353.83	0.00	353.83	20.91	0.00	792.95
Water						0.00	0.00		0.00	0.00	0.00	10,199.40	10,199.40	42.73	1.14	11,451.56
Total	1.43	0.71	0.55	0.00	0.02	0.02	0.05	0.00	0.02	0.04	353.83	12,461.14	12,814.97	63.69	1.16	14,514.24

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	2,200.92	2,200.92	0.05	0.02	2,208.87
Mobile	0.05	0.45	0.33	0.00	0.02	0.02	0.03	0.00	0.02	0.02	0.00	60.82	60.82	0.00	0.00	60.86
Waste						0.00	0.00		0.00	0.00	353.83	0.00	353.83	20.91	0.00	792.95
Water						0.00	0.00		0.00	0.00	0.00	10,199.40	10,199.40	42.73	1.14	11,451.56
Total	1.43	0.71	0.55	0.00	0.02	0.02	0.05	0.00	0.02	0.04	353.83	12,461.14	12,814.97	63.69	1.16	14,514.24

Appendix C

3.0 Construction Detail

3.1 Mitigation Measures Construction

3.2 Demolition - 2011

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29
Total	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73
Total	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29
Total	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73
Total	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73

Appendix C

4.0 Mobile Detail

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.05	0.45	0.33	0.00	0.02	0.02	0.03	0.00	0.02	0.02	0.00	60.82	60.82	0.00	0.00	60.86
Unmitigated	0.05	0.45	0.33	0.00	0.02	0.02	0.03	0.00	0.02	0.02	0.00	60.82	60.82	0.00	0.00	60.86
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

4.2 Trip Summary Information

Land Use	Average Daily Trip Rate			Unmitigated	Mitigated
	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Heavy Industry	11.33	11.33	11.33	30,507	30,507
Total	11.33	11.33	11.33	30,507	30,507

4.3 Trip Type Information

Land Use	Miles			Trip %		
	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW
General Heavy Industry	8.90	13.30	7.40	0.00	0.00	100.00

Appendix C

5.0 Energy Detail

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.00	0.00		0.00	0.00	0.00	1,916.71	1,916.71	0.04	0.02	1,922.93
Electricity Unmitigated							0.00		0.00	0.00	0.00	1,916.71	1,916.71	0.04	0.02	1,922.93
NaturalGas Mitigated	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
NaturalGas Unmitigated	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
General Heavy Industry	5.32586e+006	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total		0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
General Heavy Industry	5.32586e+006	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total		0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
General Heavy Industry	3.41184e+006					1,916.71	0.04	0.02	1,922.93
Total						1,916.71	0.04	0.02	1,922.93

Mitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
General Heavy Industry	3.41184e+006					1,916.71	0.04	0.02	1,922.93
Total						1,916.71	0.04	0.02	1,922.93

Appendix C

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unmitigated	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.33					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	1.02					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.33					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	1.02					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix C

7.0 Water Detail

7.1 Mitigation Measures Water

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr				MT/yr			
Mitigated					10,199.40	42.73	1.14	11,451.56
Unmitigated					10,199.40	42.73	1.14	11,451.56
Total	NA	NA	NA	NA	NA	NA	NA	NA

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			
General Heavy Industry	1392.18 / 0					10,199.40	42.73	1.14	11,451.56
Total						10,199.40	42.73	1.14	11,451.56

Mitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			
General Heavy Industry	1392.18 / 0					10,199.40	42.73	1.14	11,451.56
Total						10,199.40	42.73	1.14	11,451.56

Appendix C

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
	tons/yr				MT/yr			
Mitigated					353.83	20.91	0.00	792.95
Unmitigated					353.83	20.91	0.00	792.95
Total	NA	NA	NA	NA	NA	NA	NA	NA

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
General Heavy Industry	1743.08					353.83	20.91	0.00	792.95
Total						353.83	20.91	0.00	792.95

Mitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
General Heavy Industry	1743.08					353.83	20.91	0.00	792.95
Total						353.83	20.91	0.00	792.95

9.0 Vegetation

Appendix C

CalEEMod Version: CalEEMod.2011.1.1

Date: 6/13/2011

Table B-29. Oxy Offsite Operational Emission Estimation-Future Project-NGL Hauling
Los Angeles-South Coast County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric
General Heavy Industry	283.14	1000sqft

1.2 Other Project Characteristics

Urbanization	Urban	Wind Speed (m/s)		Utility Company	Los Angeles Department of Water & Power
Climate Zone	9		2.2		
		Precipitation Freq (Days)			

1.3 User Entered Comments

Project Characteristics -
Land Use - Project description
Construction Phase - No Construction Phase
Off-road Equipment - No Construction emissions
Trips and VMT - No Construction emissions
On-road Fugitive Dust - No construction emission
Grading - No Construction Phase
Vehicle Trips - Based on the information provided by Mark
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Road Dust -
Energy Use -
Water And Wastewater - User Defined Commercial default values are assumed to be equal to General Office Buildings.
User Defined Recreational default values are assumed to be equal to Strip Mall
Solid Waste - User Defined Commercial default values are assumed to be equal to General Office Buildings.
User Defined Recreational default values are assumed to be equal to Strip Mall
Construction Off-Road Equipment Mitigation -

Appendix C

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2011	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01
Total	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2011	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01
Total	0.10	0.80	0.47	0.00	0.00	0.04	0.04	0.00	0.04	0.04	0.00	69.84	69.84	0.01	0.00	70.01

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	2,200.92	2,200.92	0.05	0.02	2,208.87
Mobile	0.15	1.47	0.78	0.00	0.08	0.07	0.15	0.01	0.07	0.08	0.00	244.35	244.35	0.01	0.00	244.47
Waste						0.00	0.00		0.00	0.00	353.83	0.00	353.83	20.91	0.00	792.95
Water						0.00	0.00		0.00	0.00	0.00	10,199.40	10,199.40	42.73	1.14	11,451.56
Total	1.53	1.73	1.00	0.00	0.08	0.07	0.17	0.01	0.07	0.10	353.83	12,644.67	12,998.50	63.70	1.16	14,697.85

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	2,200.92	2,200.92	0.05	0.02	2,208.87
Mobile	0.15	1.47	0.78	0.00	0.08	0.07	0.15	0.01	0.07	0.08	0.00	244.35	244.35	0.01	0.00	244.47
Waste						0.00	0.00		0.00	0.00	353.83	0.00	353.83	20.91	0.00	792.95
Water						0.00	0.00		0.00	0.00	0.00	10,199.40	10,199.40	42.73	1.14	11,451.56
Total	1.53	1.73	1.00	0.00	0.08	0.07	0.17	0.01	0.07	0.10	353.83	12,644.67	12,998.50	63.70	1.16	14,697.85

Appendix C

3.0 Construction Detail

3.1 Mitigation Measures Construction

3.2 Demolition - 2011

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29
Total	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73
Total	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29
Total	0.10	0.80	0.46	0.00		0.04	0.04		0.04	0.04	0.00	68.12	68.12	0.01	0.00	68.29

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73
Total	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.00	0.00	1.73

Appendix C

4.0 Mobile Detail

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.15	1.47	0.78	0.00	0.08	0.07	0.15	0.01	0.07	0.08	0.00	244.35	244.35	0.01	0.00	244.47
Unmitigated	0.15	1.47	0.78	0.00	0.08	0.07	0.15	0.01	0.07	0.08	0.00	244.35	244.35	0.01	0.00	244.47
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

4.2 Trip Summary Information

Land Use	Average Daily Trip Rate			Unmitigated	Mitigated
	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Heavy Industry	2.83	2.83	2.83	133,982	133,982
Total	2.83	2.83	2.83	133,982	133,982

4.3 Trip Type Information

Land Use	Miles			Trip %		
	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW
General Heavy Industry	8.90	13.30	130.00	0.00	0.00	100.00

Appendix C

5.0 Energy Detail

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.00	0.00		0.00	0.00	0.00	1,916.71	1,916.71	0.04	0.02	1,922.93
Electricity Unmitigated						0.00	0.00		0.00	0.00	0.00	1,916.71	1,916.71	0.04	0.02	1,922.93
NaturalGas Mitigated	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
NaturalGas Unmitigated	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
General Heavy Industry	5.32586e+006	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total		0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
General Heavy Industry	5.32586e+006	0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94
Total		0.03	0.26	0.22	0.00		0.00	0.02		0.00	0.02	0.00	284.21	284.21	0.01	0.01	285.94

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
General Heavy Industry	3.41184e+006					1,916.71	0.04	0.02	1,922.93
Total						1,916.71	0.04	0.02	1,922.93

Mitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
General Heavy Industry	3.41184e+006					1,916.71	0.04	0.02	1,922.93
Total						1,916.71	0.04	0.02	1,922.93

Appendix C

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unmitigated	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.33					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	1.02					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.33					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	1.02					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.35	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix C

7.0 Water Detail

7.1 Mitigation Measures Water

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr				MT/yr			
Mitigated					10,199.40	42.73	1.14	11,451.56
Unmitigated					10,199.40	42.73	1.14	11,451.56
Total	NA	NA	NA	NA	NA	NA	NA	NA

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			
General Heavy Industry	1392.18 / 0					10,199.40	42.73	1.14	11,451.56
Total						10,199.40	42.73	1.14	11,451.56

Mitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			
General Heavy Industry	1392.18 / 0					10,199.40	42.73	1.14	11,451.56
Total						10,199.40	42.73	1.14	11,451.56

Appendix C

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
	tons/yr				MT/yr			
Mitigated					353.83	20.91	0.00	792.95
Unmitigated					353.83	20.91	0.00	792.95
Total	NA	NA	NA	NA	NA	NA	NA	NA

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
General Heavy Industry	1743.08					353.83	20.91	0.00	792.95
Total						353.83	20.91	0.00	792.95

Mitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
General Heavy Industry	1743.08					353.83	20.91	0.00	792.95
Total						353.83	20.91	0.00	792.95

9.0 Vegetation

Appendix C

Table B-30: Project GHG Emissions for Backhoe¹

Pollutant	Emission Factor ⁴	Maximum Daily Emissions	Average Annual Emissions
	g/hp-hr	lbs/day	MT/yr
CO2	568.299	49.47	8.2
CH4	0.062	0.01	0.0
Total CO2e			8.2

Operation Schedule

Maximum: 1.4 hr/day
10 hr/week
520 hour/year

Average: 1.4 hr/day
10 hr/week
520 hour/year

Calculation Factors

1	Number of Equipment
75 hp	Horsepower ²
37% %	Load Factor ³
453.59 g/lb	

Notes:

1. One backhoe will be operating on the site to move solids around the site during operation.
2. Based on CalEEMod default horsepower for backhoes.
3. Emission factors are from CalEEMod user manual, Appendix D, Table 3.4: OFFROAD Equipment Emission Factors and the selected equipment category for tractors/loaders/backhoes. Load factor for backhoes are from CalEEMod User manual, Appendix D, Table 3.3 Offroad Default Horsepower Load Factors. It is noted a 33% adjustment factor was applied to the load factor per CARB recent updates on in-use offroad equipment load factors.

Table B-31. Project GHG Emissions from Electricity¹

Pollutant	GHG Emissions (metric tons/year)
CO ₂	28,029
CH ₄	1.3
N ₂ O	0.5
CO ₂ e	28,204

SCE Electricity Carbon Intensity²:641.26 lb/MWh, SCE CO₂ factor0.029 lb/MWh, SCE CH₄ factor0.011 lb/MWh, SCE N₂O factor**Project Electricity Demand³:**

22 MW, electricity demand

50% Load

8760 hours/year, operation hours

Notes:

1. Electricity consumption is for the general operation of the Oxy facility.
2. Based on the CalEEMod Input.
3. Provided by SPEC Services.

Appendix C

Table B-32. Project GHG Emissions For Office Waste Generation - CalEEMod Output File

CalEEMod Version: CalEEMod.2011.1.1

Date: 7/11/2011

Oxy GHG emission - Operation Los Angeles-South Coast County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric
Office Park	10	1000sqft

1.2 Other Project Characteristics

Urbanization	Urban	Wind Speed (m/s)		Utility Company	Southern California Edison
Climate Zone	9		2.2		
		Precipitation Freq (Days)			

1.3 User Entered Comments

33

Project Characteristics -
Land Use - Project description
Construction Phase - No Construction Phase
Off-road Equipment - No Construction emissions
Trips and VMT - No Construction emissions
On-road Fugitive Dust - No construction emission
Grading - No Construction Phase
Vehicle Trips - Based on the information provided by Mark
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Vehicle Emission Factors - Based on the total number of vehicle types commute to the site
Road Dust -
Energy Use -
Water And Wastewater -
Solid Waste -
Construction Off-road Equipment Mitigation -

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2011	0.01	0.08	0.05	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00	7.27	7.27	0.00	0.00	7.29
Total	0.01	0.08	0.05	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00	7.27	7.27	0.00	0.00	7.29

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2011	0.01	0.08	0.05	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00	7.27	7.27	0.00	0.00	7.29
Total	0.01	0.08	0.05	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00	7.27	7.27	0.00	0.00	7.29

2.2 Overall Operational

Appendix C

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.05	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.00	0.01	0.00	0.00		0.00	0.00		0.00	0.00	0.00	51.74	51.74	0.00	0.00	52.06
Mobile	0.09	0.23	0.92	0.00	0.15	0.01	0.16	0.01	0.01	0.02	0.00	142.76	142.76	0.01	0.00	142.87
Waste						0.00	0.00		0.00	0.00	1.89	0.00	1.89	0.11	0.00	4.23
Water						0.00	0.00		0.00	0.00	0.00	10.27	10.27	0.05	0.00	11.89
Total	0.14	0.24	0.92	0.00	0.15	0.01	0.16	0.01	0.01	0.02	1.89	204.77	206.66	0.17	0.00	211.05

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.05	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.00	0.01	0.00	0.00		0.00	0.00		0.00	0.00	0.00	51.74	51.74	0.00	0.00	52.06
Mobile	0.09	0.23	0.92	0.00	0.15	0.01	0.16	0.01	0.01	0.02	0.00	142.76	142.76	0.01	0.00	142.87
Waste						0.00	0.00		0.00	0.00	1.89	0.00	1.89	0.11	0.00	4.23
Water						0.00	0.00		0.00	0.00	0.00	10.27	10.27	0.05	0.00	11.89
Total	0.14	0.24	0.92	0.00	0.15	0.01	0.16	0.01	0.01	0.02	1.89	204.77	206.66	0.17	0.00	211.05

3.0 Construction Detail

3.1 Mitigation Measures Construction

3.2 Demolition - 2011

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.01	0.08	0.05	0.00		0.01	0.01		0.01	0.01	0.00	6.69	6.69	0.00	0.00	6.71
Total	0.01	0.08	0.05	0.00		0.01	0.01		0.01	0.01	0.00	6.69	6.69	0.00	0.00	6.71

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix C

Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.57	0.00	0.00	0.58
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.57	0.00	0.00	0.58

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.01	0.08	0.05	0.00		0.01	0.01		0.01	0.01	0.00	6.69	6.69	0.00	0.00	6.71
Total	0.01	0.08	0.05	0.00		0.01	0.01		0.01	0.01	0.00	6.69	6.69	0.00	0.00	6.71

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.57	0.00	0.00	0.58
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.57	0.00	0.00	0.58

4.0 Mobile Detail

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.09	0.23	0.92	0.00	0.15	0.01	0.16	0.01	0.01	0.02	0.00	142.76	142.76	0.01	0.00	142.87
Unmitigated	0.09	0.23	0.92	0.00	0.15	0.01	0.16	0.01	0.01	0.02	0.00	142.76	142.76	0.01	0.00	142.87
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

4.2 Trip Summary Information

Land Use	Average Daily Trip Rate			Unmitigated	Mitigated
	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Office Park	114.20	16.40	7.60	284,691	284,691
Total	114.20	16.40	7.60	284,691	284,691

4.3 Trip Type Information

Land Use	Miles			Trip %		
	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW
Office Park	8.90	13.30	7.40	33.00	48.00	19.00

5.0 Energy Detail

5.1 Mitigation Measures Energy

Appendix C

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.00	0.00		0.00	0.00	0.00	46.25	46.25	0.00	0.00	46.54
Electricity Unmitigated						0.00	0.00		0.00	0.00	0.00	46.25	46.25	0.00	0.00	46.54
NaturalGas Mitigated	0.00	0.01	0.00	0.00		0.00	0.00		0.00	0.00	0.00	5.49	5.49	0.00	0.00	5.52
NaturalGas Unmitigated	0.00	0.01	0.00	0.00		0.00	0.00		0.00	0.00	0.00	5.49	5.49	0.00	0.00	5.52
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
Office Park	102900	0.00	0.01	0.00	0.00		0.00	0.00		0.00	0.00	0.00	5.49	5.49	0.00	0.00	5.52
Total		0.00	0.01	0.00	0.00		0.00	0.00		0.00	0.00	0.00	5.49	5.49	0.00	0.00	5.52

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
Office Park	102900	0.00	0.01	0.00	0.00		0.00	0.00		0.00	0.00	0.00	5.49	5.49	0.00	0.00	5.52
Total		0.00	0.01	0.00	0.00		0.00	0.00		0.00	0.00	0.00	5.49	5.49	0.00	0.00	5.52

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
Office Park	159000					46.25	0.00	0.00	46.54
Total						46.25	0.00	0.00	46.54

Mitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
Office Park	159000					46.25	0.00	0.00	46.54
Total						46.25	0.00	0.00	46.54

6.0 Area Detail

6.1 Mitigation Measures Area

Appendix C

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.05	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unmitigated	0.05	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.01					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	0.04					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.05	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.01					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	0.04					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.05	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

7.0 Water Detail

7.1 Mitigation Measures Water

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr				MT/yr			
Mitigated					10.27	0.05	0.00	11.89
Unmitigated					10.27	0.05	0.00	11.89
Total	NA	NA	NA	NA	NA	NA	NA	NA

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			
Office Park	1.77734 / 1.08934					10.27	0.05	0.00	11.89
Total						10.27	0.05	0.00	11.89

Mitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			

Appendix C

Office Park	1.77734 / 1.08934					10.27	0.05	0.00	11.89
Total						10.27	0.05	0.00	11.89

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
	tons/yr				MT/yr			
Mitigated					1.89	0.11	0.00	4.23
Unmitigated					1.89	0.11	0.00	4.23
Total	NA	NA	NA	NA	NA	NA	NA	NA

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
Office Park	9.3					1.89	0.11	0.00	4.23
Total						1.89	0.11	0.00	4.23

Mitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
Office Park	9.3					1.89	0.11	0.00	4.23
Total						1.89	0.11	0.00	4.23

9.0 Vegetation

Appendix C

OXY USA Inc. – Dominguez Oil Field Production Facility
Greenhouse Gas and Climate Change Technical Report

Appendix C

GHG Life Cycle Model Information Tables

Appendix C: GHG Life Cycle Model Information Tables

Table C-1: Details on How Efficiency is Used to Calculate Energy Consumption for Crude Recovery (Table 1.02)			
Fuel Type	Fuel Shares	Relationship of Recovery Efficiency (0.93) and Fuel Shares	Direct Energy (Btu/mmBtu)
Crude oil	0.2%	$(106)(1/0.93 - 1)(0.002) = 124$	124
Residual oil	0.2%	$(106)(1/0.93 - 1)(0.002) = 124$	124
Diesel fuel	2.5%	$(106)(1/0.93 - 1)(0.086) = 1,867$	1,867
Gasoline	0.3%	$(106)(1/0.93 - 1)(0.011) = 249$	249
Natural gas	94.3%	$(106)(1/0.93 - 1)(0.943) = 70,595$	70,595
Coal and Pet. Coke	2.4%	$(106)(1/0.93 - 1)(0.0024) = 1,803$	1,803
Electricity	0%	$(106)(1/0.93 - 1)(0) = 0$	0
Feed Loss	0.1%	$(106)(1/0.93 - 1)(0.001) = 75$	75
Natural Gas Flared		Weighted average for worldwide crude for CA refineries	13,107

Note: The direct energy consumption for both project case and base case in Table C-3 were estimated using the equations provided in the Table above. Additional 4,314 Btu/mmBtu credit for electricity co-produced is applied to average petroleum. This data is obtained from ARB (http://www.arb.ca.gov/fuels/lcfs/022709lcts_carbob.pdf).

Table C-2: Summary of Recovery Efficiency and Proportion of Fuels used in Crude Recovery

	CA TEOR	CA Water Flood	CA Gas Injection	CA Primary	Alaska	Imported
Recovery Efficiency (%)	71	97	93.5	98	98	98
Fuel Shares (%)						
Crude Oil	0	0	0	0	1	1
Residual Oil	0	0	0	0	1	1
Diesel	0	0	0	0	15	15
Gasoline	0	0	0	0	2	2
Natural gas	97	81	0	81	62	62
Coal/pet coke	3	0	0	0	0	0
Electricity	-	19	100	19	19	19

Note: The proportions of different fuels used in crude recovery and recovery efficiency as summarized in the above table were used to calculate direct energy consumption (Table C-3). This data was obtained from personal communications with ARB staff.

Table C-3. Energy Consumption Calculations for Crude Recovery

Direct Energy Calculation from CARBOB document (Table 1.02)					Fuel Share by Source of Crude Oil - Base Case			Direct Energy by Source of Crude Oil (Btu/mmBtu) - Base Case			Fuel Share by Source of Crude Oil- Project Case			Direct Energy by Source of Crude Oil (Btu/mmBtu) - Project Case		
Fuel Type	Fuel Shares	Relationship of Recovery Efficiency (0.93) and Fuel Shares	Direct Energy (Btu/mmBtu)	Revised Recovery Eff	CA (Weighted Average)	Alaska	Others	CA (Weighted Average)	Alaska	Others	CA (Weighted Average)	Alaska	Others	CA (Weighted Average)	Alaska	Others
Crude Oil	0.20%	$(10^6) \times (1/0.93-1) \times (0.002)$	124	94.16%	0.00%	1.00%	1.00%	0	33	92	0.00%	1.00%	1.00%	0	32	89
Residual Oil	0.20%	$(10^6) \times (1/0.93-1) \times (0.002)$	124	94.16%	0.00%	1.00%	1.00%	0	33	92	0.00%	1.00%	1.00%	0	32	89
Diesel Fuel	2.50%	$(10^6) \times (1/0.93-1) \times (0.0250)$	1867	93.05%	0.00%	15.00%	15.00%	0	493	1,378	0.00%	15.00%	15.00%	0	475	1,328
Gasoline	0.30%	$(10^6) \times (1/0.93-1) \times (0.033)$	225	93.02%	0.00%	2.00%	2.00%	0	66	184	0.00%	2.00%	2.00%	0	63	177
Natural Gas - On Site	94.30%	$(10^6) \times (1/0.93-1) \times (0.943)$	70978	93.00%	84.40%	62.00%	62.00%	47,478	2,037	5,694	84.22%	62.00%	62.00%	47,731	1,963	5,488
Coal and Pet. Coke - On Site	2.40%	$(10^6) \times (1/0.93-1) \times (0.024)$	1803	93.01%	1.15%	0.00%	0.00%	645	0	0	1.09%	0.00%	0.00%	615	0	0
Natural Gas Flared	Weighted average for worldwide crude for CA refineries		13,107	-	-	-	-	5,099	2,110	5,898	-	-	-	5,388	2,034	5,694
Natural Gas - From Electricity	-	-	-	-	13.73%	18.05%	18.05%	432,422	235,248	657,525	13.96%	18.05%	18.05%	464,699	226,743	633,613
Coal and Pet. Coke - From Electricity	-	-	-	-	0.72%	0.95%	0.95%	22,759	12,381	34,607	0.73%	0.95%	0.95%	24,458	11,934	33,355
Electricity	0.00%	$(10^6) \times (1/0.93-1) \times (0.0)$	0	0.00%	0.00%	0.00%	0.00%	0	0	0	0.00%	0.00%	0.00%	0	0	0

Table C-4: Specific Fuel Shares Contributing to CO₂ Emissions (Table 1.07)

Fuel	Calculations	CO ₂ Emissions (g CO ₂ /mmBtu)
Crude Oil	124 *(crude oil emissions factor + total CO ₂ emissions from crude recovery)/ 10 ⁶	10
Residual Oil	124 *(Fraction of residual oil consumed in a commercial boiler*emissions factor of a commercial boiler + emissions from crude*loss factor for emissions from crude + total emissions from residual oil)/ 10 ⁶	12
Diesel fuel	1.867*(percentage from diesel boiler*emission factor for diesel boiler + percentage from stationary diesel engine*emissions factor for diesel engine + percentage from stationary diesel turbine*emission factor of diesel turbine + emissions from crude*loss factor + total emissions from diesel)/ 10 ⁶ (see Table 1.08A for further details)	174
Gasoline	249*(emissions factor of reciprocating engine + crude emissions* loss factor + emissions from conventional gasoline)/ 10 ⁶	17
Natural Gas	70.595*(percentage of natural gas used in an engine*emissions factor for natural gas engine + percentage of natural gas used in a small industrial boiler*emissions factor for small industrial boiler + emissions from natural gas as a stationary fuel)/10 ⁶ (see Table 1.08B for further details)	4,413
Coal (Pet. Coke)	1803*(emission factor for coal boiler + WTT emissions for coal)	176
Electricity	0*(emissions from producing feedstock + emissions from consuming feedstock)/10 ⁶	0
Natural Gas (flared)	13,107*(emissions factor for natural gas flaring)/10 ⁶	761

Note: The direct energy and CO₂ emissions provided in the above table were used to calculate fuel specific emission factors which in turn were utilized to estimate CO₂ emissions by geographic source in Table C-5. This data is obtained from ARB (http://www.arb.ca.gov/fuels/lcfs/022709lcfs_carbob.pdf).

Table C-5. CO₂ Emissions Calculation by Fuel and by Source of Crude Oil

Fuel	Equations from CARBOB document (Table 1.07)	Direct Energy - Base Case (Btu/mmBtu)			Direct Energy - Project Case (Btu/mmBtu)			Values of all the Parameter except Direct Energy used in the Equations			CO ₂ emissions (g CO ₂ /mmBtu) - Base Case			CO ₂ emissions (g CO ₂ /mmBtu) - Project Case		
		California	Alaska	Others	California	Alaska	Others	California	Alaska	Others	California	Alaska	Others	California	Alaska	Others
Crude Oil	Direct Energy*(Crude oil emission factor + total CO2 emissions from crude recovery)/10^6	0	33	92	0	32	89	0.080645161	0.080645161	0.080645161	0	3	7	0	3	7
Residual Oil	Direct Energy*(Fraction of residual oil consumed in a commercial boiler*emission factor of a commercial boiler + emissions from crude * loss factor for emissions from crude + total emissions from residual oil)/10^6	0	33	92	0	32	89	0.096774194	0.096774194	0.096774194	0	3	9	0	3	9
Diesel Fuel	Direct Energy* (percentage from diesel boiler*emission factor for diesel boiler + percentage from stationary diesel engine * emission factor for diesel engine + percentage from stationary diesel turbine * emission factor of diesel turbine + emissions from crude * loss factor + total emission from diesel)/10^6	0	493	1378	0	475	1328	0.093197643	0.093197643	0.093197643	0	46	128	0	44	124
Gasoline	Direct Energy* (emission factor of reciprocating engine + crude emissions * loss factor + emissions from conventional gasoline)/10^6	0	66	184	0	63	177	0.075555556	0.075555556	0.075555556	0	5	14	0	5	13

Table C-5. CO ₂ Emissions Calculation by Fuel and by Source of Crude Oil																
Fuel	Equations from CARBOB document (Table 1.07)	Direct Energy - Base Case (Btu/mmBtu)			Direct Energy - Project Case (Btu/mmBtu)			Values of all the Parameter except Direct Energy used in the Equations			CO ₂ emissions (g CO ₂ /mmBtu) - Base Case			CO ₂ emissions (g CO ₂ /mmBtu) - Project Case		
		California	Alaska	Others	California	Alaska	Others	California	Alaska	Others	California	Alaska	Others	California	Alaska	Others
Natural Gas	Direct Energy * (percentage of natural gas used in an engine * emissions factor for natural gas engine + percentage of natural gas used in a small industrial boiler * emissions factor for small industrial boiler + emissions from natural gas as a stationary fuel)/10 ⁶	47478	2037	5694	47731	1963	5488	0.062174195	0.062174195	0.062174195	2952	127	354	2968	122	341
Coal (Pet. Coke)	Direct Energy * (emission factor for coal boiler + WTT emissions for coal)	645	0	0	615	0	0	0.097615086	0.097615086	0.097615086	63	0	0	60	0	0
Electricity	Direct Energy * (emissions from producing feedstock + emissions from consuming feedstock)/10 ⁶	0	0	0	0	0	0	-	-	-	0	0	0	0	0	0
Natural Gas (flared)	Direct Energy * (emissions factor for natural gas flaring)/10 ⁶	5099	2110	5898	5388	2034	5685	0.058060578	0.058060578	0.058060578	296	123	342	313	118	330
Natural Gas - From Electricity	Energy used as natural gas *9971*5084/10 ⁶ /10 ⁶	432422	235248	657525	464699	226743	633753	-	-	-	22	12	33	24	11	32
Coal and Pet. Coke - From Electricity	Energy used as coal *9971*5084/10 ⁶ /10 ⁶	22759	12381	34607	24458	11934	33355	-	-	-	1	1	2	1	1	2

Table C-6. Summary of CO ₂ Emissions by Fuel Type and by Source of Crude Oil									
Fuel Type	g CO ₂ /MJ- Base Case				g CO ₂ /MJ - Project Case				Total
	California	Alaska	Others	Total	California	Alaska	Others	Total	
Crude Oil	0.000	0.003	0.007	0.010	0.000	0.002	0.007	0.009	0.009
Residual Oil	0.000	0.003	0.008	0.011	0.000	0.003	0.008	0.011	0.011
Diesel Fuel	0.000	0.044	0.122	0.165	0.000	0.042	0.117	0.159	0.159
Gasoline	0.000	0.005	0.013	0.018	0.000	0.005	0.013	0.017	0.017
Natural Gas	2.819	0.131	0.367	3.317	2.835	0.127	0.354	3.316	3.316
Coke (Pet. Coke)	0.061	0.001	0.002	0.063	0.058	0.001	0.002	0.060	0.060
Electricity	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural Gas (flared)	0.281	0.116	0.325	0.721	0.297	0.112	0.313	0.721	0.721
Total	3.160	0.302	0.844	4.306	3.190	0.291	0.813	4.294	4.294

Table C-7: Energy Breakdown from Electricity (Feedstock Consumption) (Table 1.10)				
Fuel	Conv. Efficiency	Generation Mix	Relationship of Conversion Efficiency and Energy Use	Description
Nat. Gas	39.0%	100%	$(106/0.394) \times (1/1 - 0.081)$	Energy used as natural gas (Btu/mmBtu), a CA-GREET calculation

Note: Emissions from natural gas and coal-fired based electricity estimated in Table C-5 utilized data provided in the above Table. This data is obtained from ARB (http://www.arb.ca.gov/fuels/lcfs/022709lcfs_carbob.pdf).

Table C-8: Detailed CO ₂ Emissions from Feedstock Production (Table 1.11)		
Feedstock	Calculation	g CO ₂ /mmBtu
Natural Gas	$9,971 \times (2,793,243 \times 5,084) / 106$	142

Note: Emissions from natural gas and coal-fired based electricity estimated in Table C-5 used equation provided in the above Table. This data is obtained from ARB (http://www.arb.ca.gov/fuels/lcfs/022709lcfs_carbob.pdf).

Table C-9: CH₄, N₂O, VOC and CO Emissions from Crude Recovery (Table 1.12)

Fuel Type (g /mmBtu)	CH ₄	N ₂ O	VOC	CO
Crude oil	0.003	0.000	0.000	0.005
Residual oil	0.014	0.000	0.001	0.005
Diesel fuel	0.220	0.003	0.097	0.398
Gasoline	0.053	0.001	0.449	3.262
Natural gas	22.158	0.069	1.981	13.914
Electricity	0.000	0.000	0.000	0.000
Natural gas (flared)	0.642	0.014	0.033	0.341
Total (without non-combustion)	23.090	0.088	2.561	17.925
Non-combustion	11.0	-	0.702	-
Vented	54.2	-	-	-
Total	88.29	0.088	3.263	17.925

Note: Emissions from other greenhouse gases in Table C-11 were scaled proportionately to the model's calculated CO₂ emissions using the information provided in the above table. This data is obtained from ARB (http://www.arb.ca.gov/fuels/lcfs/022709lcfs_carbob.pdf).

Table C-10: Total GHG Emissions from Crude Recovery (Table 1.13)

	(g/mmBtu)	Formula	gCO ₂ e/mmBtu	gCO ₂ e/MJ
CO ₂	5,564	5,564*1	5,564	5.27
CH ₄	88,290	88,290*25	2,207,253	2.09
N ₂ O	0.088	0.088*298	26,095	0.03
CO	17,925	17,925*0.43*(44/12)	28,168	0.03
VOC	3,263	3,263*0.85*(44/12)	10,169	0.01
Total GHG emissions			7,836	7.43
Electricity Co-Product Credit				-0.51
Total GHG emissions				6.93

Note: The information provided in the formula column was used to obtain Total GHG emissions estimated in Table C-12. This data is obtained from ARB (http://www.arb.ca.gov/fuels/lcfs/022709lcfs_carbob.pdf).

Table C-11. Summary of CH ₄ , N ₂ O, VOC and CO Emissions from Crude Recovery									
Fuel Type	Base Case (g/mmBtu)				Project Case (g/mmBtu)				
	CH ₄	N ₂ O	VOC	CO	CH ₄	N ₂ O	VOC	CO	
Crude Oil	0.0029	0	0	0.0048	0.0028	0	0	0.004593551	
Residual Oil	0.0160	0	0.0011	0.0057	0.0154	0	0.001102452	0.0055	
Diesel Fuel	0.2138	0.0029	0.0943	0.3868	0.2061	0.002810404	0.090869737	0.3728	
Gasoline	0.0473	0.0009	0.4010	2.9130	0.0456	0.0009	0.3865	2.8077	
Natural Gas	17.5849	0.0548	1.5722	11.0424	17.5767	0.0547	1.5714	11.03721921	
Coke (Pet. Coke)	-	-	-	-	-	-	-	-	
Electricity	0	0	0	0	0	0	0	0	
Natural Gas (flared)	0.6432	0.0140	0.0331	0.3416	0.6432	0.0140	0.0331	0.3416	
Total (without non-combustion)	18.51	0.07	2.10	14.69	18.49	0.07	2.08	14.57	
Non-Combustion	8.99	-	0.57	-	8.96	0.00	0.57	0.00	
Vented	44.28	-	-	-	44.16	0.00	0.00	0.00	
Total	71.78	0.07	2.68	14.69	71.62	0.07	2.65	14.57	

Note: ARB did not have information where there are blanks (http://www.arb.ca.gov/fuels/lcfs/022709lcfs_carbob.pdf).

Table C-12. Total GHG Emissions (g/MJ) from Crude Recovery		
Pollutant (CO ₂ equivalent)	Base Case (g/MJ)	Project Case (g/MJ)
CO ₂	4.31	4.29
CH ₄	1.70	1.70
N ₂ O	0.02	0.02
CO	0.02	0.02
VOC	0.01	0.01
Electricity Co-Product Credit	-0.51	-0.51
Total GHG emissions	5.55	5.53

Table C-13. Total Crude Make-up in California	
Crude Make-up	bbl/yr
Total Crude in 2006 (bbl/yr)*	233,600,000
California Crude in 2006 (bbl/yr)	90,870,400
California Crude in 2006 (Water Flood Method) (bbl/yr)	5,571,741
Additional Crude in 2006 (Water Flood Method) from Oxy Field (bbl/yr)	2,190,000
Total California Crude (Water Flood Method) (addition of Oxy field) (bbl/yr)	7,761,741
New California Crude Contribution (Water Flood Method)	8.34%

Note: The data in the above table were utilized to calculate contribution of crude supplied to California refineries by geographic source for project case as summarized in Table C-14.

*This data is obtained from the ARB Proposed Regulation to Implement the Low Carbon Fuel Standard Volume II Appendices, Figure C12-1 Crude Make-up in CA from 1982-2007 (<http://www.arb.ca.gov/regact/2009/lcfs09/lcfs092.pdf>).

Table C-14. Breakdown of Crude Supplied to California Refineries			
Source of Crude	Contribution of Crude Supplied to California Refineries (Base Case)	Contribution of Crude Supplied to California Refineries Renormalized (Base Case)	Contribution of Crude Supplied to California Refineries (Project Case)
California -Water Flood	6.10%	6.13%	8.34%
California - Gas Inject	1.30%	1.31%	1.31%
California - Primary	16.50%	16.59%	16.59%
California - TEOR	14.80%	14.88%	14.88%
Alaska	16.10%	16.10%	15.52%
Other Imported	44.44%	44.37%	42.77%
Venezuela	0.63%	0.63%	0.61%
Total	99.87%	100.00%	100.00%

Table C-15: Crude Oil Transport Details (Table 2.01)

			Crude Pipeline			Ocean Tanker		
Crude Supply (2005)	Mix	Dest.	Source Share	Distance (miles)	Dest.	Source Share	Distance (miles)	
Alaska	16.1%	Valdez	100%	870	SF	100%	1,974	
Domestic	38.9%	Refineries	100%	200	-	-	-	
Foreign	45.0%	Weighted Calc.	100%	498	Weighted Calc.	100%	8,884	
Annual Total		Weighted Average		442	Weighted Average		7,063	
			Barge					
Crude Supply (2005)	Destination		Source Share	Distance (miles)				
Alaska								
Domestic	CA		5.0%	200				
Foreign								
Annual Total	Weighted Average		1.9%	200				

Note: The information provided in the above table was used in Table C-18 through Table C-23 to estimate CO₂ emissions from the crude transport. This data is obtained from ARB (http://www.arb.ca.gov/fuels/lcfs/022709lcfs_carbob.pdf).

Table C-16: Crude Transport CO ₂ Emissions (Table 2.04)			
Mode	Formula	gCO ₂ /mmBtu	gCO ₂ /MJ
Ocean Tanker	(Density of crude/LHV of crude)*(miles traveled) * $(1/454) * (1/2000) * ((\text{Energy intensity on trip from origin to destination} * (\text{emission factor for residual oil} + \text{WTT CO}_2 \text{ for residual oil})) + (\text{Energy intensity on return trip} * (\text{emission factor for bunker fuel} + \text{emission factor for residual oil}))$	586	0.56
Pipeline	(Density of crude/LHV of crude)*(Energy intensity of pipeline)*(miles traveled)*($1/454) * (1/2000) * (\text{WTT emissions for electricity})$	538	0.51
Barge	(Density of crude/LHV of crude)*(miles traveled) * $(1/454) * (1/2000) * ((\text{Energy intensity on trip from origin to destination} * (\text{emission factor for residual oil} + \text{WTT residual oil CO}_2)) + (\text{Energy intensity on return trip} * (\text{emission factor for residual oil} + \text{WTT residual oil CO}_2)))$	7	0.01
	Total	1,131	1.07

Note: The information provided in the above table was used in Table C-18 through Table C-23 to estimate CO₂ emissions from the crude transport. This data is obtained from ARB (http://www.arb.ca.gov/fuels/lcfs/022709lcfs_carbob.pdf).

Table C-17: Values of Properties Used in Table 2.04 (Table 2.05)

Parameters	Values	Sources
Miles traveled by Ocean Tanker (miles)	7,063	Table 2.01
Pipeline transport (miles)	442	Table 2.01
Density of crude (grams/gallon)	3,205	CA-GREET default
Lower heating value (LHV) of crude (Btu/gallon)	129,670	CA-GREET default
Energy intensity of Ocean Tanker on trip to destination (Btu/ton-mile)	27	CA-GREET default
Energy intensity of Ocean Tanker on return trip (Btu/ton-mile)	24	CA-GREET default
Energy intensity of Pipeline (Btu/ton-mile)	253	CA-GREET default
Energy intensity of Barge on trip to destination (Btu/ton-mile)	403	CA-GREET default
Energy intensity of Barge on trip to destination (Btu/ton-mile)	307	CA-GREET default
Conversion from pounds to grams	454	
Conversion from tons to pounds	2,000	
Conversion from MJ to mmBtu	1055	
CO ₂ EF for residual oil in barge (g/mmBtu fuel burned)	84,515 (both trips)	CA-GREET default
WTT electricity CO ₂ emissions (g/mmBtu)	176,891	CA-GREET calculated
WTT Emission factor for Residual Oil (g/mmBtu)	11,920	CA-GREET default

Note: The information provided in the above table was used in Table C-18 through Table C-23 to estimate CO₂ emissions from the crude transport. This data is obtained from ARB (http://www.arb.ca.gov/fuels/lcfs/022709lcfs_carbob.pdf).

Table C-18: Total GHG Emissions Crude Transport and Distribution (Table 2.07)

GHG	(g/mmBtu)	Formula to Convert to CO ₂ e	g CO ₂ e/mmBtu	g CO ₂ e/MJ
CO ₂	1,131	1.31*1	1,131	1.07
CH ₄	1.829	1.829*25	46	0.04
N ₂ O	0.024	0.024*298	7	0.01
CO	1.601	1.601*0.43*(44/12)	3	0.00
VOC	0.619	0.619*0.85*(44/12)	2	0.00
Total GHG Emissions				1.14

Note: Emissions from other greenhouse gases in Table C-25 were scaled proportionately to the model's calculated CO₂ emissions using the information provided in the above table. This data is obtained from ARB (http://www.arb.ca.gov/fuels/lcfs/022709lcfs_carbob.pdf).

Table C-19. Crude Oil Transport Details

Crude Supply (2005)	Base Case - Mix	Crude Pipeline			Ocean Tanker			Barge			Project Case Mix
		Destination.	Source Share	Distance (miles)	Destination.	Source Share	Distance (miles)	Destination.	Source Share	Distance (miles)	
Alaska	16.10%	Valdez	100%	870	SF	100%	1,974	-	-	-	15.52%
Domestic	38.90%	Refineries	100%	200	-	-	-	CA	5.00%	200	41.11%
Foreign	45.00%	Weighted Cal.	100%	498	Weighted Cal.	100%	8,884	-	-	-	43.37%
Annual Total	-	Weighted Average	-	442	Weighted Average	-	7,063	Weighted Average	-	200	100.00%

Table C-20. CO₂ Emissions Calculation for Crude Oil from California

Mode	Ocean Tanker		Pipeline		Barge
	CO ₂ emissions (gCO ₂ /mmbtu)	CO ₂ emissions (gCO ₂ /MJ)	CO ₂ emissions (gCO ₂ /mmbtu)	CO ₂ emissions (gCO ₂ /MJ)	
CO ₂ emissions (gCO ₂ /mmbtu)	0	0	243.44	7	0.007
CO ₂ emissions (gCO ₂ /MJ)	0	0	0.231	0.007	0.007
CO ₂ emissions Equation	(Density of crude/LHV of crude)*(miles traveled)*(1/454)*((Energy intensity on trip from origin to destination)*(emission factor for residual oil+ WTT CO ₂ for residual oil) + (Energy intensity on return trip* (emission factor for bunker fuel + emission factor for residual oil)))		(Density of crude/LHV of crude)*(Energy intensity of pipeline)*(miles traveled)*(1/454)*((Energy intensity on trip from origin to destination)*(emission factor for residual oil + WTT residual oil CO ₂)) + (Energy intensity on return trip*(emission factor for residual oil + WTT residual oil CO ₂))		
Density of crude (grams/gallon)	3,205	3,205	3,205	3,205	3,205
Lower heating value (LHV) of crude (Btu/gallon)	129,670	129,670	129,670	129,670	129,670
miles traveled	0	0	200	200	200
Energy intensity on trip from origin to destination (Btu/ton-mile)	27	27	-	-	403
Pipeline energy intensity (Btu/ton-mile)	-	-	253	253	-
Energy intensity on return trip	24	24	-	-	307
((Energy intensity on trip from origin to destination*(emission factor for residual oil+ WTT CO ₂ for residual oil)) + (Energy intensity on return trip* (emission factor for bunker fuel + emission factor for residual oil)))	3,047,935	3,047,935	-	-	1285776.162
WTT Emissions for electricity	-	-	176740.7976	176740.7976	-

Table C-21. CO ₂ Emissions Calculations for Crude Oil from Alaska			
Mode	Ocean Tanker	Pipeline	Barge
CO ₂ emissions (gCO ₂ /mmbtu)	163.777998	1058.96	0
CO ₂ emissions (gCO ₂ /MJ)	0.155239809	1.004	0.000
CO ₂ emissions Equation	(Density of crude/LHV of crude)*(miles traveled)*(1/454)*(1/2000)*((Energy intensity on trip from origin to destination*(emission factor for residual oil+ WTT CO ₂ for residual oil)) + (Energy intensity on return trip* (emission factor for bunker fuel + emission factor for residual oil))	(Density of crude/LHV of crude)*(Energy intensity of pipeline)*(miles traveled)*(1/454)*(1/2000)*(WTT emissions for electricity)	(Density of crude/LHV of crude)*(miles traveled) *(1/454)*(1/2000)*((Energy intensity on trip from origin to destination*(emission factor for residual oil + WTT residual oil CO ₂)) + (Energy intensity on return trip*(emission factor for residual oil + WTT residual oil CO ₂))
Density of crude (grams/gallon)	3,205	3,205	3,205
Lower heating value (LHV) of crude (Btu/gallon)	129,670	129,670	129,670
miles traveled	1,974	870	0
Energy intensity on trip from origin to destination (Btu/ton-mile)	27	-	403
Pipeline energy intensity (Btu/ton-mile)	-	253	-
Energy intensity on return trip	24	-	307
((Energy intensity on trip from origin to destination*(emission factor for residual oil+ WTT CO ₂ for residual oil)) + (Energy intensity on return trip* (emission factor for bunker fuel + emission factor for residual oil))	3,047,935	-	1285776.162
WTT Emissions for electricity	-	176740.7976	-

Table C-22. CO ₂ Emissions Calculations for Crude Oil from Other Foreign Sources				
Mode	Ocean Tanker	Pipeline	Barge	
CO ₂ emissions (gCO ₂ /mmbtu)	737.0839587	606.16	0	
CO ₂ emissions (gCO ₂ /MJ)	0.698657781	0.575	0.000	
CO ₂ emissions Equation	(Density of crude/LHV of crude)*(miles traveled)*(1/454)*(1/2000)*((Energy intensity on trip from origin to destination*(emission factor for residual oil) + (Energy intensity on return trip* (emission factor for bunker fuel + emission factor for residual oil)))	(Density of crude/LHV of crude)*(Energy intensity of pipeline)*(miles traveled)*(1/454)*(1/2000)*(WTT emissions for electricity)	(Density of crude/LHV of crude)*(miles traveled) *(1/454)*(1/2000)*((Energy intensity on trip from origin to destination*(emission factor for residual oil + WTT residual oil CO ₂)) + (Energy intensity on return trip*(emission factor for residual oil + WTT residual oil CO ₂))	
Density of crude (grams/gallon)	3,205	3,205	3,205	
Lower heating value (LHV) of crude (Btu/gallon)	129,670	129,670	129,670	
miles traveled	8,884	498	0	
Energy intensity on trip from origin to destination (Btu/ton-mile)	27	-	403	
Pipeline energy intensity (Btu/ton-mile)	-	253	-	
Energy intensity on return trip	24	-	307	
((Energy intensity on trip from origin to destination*(emission factor for residual oil+ WTT CO ₂ for residual oil)) + (Energy intensity on return trip* (emission factor for bunker fuel + emission factor for residual oil)))	3,047,935	-	1285776.162	
WTT Emissions for electricity	-	176740.7976	-	

Table C-23. Summary of Composite CO₂ Emissions (g CO₂/MJ) Related to Crude Transport and Distribution

Mode	Base Case				Project Case				% Change			
	Ocean Tanker	Pipeline	Barge	Total	Ocean Tanker	Pipeline	Barge	Total	Ocean Tanker	Pipeline	Barge	Total
Alaska	0.04	0.16	0.00	0.20	0.04	0.16	0.00	0.20	0.00%	-3.62%	0.00%	-2.89%
California	0.00	0.09	0.01	0.10	0.00	0.09	0.01	0.10	0.00%	5.68%	0.00%	5.29%
Others	0.51	0.26	0.00	0.77	0.51	0.25	0.00	0.76	0.00%	-3.62%	0.00%	-1.21%
Total	0.56	0.51	0.01	1.07	0.56	0.50	0.01	1.06	0.00%	-1.98%	0.00%	-0.94%

Table C-24. Total GHG Emissions (g/MJ) Crude Transport and Distribution

Pollutant (CO ₂ equivalent)	Base Case (g/MJ)	Project Case (g/MJ)
CO ₂	1.07	1.06
CH ₄	0.04	0.04
N ₂ O	0.01	0.01
CO	0.00	0.00
VOC	0.00	0.00
Total GHG emissions	1.13	1.12

Appendix C

OXY USA Inc. – Dominguez Oil Field Production Facility
Greenhouse Gas and Climate Change Technical Report

Appendix D

Technical Memorandum – Evaluation of California Crude Oil Demand and Life Cycle Considerations

April 17, 2012

TECHNICAL MEMORANDUM

To: Mr. Mark Kapelke, OXY USA, Inc.

From: Mr. Steven Messner, ENVIRON
Ms. Shari Libicki, ENVIRON
Mr. Eric Lu, ENVIRON

Subject: Evaluation of California Crude Oil Demand and Life Cycle Implications

Introduction

ENVIRON has prepared the following analysis to supplement our previous work on the life cycle analysis of the crude oil produced from the Dominguez oilfield. We first discuss whether there is likely to be an expansion of oil processed in California. Given our findings that there is a limited refining capacity in California, we evaluate whether the Dominguez oil would replace imported oil or California-based production. We will address this question by first describing studies that show declining California oil production and the resulting increase in tankered imports. These studies indicate that increases in California production from projects, such as Dominguez, have the effect of reducing imports, rather than replacing California production. In addition, we provide an evaluation on a crude-by-crude basis that shows that the production from Dominguez has lower embodied carbon footprint than the crudes predominantly processed in California refineries, including California oils.

California Oil Production is Supplemented by Imported Oil

California State policy makers have consistently recognized that declines in State production are replaced with imported oils brought by tankers to California refineries. California's most recent Integrated Energy Policy Report (IEPR) discusses this relationship: "The quantity of crude oil imported into California is determined by the rate of decline of California production, processing capacities, and operating rates of refineries."¹ A key finding from a 2006 study by the California Energy Commission also directly linked declining California production with foreign imports: "The declining crude oil production in South-Central California has resulted in higher crude oil costs because of reliance on higher priced imported crude oils".² State policy makers also recognize that California refineries are operating at capacity and that the State is importing finished petroleum products to meet demand. The IEPR goes on to state: "Staff expects crude oil imports compared to 2010 levels to rise by between 22 million and 104 million barrels per year by 2030. At the high end, this increase is solely the result of declining California crude oil production, since refining capacity remains fixed [emphasis added]. The forecast for the low end is driven primarily by the assumption of declining refining capacity, reducing the need for crude oil supply." An increase in refining capacity could not realistically occur without an expansion project at one of California's refineries, or the siting of a new refinery. Such an expansion would require an evaluation under the California Environmental Quality Act.

¹ California Energy Commission, 2012. 2011 Integrated Energy Policy Report. February. CEC-100-2011-001-CMF.

² Sheridan, M., 2006. "California Crude Oil Production and Imports". April. CEC-600-2006-006.

A 2008 study was undertaken by Baker & O'Brien, Inc., an independent consulting engineering firm, for a new terminal for oil imports at the Port of Los Angeles.³ Baker & O'Brien examined publicly available data on the sources of California and foreign crude oil refined by Southern California refineries from 1996 to 2006 and predicted how those sources would change between 2007 and 2040. Baker & O'Brien based their analysis on refinery demand for crude oil rather than consumer demand for refined products due to the limited refining capacity in California. They also noted that the state already was importing ten percent of its refined blending components and finished gasoline and diesel to meet demand (IEPR 2007). This study determined that crude production from the Los Angeles Basin (which includes Dominguez) and Ventura areas would continue to be directed to southern California refineries and also concluded that crude production closer to Bakersfield and Santa Maria would be preferentially supplied to refineries in those areas first, as these areas do not have access to imports.

Given the above, ENVIRON concluded that increased oil production from Dominguez would likely replace the foreign and Alaska imports in Southern California refineries and reduce overall annual GHG emissions from the production and transportation of the crude oil by 38,037 metric tons of carbon dioxide equivalent (CO₂e)⁴. However, we have also considered an unlikely case that the Dominguez oil would replace California based production in California refineries. The following table summarizes the carbon intensity (CI) values associated with the production and transportation of different California crude oils, as well as imported crude oils that are commonly used in Southern California refineries. The CI values used to compare these oils are from the CARB LCFS approval documents (CARB 2009)⁵ and from a separate study performed by the National Energy Technology Laboratory (NETL)⁶. The CI value for the Dominguez oil was calculated directly using project emission information from the project GHG Technical report.⁷

The NETL study considered GHG emissions resulting from the production, transportation, and refining of average crudes from several foreign countries including Saudi Arabia, Iraq, and Ecuador. The latter three are especially relevant as they have recently been the predominant foreign crude oils imported into Southern California refineries. ENVIRON reviewed monthly shipment records available from the Energy Information Administration (EIA) for the year 2011.⁸ The most recent report from November shows that nearly 77% of foreign imports into Southern California refineries were from Saudi Arabia (18.5%), Iraq (23.2%), and Ecuador (34.9%). Smaller amounts were imported from other countries including Oman (5.2%), Canada (5.1%), Argentina (3.8%), Brazil (2.6%), Colombia (2.6%), Peru (2.6%) and Australia (1.6%). The NETL report provides GHG emission estimates for Canadian crude, but not for any of the other crudes with smaller imported volumes. The NETL report also provides estimates for Venezuelan crude which has been imported into California in the past year, so it is also presented in Table 1 below.

³ POLA, 2008. Pacific L.A. Marine Terminal LLC Crude Oil Terminal Draft SEIS/SEIR. Appendix D1. May.

⁴ ENVIRON, 2012. DRAFT Greenhouse Gas and Climate Change Technical Report.

⁵ CARB, 2009. "Proposed Regulation to Implement the Low Carbon Fuel Standard", Initial Statement of Reasons, Volume II Appendices". March 5. Table C12-6.

⁶ DOE, 2009. "An evaluation of the Extraction, Transport and Refining of Imported Crude Oils and the Impact on Life Cycle Greenhouse Gas Emissions". National Energy Technology Laboratory. DOE/NETL-2009/1362.

⁷ ENVIRON, 2012. DRAFT Greenhouse Gas and Climate Change Technical Report. Table 7.

⁸ USEIA, 2012. Petroleum & Other Liquids. Available at: http://205.254.135.7/petroleum/imports/companylevel/cli_note.cfm. Accessed on: March, 2012.

Table 1. Carbon Intensities for Recovery and Transportation of Crude Oil by Source.

Crude Origin	Crude Recovery Emissions (Kg CO ₂ e/bbl of crude)	Transportation Emissions (Kg CO ₂ e/bbl of crude transported)	Total Emissions (kg CO ₂ e/bbl crude)
ENVIRON GHG Technical Report			
Dominguez, CA	21.4	na	21.4
CARB 2009 Study			
California Water Flood	34.0	0.7	34.6
California Thermal - OTSG ⁽¹⁾	113.5	0.8	114.3
California Thermal - Co-gen ⁽²⁾	115.9	0.8	116.7
California Primary	25.6	0.7	26.3
Alaska	22.6	4.0	26.6
Other Imported ⁽³⁾	20.5	7.9	28.4
Venezuela Bitumen	128.0	5.9	133.9
NETL 2009 Study			
Ecuador	31.3	10.1	41.4
Canada Conventional	35.2	5.3	40.5
Iraq	19.6	15.9	35.5
Venezuela Conventional	24.2	6.7	30.9
Saudi Arabia	13.6	15.6	29.2
US Domestic Average Oil ⁽⁴⁾	24.5	4.2	28.7
- Both OTSG (Once-through steam generator) and Co-Gen refer to Thermal Enhanced Oil Recovery methods used in California. For California TEOR recovered crude, 60% was from OTSG and 40% from Co-gen - A credit for electricity co-generation of 113 CO₂e kg/bbl was deducted to the Co-gen crude recovery emissions - Light crude imported from overseas countries obtained by primary recovery methods. Table C12-2. CARB, 2009 - Assumes U.S. average crude oil of 32.8 API and 0.96 % sulfur content			

Since oil produced in California is refined in California refineries, an assumption inherent in the above table is that some other oil production would be curtailed when the Dominguez production is brought online. In a case where the Dominguez oil replaces another California oil, highest cost oil would be taken off line first. California thermal oil is typically the highest cost to produce, given the high energy (steam) demands to produce the oil. The CI values in the table show that considerably lower emissions would result from a scenario where the Dominguez oil replaces California thermal oil in refineries. Further, if the Dominguez oil were to replace primary oil from California, there would likely be an emission decrease, as the CI for an average barrel of California is slightly higher than for the Dominguez oil. However, this scenario is unlikely due to the relatively lower production costs typical of primary oil.

In scenarios where the Dominguez oil replaces imported crudes from Alaska or from foreign countries, the table also shows lower CI values for the Dominguez oil. Alaskan imports are comparable for crude recovery carbon intensity and have slightly higher transportation carbon

intensity due to the tankering distance. From the NETL study, the table shows that some foreign oils have lower CI values for the crude recovery, but the considerably higher transportation CI values still make these more carbon intensive by the time they are received by the refinery.

CARB is currently updating their CI values for imported and California oils. CARB, through a contract with Stanford University, has developed a beta version (March 2012) of the Oil Production Greenhouse Gas Emissions Estimator (OPGEE). OPGEE will, when completed, replace the previous calculations for crude production and transport Carbon Intensity (CI).

The crude production and transportation CI values are scheduled to be updated by CARB when OPGEE is more fully developed in the summer of 2012. The existing CI values date from 2009-2010 and are the values ENVIRON used to develop the model for the comparative analysis of the Dominguez crude oil in the GHG Technical Report. The beta version of OPGEE is currently usable if a considerable amount of field-specific information is available to the user, as is the case with Dominguez. However, OPGEE does not yet contain information on any existing crude oils used in California refineries. The Stanford researchers are now populating OPGEE with information on imported crude oils, against which OPGEE could be used to compare the Dominguez project crude. This comparative work may be possible by the summer of 2012.

APPENDIX D

Noise Analysis



OXY USA Inc.
Dominguez Oil Field
Production Facility
Noise Technical Report

Prepared for:
City of Carson
Carson, California

On behalf of:
OXY USA, Inc.
Long Beach, California

Prepared by:
ENVIRON International Corporation
Los Angeles, California

Date:
June 2013

Project Number:
03-25072M

Contents

	Page
1 Introduction	1
2 Project Description	2
3 Existing Conditions	3
3.1 Introduction to Noise and Noise Terminology	3
3.2 Existing Sound Levels	5
4 Regulatory Context	7
4.1 State	7
4.2 Local	7
4.2.1 Carson General Plan Noise Element	7
4.2.2 Dominguez Technology Centre, Phase 2, Specific Plan	8
4.2.3 Carson Noise Ordinance	9
5 Project Design Features	11
5.1 Construction	11
5.2 Operation	11
6 Impact Assessment	12
6.1 Thresholds of Significance	12
6.2 Construction	13
6.2.1 On-site Production Facility Construction	13
6.2.2 Short-term Off-site Construction	16
6.3 Assessment of Construction Noise Impacts	21
6.3.1 Impact Criterion 1	21
6.3.2 Impact Criterion 4	24
6.4 Operation	25
6.4.1 Sources, Assumptions, and Methodology	25
6.4.2 Sound Level Results	28
6.4.3 Short-term Metal-on-Metal Sound Level Results	29
6.5 Assessment of Operational Noise Impacts	30
6.5.1 Impact Criterion 1	30
6.5.2 Impact Criterion 3	30
6.6 Cumulative Impacts	30
6.7 Impacts and Mitigation Summary	30
6.7.1 Construction	30
6.7.2 Operation	31
7 References	32

List of Tables

Table 1.	Typical Sound Levels in the Environment and Industry	3
Table 2.	Existing Sound Levels (dBA)	5
Table 3.	City of Carson Noise and Land Use Compatibility Matrix	8
Table 4.	City of Carson/Los Angeles County Exterior Noise Limits (dBA)	9
Table 5.	Maximum Noise Level Limits for Construction (dBA)	9

Appendix D

OXY USA Inc. – Dominguez Oil Field Production Facility
Noise Technical Report

Table 6:	Production Facility Construction Equipment	14
Table 7:	Projected Demolition/Site Preparation Sound Levels (Hourly Leq, dBA)	16
Table 8:	Pipeline Installation Equipment	17
Table 9:	Projected Pipe Installation/Connection Sound Levels (Hourly Leq, dBA)	18
Table 10:	SCE Interconnect Equipment	19
Table 11:	SCE Interconnect Sound Levels (Hourly Leq, dBA)	21
Table 12:	Primary Equipment Sound Levels (dBA)	26
Table 13:	Model-Calculated Operational Sound Levels (L50, dBA)	28
Table 14:	Operational Sound Levels and Sound Level Increases (CNEL, dBA)	28
Table 15:	Modeled Short-term Metal-on-Metal Sound Levels (Lmax, dBA)	29

List of Figures

Figure 1:	Site Vicinity Map
Figure 2:	Site Details
Figure 3:	Site Location Map and Model Receptor Locations
Figure 4:	Location of Oil Pipelines
Figure 5:	Location of Gas Pipelines
Figure 6:	Proposed Power Supply

List of Appendices

Appendix A:	Sound Level Measurement Details
Appendix B:	Equipment Sound Level Data

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Acronyms and Abbreviations

c	acre
bpd	barrels per day
CadnaA	Computer Aided Noise Abatement (a computer noise model)
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CMC	Carson Municipal Code
CNEL	Community Noise Equivalent Level
dB	decibel
dBA	A-weighted decibel
EIR	Environmental Impact Report
ER	Environmental Report
FHWA	Federal Highway Administration
Ft	feet
HDD	horizontal directional drilling
ISO	International Organization for Standardization
Ldn	Day-Night Sound Level
Leq	Equivalent Sound Level
Lmax	Maximum Sound Level
Ln	Percentile Level
m	meter
MSCFD	Thousand square cubic feet per day
NEMA	National Electrical Manufacturers Association
NEPA	National Environmental Policy Act
RCNM	Roadway Construction Noise Model
ROW	right-of-way
SCE	Southern California Edison
SLM	Sound Level Measurement
TNM	Traffic Noise Model
VRU	Vapor Recovery Unit
USEPA	US Environmental Protection Agency

1 Introduction

This report presents the results of ENVIRON International Corporation's (ENVIRON) noise assessment of the Dominguez Oil Field Development Project (Project). The Project would involve drilling wells and producing oil and gas from the Project Site. The Project Applicant is OXY USA Inc. The Project Site (Site) is owned by the Carson Dominguez Properties, LP. Equipment installed at the Site would include vessels and tanks for storing and processing the oil and gas.

OXY USA Inc. proposes to construct a production facility consisting of wells, an oil and gas processing facility, salt water treatment, salt water injection operations, slurry injection or disposal, an electrical substation, and shipment and pipeline facilities to produce and transport approximately 6,000 barrels per day (BPD) of oil and 3 million standard cubic feet per day (MMSCFD) of natural gas. Directional drilling techniques will be used to pinpoint oil reservoirs at depths of 4,000 to 13,500 feet below mean sea level (msl). In general, the Project will consist of the following elements: 1) wells surrounded by well cellars; 2) an office/control building; 3) resource (oil, natural gas and water) staging areas; 4) facades along the streets; 5) ground flares for combusting vent gases; 6) oil and natural gas pipeline interconnections; 7) a temporary drill rig and 8) a Southern California Edison (SCE) electrical substation. The drill rig will be enclosed in an outer shell that will reduce and minimize the noise emanating from this operation. In addition, the drill rig will be electrically powered.

The Project will use directional drilling to extract oil and natural gas resources from the subsurface. The Site was chosen to consolidate drilling and production operations at a previously developed industrial site located near existing pipelines. This consolidation limits the need to construct additional internal and off-site pipelines and related infrastructure

Compliance with the California Environmental Quality Act (CEQA) is required because the Project requires discretionary approval from the City of Carson for a Development Application. Therefore, this Draft Noise Technical Study Report provides the basis for preparation of CEQA documentation with the City of Carson as the lead agency under CEQA. This noise report includes an introduction to the Project context (Section 1), a brief Project description (Section 2), a description of existing conditions (Section 3), a discussion of the regulatory setting (Section 4), and an impact analysis (Section 5).

2 Project Description

Key attributes of the Project related to the noise evaluation are summarized here. The full project description is included in the Draft Environmental Impact Report.

The Project will involve the construction and operation of a new oil production facility located in the northern portion of the City of Carson within Los Angeles County. The Site is approximately 6.5 acres and is located at 1450-1480 Charles Willard Street (see Figures 1 and 2). The Site is bounded to the north and east by streets, on the west by a commercial/light industrial building, and on the south by a vegetated swale that acts as a conveyance for stormwater. The Site currently contains an industrial building which will be demolished, two oil wells, and an oil and gas testing facility.

The Project will include the installation of oil handling equipment and facilities to process the produced crude oil, natural gas, and natural gas liquids so that they can be transported to local refineries and other off-site facilities. The production facility will consist of wells; equipment for oil and gas processing, salt water treatment, salt water injection, slurry injection or disposal, oil and natural gas shipping, and an electrical substation to be operated by SCE. Natural gas liquids will be blended into the crude oil to the extent allowed by oil sales specifications and the remainder will be transported off-site by trucks. Produced water and stormwater will be treated to remove solids and oil, and reinjected into the oil bearing formations to enhance production. The facility is expected to produce and transport approximately 6,000 BPD of oil and 3 MMSCFD of natural gas. The Project plans to begin construction in January 2013 and begin operations in January 2014.

The Project will include up to 200 wells. Approximately 130 wells will be oil and gas production wells, 65 wells will be water injection wells, four wells will be salt water production wells and one well may be a slurry injection well. Directional drilling techniques will be used to pinpoint oil reservoirs at depths of 4,000 to 13,500 feet. Production wells will target separate pockets of oil and gas with water injection support. The wells drilled at the Facility will not make use of hydraulic fracturing.

Various off-site improvements are also proposed. Crude oil and natural gas will be transported by new pipelines (each approximately 2,000 feet in length) that will connect to the existing crude oil and natural gas pipeline networks in the area of the Project. The connections are expected to be with the existing Crimson Dominguez oil pipeline and the existing SCGC gas pipeline, both of which are located at the intersection of Charles Willard Street and South Central Avenue. The new pipelines and connections to utilities (e.g., potable water, electricity, and non-industrial wastewater) are expected to be constructed in public rights-of-way. The existing idle Crimson Dominguez Gathering Pipeline (Crimson Pipeline) will also require replacement of several previously removed sections.

The electrical power supply to the Project Site will be provided by SCE. SCE is currently performing a method of service study to evaluate the options to supply approximately 25 Megavolt amperes (MVA) to the Facility. The options may require the construction of above and underground cables to provide power to the Project Site, as well as a substation.

3 Existing Conditions

3.1 Introduction to Noise and Noise Terminology

Noise is sometimes defined as unwanted sound, and the terms noise and sound are used more or less synonymously in this exhibit. The human ear responds to a very wide range of sound intensities. The decibel scale (dB) used to describe sound is a logarithmic rating system which accounts for the large differences in audible sound intensities. This scale accounts for the human perception of a doubling of loudness as an increase of 10 db. Therefore, a 70-dB sound level will sound about twice as loud as a 60-dB sound level. People generally cannot detect differences of 1 db. In ideal laboratory situations, differences of 2 or 3 dB can be detected by people, but such a change probably would not be noticed in a typical outdoor environment. A 5-dB change would probably be clearly perceived by most people under normal listening conditions.

On the logarithmic scale used to measure noise a doubling of sound-generating activity (i.e., a doubling of the sound energy) causes a 3-dB increase in average sound produced by that source, not a doubling of the loudness of the sound (which requires a 10-dB increase). For example, if traffic along a road is causing a 60 dB sound level at a nearby location, a doubling of the number of vehicles on this same road would cause the sound level at this same location to increase to 63 db. Such an increase might not be discernible in a complex acoustical environment.

When addressing the effects of noise on people, it is necessary to consider the frequency response of the human ear, or those frequencies that people hear best. Sound measuring instruments are therefore often designed to "weight" sounds based on the way people hear. The frequency-weighting most often used to evaluate environmental noise is A-weighting because it best reflects how humans perceive sound. Measurements from instruments using this system are reported in "A-weighted decibels," or db. Unless specified otherwise, noise levels are reported in A-weighted decibels.

Distance from the source, the frequency of the sound, the absorbency of the intervening ground, obstructions, and duration of the noise-producing event all affect the transmission and perception of noise. The degree of the effect on perception also depends on who is listening (individual physiological and psychological factors) and on existing sound levels (background noise). **Table 1** shows the relative A-weighted noise levels of common sounds measured in the environment and in industry for various sound levels.

Table 1. Typical Sound Levels in the Environment and Industry			
Noise Source At a Given Distance	A-Weighted Sound Level in Decibels	Noise Environments	Subjective Impression
Civil defense siren (100 ft)	130		
Jet takeoff (200 ft)	120		Pain threshold
	110	Rock music concert	

Appendix D

OXY USA Inc. – Dominguez Oil Field Production Facility
Noise Technical Report

Table 1. Typical Sound Levels in the Environment and Industry			
Noise Source At a Given Distance	A-Weighted Sound Level in Decibels	Noise Environments	Subjective Impression
Pile driver (50 ft)	100		Very loud
Ambulance siren (100 ft)	90	Boiler room	
Pneumatic drill (50 ft)	80	In kitchen with garbage disposal running	
Freeway (100 ft)	70		Moderately loud
Vacuum cleaner (10 ft)	60	Data processing center	
Department Store; Light traffic (100 ft)	50	Private business office	
Large transformer (200 ft)	40		Quiet
Soft whisper (5 ft)	30	Quiet bedroom	
	20	Recording studio	
	10		Hearing threshold
Source: Beranek, L.L., 1988.			

Although a measured A-weighted noise level will adequately indicate the level of environmental noise at any instant in time, community noise levels affected by a variety of sources typically vary continuously. Several noise descriptors have been developed to characterize community noise by accounting for the total acoustical energy content of the noise over defined periods of time. Important noise descriptors identified in this evaluation include the Equivalent Noise Level (L_{eq}), the Day-Night Sound Level (L_{dn}), and the Community Noise Equivalent Level (CNEL) described below.

The L_{eq} is the sound level corresponding to a steady-state sound containing the same total energy as a time-varying signal over a given sample period. That is, the L_{eq} is a single number representing the level of a constant sound containing the same amount of sound energy as the varying sound levels over a specific period. Thus, the L_{eq} is the "energy average" noise level for the measurement time interval. The L_{eq} can be measured for any time period, but is typically measured for one hour. It is the energy sum of all the noise events and background noise levels that occur during that time period.

The L_{dn} represents a time-weighted 24-hour average noise level based on hourly L_{eq} s measured (or calculated) in A-weighted decibels. Time-weighted refers to the fact that noise occurring during certain "noise-sensitive" time periods is "penalized" for occurring at these times by having additional noise added to the actual measured or calculated sound level. The L_{dn} includes a 10-decibel penalty added to sound levels between 10 PM and 7 AM to account for potential increased sensitivity to noise during nighttime hours when most people sleep.

The CNEL is the predominant noise descriptor now in use in California for land use compatibility assessments. Similar to the L_{dn}, the CNEL is a time-weighted average noise level. The CNEL, however, adds 5 dBA to the hourly Leqs occurring during evening hours (7 PM to 10 PM) and 10 dBA to the hourly Leqs during nighttime hours (10 PM to 7 AM). The time periods and sound level penalties used in computing the CNEL were selected to reflect people's potentially increased sensitivity to noise during these time periods.

3.2 Existing Sound Levels

To characterize the existing noise environment, Acoustics Group, Inc. (AGI) measured sound levels at locations near the proposed facility site in April 2011. For these measurements, AGI used three Larson Davis 870 Type I sound level meters to document hourly sound levels over a 24-hour period at three locations representing the residential receivers nearest the site.

Observations during the sound measurements indicated the existing sound environment in the Project vicinity is composed primarily of noise from traffic. Other noise sources include birds, aircraft, parking noises, residential activities, and other localized noises. The measured sound levels and brief descriptions of the sound level measurement (SLM) locations are summarized in **Table 2**; the SLM locations are displayed in **Figure 3** (attached to the report). Details regarding the measurements are included in Appendix A.

Measurements taken in July 2010 prior to test drilling activities conservatively characterize the ambient sound levels at properties in the Dominguez Technology Centre. These SLM locations (DTC1, DTC2, and DTC3) are displayed in **Figure 3** (attached to the report).

Table 2. Existing Sound Levels (dBA)				
Location	Time ^(a)	Range of Hourly Leqs	Range of Hourly Lmaxs	CNEL
Nearest Residential Properties				
SLM1	Day	55-61	69-81	63
	Night	52-60	65-73	
SLM2	Day	50-57	63-77	58
	Night	46-56	53-71	
SLM3	Day	53-60	70-88	59
	Night	45-56	61-80	
Dominguez Technology Centre Properties				
DTC1	9-9:15 AM	67	NA	70
	11:28-11:43 AM	64		
	3:35-3:50 PM	67		
DTC2	9:21-9:36 AM	50	NA	59
	11:58 AM-12:13 PM	57		
	3:57-4:12 PM	57		

Appendix D

OXY USA Inc. – Dominguez Oil Field Production Facility
Noise Technical Report

Table 2. Existing Sound Levels (dBA)				
Location	Time ^(a)	Range of Hourly Leqs	Range of Hourly Lmaxs	CNEL
DTC3	9:46-10:01 AM	58	NA	63
	1:01-1:16 PM	61		
	4:17-4:32 PM	60		

^(a) Daytime hours are from 7 AM to 10 PM; nighttime hours from 10 PM to 7 AM.

The Lmax, also characterized as the L0, is the maximum sound level, i.e., the sound level that cannot be exceeded for any portion (0%) of a time period.

SLM 1 – Taken at 1278 Redwood Court, this location represents residences in the Dominguez Village community northwest of the Project Site. Noted noise sources included traffic, birds, residential activity, and parking lot activity.

SLM 2 – Taken at Cal State University Dominguez Hills to represent student housing due west of the Project Site. Noted noise sources included traffic, birds, an adjacent commercial nursery, and parking lot activity.

SLM 3 – Taken at 19063 Tajauta Avenue, this location represents single-family residences south of the Project Site and University Drive. Noted noise sources included traffic, distant aircraft, and lawn and garden maintenance.

DTC1 – Taken near the corner of Charles Willard Street and Bishop Avenue, this location is used to represent properties east and north of the Project site. At DTC1, three 15-minute sound level measurements are used to represent the range of hourly daytime sound levels. The CNEL was estimated by adding 3.7 dBA to the average daytime hourly level (i.e., similar to the difference between the average daytime hourly level and the CNEL at SLM1, a location also dominated by traffic noise). The dominant noise source at this location was truck traffic noise.

DTC2 – Taken on the nearest affected property south of the Project site. As with DTC1, three 15-minute sound level measurements are used to represent the range of hourly daytime sound levels, and the CNEL was estimated by adding 3.7 dBA to the average daytime hourly level. The noise sources noted at this location included both car and truck traffic.

DTC3 – Taken on the Project site, this location represents sound levels at the property west of the site. As with DTC1, three 15-minute sound level measurements are used to represent the range of hourly daytime sound levels, and the CNEL was estimated by adding 3.7 dBA to the average daytime hourly level. The noise sources noted at this location included truck traffic and truck loading/unloading.

Source: Acoustics Group, Inc., 2011.

4 Regulatory Context

The Project was evaluated against existing state and local noise regulations and standards. A summary of the findings are presented here.

The proposed Project Site is located in the City of Carson in Los Angeles County, California. The Project Site is approximately 6.5 acres and is within the Dominguez Technology Center in the northern portion of the City of Carson. The Project Site is within 0.2 miles of the City of Compton¹. Plans and policies that pertain to the noise conditions affecting and affected by the proposed Project include those set by the State of California and the City of Carson. The noise policies established by Los Angeles County have been adopted for use by the City of Carson and are included in the discussion of the Carson noise policies. These are described below.

4.1 State

CEQA contains guidelines to evaluate the significance of effects of environmental noise attributable to a proposed project. Among other questions, CEQA asks whether a proposed project would result in exposure of persons to noise levels in excess of established standards or guidelines or exposure of persons to a substantial permanent or temporary increase in noise level. CEQA does not identify noise level increases that would be considered substantial, and instead directs individual jurisdictions to identify appropriate noise levels for various land uses (using either a Noise Element developed as part of a jurisdiction's General Plan and/or a noise ordinance).

4.2 Local

The Project Site is located within the City of Carson, and is subject to the Noise Element of the City of Carson General Plan, the Dominguez Technology Centre Specific Plan, and any noise ordinance or other noise regulations adopted by the City.

4.2.1 Carson General Plan Noise Element

The City of Carson General Plan Noise Element is a comprehensive program to limit exposure of the community to excessive noise levels. As part of the implementation of this goal, the City identifies compatible noise levels for various types of land uses. The Noise Element indicates that projects should incorporate noise mitigation measures if they will exceed normally acceptable levels as defined by the guidelines. These levels are identified in **Table 3**.

¹ There are no sensitive receivers within the City of Compton limits that would be meaningfully impacted by noise from the proposal.

Appendix D

OXY USA Inc. – Dominguez Oil Field Production Facility
Noise Technical Report

Table 3. City of Carson Noise and Land Use Compatibility Matrix				
Land Use Category	Community Noise Exposure (L_{dn} or CNEL, dBA)			
	Normally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Residential-Low Density; Residential-Multiple Family	50-60	60-65	65-75	75-85
Transient Lodging-Motel, Hotels	50-65	65-70	70-80	80-85
Schools, Libraries, Churches, Hospitals, Nursing Homes	50-60	60-65	65-80	80-85
Auditoriums, Concert Halls, Amphitheaters	NA	50-65	NA	65-85
Sports Arenas, Outdoor Spectator Sports	NA	50-70	NA	70-85
Playgrounds, Neighborhood Parks	50-70	NA	70-75	75-85
Golf Courses, Riding Stables, Water Recreation, Cemeteries	50-70	NA	70-80	80-85
Office Buildings, Business Commercial and Professional	50-67.5	67.5-75	75-85	NA
Industrial, Manufacturing, Utilities, Agriculture	50-70	70-75	75-85	NA
Notes: NORMALLY ACCEPTABLE Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements. CONDITIONALLY ACCEPTABLE New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice. NORMALLY UNACCEPTABLE New construction or development should be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design. CLEARLY UNACCEPTABLE New construction or development should generally not be undertaken. NA: Not Applicable				

4.2.2 Dominguez Technology Centre, Phase 2, Specific Plan

In addition to its General Plan, the City of Carson has adopted a Specific Plan for the Dominguez Technology Centre. The specific plan limits construction activities to "normal workday hours" in order to maintain conformance with the City's General Plan.

4.2.3 Carson Noise Ordinance

The City of Carson has also adopted a noise ordinance (Article 5, Chapter 5 of the Carson Municipal Code), which in turn adopts Chapter 12.08 of the Los Angeles County Code with some minor revisions. The Carson noise ordinance establishes noise limits for sources depending on the zone of the receiving property. These noise limits are displayed in **Table 4**.

Unlike the County of Los Angeles limits, the exterior noise level limits are applied on a 30-minute basis, not an hourly basis.

Table 4. City of Carson/Los Angeles County Exterior Noise Limits (dBA)						
Zone/Use	Time	Exterior Noise Level Limit				
		L50	L25	L8.3 ^(a)	L1.7	Lmax/L0
I – Sensitive	Anytime	45	50	55	60	65
II – Residential	Day	50	55	60	65	70
	Night	45	50	55	60	65
III - Commercial	Day	60	65	70	75	80
	Night	55	60	65	70	75
IV – Industrial	Anytime	70	75	80	85	90
^(a) The Carson Municipal Code indicates that the L8.3 can exceed the base level by 20 dBA. This appears to be a typographic error, since this would make the limit for the L8.3 higher than the L1.7 limit and equivalent to the L_{max}. Given this apparent error, this analysis has used an L8.3 limit that is 10 dBA over the base limit. The Exterior Noise Level Limits are displayed as percentile levels, L_n. An L_n is the sound level exceeded n % of the time. For example, the L50 is the sound level exceeded 50% of the time, or 15 minutes of a 30-minute period using the City of Carson's standard of applying the limits to 30-minute periods. Similarly, the L25, L8.3, and L1.7, are the levels exceeded 25, 8.3, and 1.7 % of the time, or 7.5, 2.5, and 0.5 minutes of a 30-minute period, respectively. The L_{max}, also characterized as the L0, is the maximum sound level, i.e., the sound level that cannot be exceeded for any portion (0%) of a time period. Sources: Carson Municipal Code Article 5, Chapter 5 and Los Angeles County Code 12.08.390						

The above base exterior noise level limits can be increased to the measured ambient sound levels at a receiving property if the measured levels are higher than the base limits.

The City of Carson's noise ordinance also limits construction noise as shown in **Table 5**.

Table 5. Maximum Noise Level Limits for Construction (dBA)		
Equipment used for non-scheduled, intermittent, short-term operations of 20 days or less		
Timing	Single-family Residential	Multi-family Residential
Daily, except Sundays and legal holidays, 7 AM to 8 PM	75	80
Daily 8 PM to 7 AM and all day Sunday and legal holidays	60	64

Table 5. Maximum Noise Level Limits for Construction (dBA)		
Equipment used for repetitively scheduled, operations of 21 days or more		
Timing	Single-family Residential	Multi-family Residential
Daily, except Sundays and legal holidays, 7 AM to 8 PM	65	70
Daily 8 PM to 7 AM and all day Sunday and legal holidays	55	60
Mobile Equipment used for non-scheduled, intermittent, short-term operations		
Timing	Business Structure	
Daily, including Sunday and legal holidays, all hours	85	
Sources: Carson Municipal Code Article 5, Chapter 5 and Los Angeles County Code 12.08.440		

The City of Carson exempts a number of activities from the noise controls identified above, including the following:

- Normal well servicing, remedial, or maintenance work performed within an existing well that does not involve drilling or redrilling and that is restricted to the hours between 7 AM and 10 PM; and
- Drilling or redrilling work which is done in full compliance with Article IX of the Carson Municipal Code, including CMC 9148.2.

5 Project Design Features

5.1 Construction

Construction activities would comply with the construction noise limits and timing established by the City of Carson (see **Table 5**). In addition, the following project design feature will be incorporated to help reduce noise from on-site construction activities:

- Maintain the existing fence with sound blankets on the west and south property boundaries until completion of demolition and site preparation activities.

5.2 Operation

The Facility design includes features to minimize noise from Project operations. These include:

- A 30-foot wall that surrounds the Project Site; and
- Sound dampening design for the drill rig.

6 Impact Assessment

6.1 Thresholds of Significance

To assist in determining whether a project will have a significant effect on the environment, the CEQA Guidelines identify criteria that may be used to define a substantial or potentially substantial adverse change in physical conditions. According to Appendix G of the CEQA Guidelines, a project will normally have a significant adverse environmental impact on noise if any of the following conditions apply:

- The project 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.
- The project would result in exposure of persons to or generation of excessive ground-borne vibration or ground-borne noise levels.
- The project would result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.
- The project would result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.
- For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, the project would expose people residing or working in the project area to excessive noise levels.
- For a project within the vicinity of a private airstrip, the project would expose people residing or working in the project area to excessive noise levels.

As stated previously, CEQA does not define what permanent or temporary noise level increase would be considered "substantial" for purposes of making the above determinations. For this impact assessment, ENVIRON applied the following definitions of substantial increases.

- A substantial *permanent* noise increase was defined as a project-related increase of 3 dBA or more in the CNEL in locations where the future overall noise level would be within the "normally unacceptable" or "clearly unacceptable" category (**Table 3**), or a 5 dBA or greater increase in the CNEL.
- A substantial *temporary* noise level increase was defined as a construction noise-related increase of 10 dBA or more in the hourly Leq at sensitive locations for construction activities lasting more than 1 day but less than 11 days, and an increase of 5 dBA or more for more than 10 days in a three month period. These definitions are based on the City of Los Angeles' *CEQA Thresholds Guide* (2006), since neither the City of Carson nor Los Angeles County has developed CEQA thresholds.

Excessive ground-borne vibration and noise are typically caused by activities such as blasting used in mining operations or the use of pile drivers during construction. The proposed construction or operation of the Project would not require either blasting or pile driving. Therefore, the Proposed Project is not expected to result in excessive ground-borne vibration or ground-borne noise levels, and Impact Criterion 2 is not considered further.

The Project Site is not located within an airport land use plan area or near a private use airstrip. However, the Project Site is located approximately 1.75 miles south of the Compton/Woodley Airport (CPM), a county-owned public-use airport serving general aviation needs. Although the Project Site is within 2 miles of a public or public use airport, there is no evidence that existing sound levels from the airport would expose workers at the oil extraction center to excessive aircraft-related noise. First, the airport runways (and resulting primary flight paths) run east-west and not over the Project Site. Second, observations during the sound level measurements in the vicinity identified local traffic as the primary noise source, and aircraft noise was identified as a secondary source. Furthermore, the highest measured hourly L_{eq} at any of the SLM locations is 61 dBA and the highest CNEL is 63 dBA, which are both well below the levels considered protective for workers at an industrial site. Therefore, no noise impacts are anticipated due to exposure of people working at the site to excessive aircraft-related noise, and Impact Criteria 5 and 6 are not considered further.

6.2 Construction

Potential noise impacts from on-site well and production facility construction and from short-term off-site construction are considered separately below.

6.2.1 On-site Production Facility Construction

6.2.1.1 Methodology and Results

To assess potential noise impacts from onsite construction equipment, ENVIRON first screened the potential overall sound levels of each of the various construction phases using the FHWA *Roadway Construction Noise Model* (RCNM) ⁽²⁾ ENVIRON used RCNM to evaluate the overall noise levels of equipment identified for each of the four active phases of expected on-site construction: demolition/site preparation, well cellars, process equipment areas, and tanks. Equipment types during the various phases of construction are displayed in **Table 6**. This screening process indicated that sound levels during demolition and site preparation would be the loudest phase of construction, resulting in an hourly L_{eq} of 77 dBA at 500 feet. Sound levels during the other three phases (i.e., construction of the well cellars, process equipment, and tanks) ranged from 64 to 71 dBA L_{eq} , and all three phases of construction occurring simultaneously would result in an overall sound level of 75 dBA at 500 feet. Therefore, to assess potential noise impacts during construction, the demolition/site preparation phase was considered further.

² Roadway Construction Noise Model (RCNM) version 1.1, 2008, Federal Highway Administration (FHWA). RCNM is a simple computer program that calculates the sound levels from various types of construction equipment based on typical construction equipment sound levels and standard distance attenuation (i.e., 6 dB of reduction for every doubling of distance from a source).

Appendix D

OXY USA Inc. – Dominguez Oil Field Production Facility
Noise Technical Report

Table 6: Production Facility Construction Equipment		
Type	Quantity	Sound Level at 500 feet (Hourly Leq, dBA)^(a)
Demolition/Site Prep Equipment		
Excavator	2	61
Loader	2	59
Hoe Ram	4	70
Backhoe	2	58
Pickup Truck	3	52
Water Truck	1	52
Dump Trucks	~31 trucks/day, ~3 trucks/hour ^(b)	57
Total Demolition Sound Level		77
Well Cellars		
Trackhoe	1	58
Loader	1	59
Dozer	1	62
Roller	1	60
Backhoe	1	58
Water Truck	1	51
Plate Compactors	1	63
Cranes	2	61
Generator	1	58
Forklift	1	52
Air Compressor	1	58
Welding Equipment (Diesel)	1	51
Pick-up Truck	1	55
Total Well Cellar Construction Sound Level		71
Process Equipment Areas		
Trackhoe	1	58
Loader	1	59
Dozer	1	62
Roller	1	60

Appendix D

OXY USA Inc. – Dominguez Oil Field Production Facility
Noise Technical Report

Table 6: Production Facility Construction Equipment		
Type	Quantity	Sound Level at 500 feet (Hourly Leq, dBA)^(a)
Backhoe	1	58
Dump Trucks	1	57
Water Truck	1	52
Plate Compactors	1	63
Cranes	2	61
Generator	1	58
Forklift	1	52
Air Compressor	2	58
Welding Equipment (Diesel)	4	54
Pick-up Truck	1	55
Dump Trucks	~8 trucks/day, <1 truck/hour	53
Total Process Equipment Construction Sound Level		71
Tanks		
Automatic Floor Welder	1	54
Automatic Horizontal Seam Welder	1	54
Crane	1	61
Manlift	1	55
Welding Equipment (Diesel)	1	54
Pick-up Truck	1	55
Total Tanks Construction Sound Level		64
^(a) Except for dump trucks, the sound level presented is for <i>each</i> individual piece of equipment. The dump truck sound level considers the number of trucks expected in a one-hour period. ^(b) The demolition and site preparation phase would require the most truck visits, with 148 to 155 truck visits a week. Assuming a five-day construction work week and 10 hours a day of construction, approximately 31 truck visits per day and 3 truck visits per hour, on average, are expected. Source: Roadway Construction Noise Model (RCNM) version 1.1, 2008		

To assess demolition/site preparation noise in more detail, ENVIRON used the *Computer Aided Noise Abatement* (CadnaA) industrial noise calculation procedure to estimate construction-related sound levels from on-site equipment.⁽³⁾ The CadnaA industrial noise

⁽³⁾ CadnaA version 4.0, 2010. Datakustik GmbH of Munich, Germany.

calculation procedure enables complete noise modeling of complex facilities using sound propagation factors as adopted by International Organization for Standardization (i.e., ISO 9613). The CadnaA modeling setup for this analysis involved building three-dimensional maps that included intervening structures (including the existing fences with sound blankets on much of the western and southern site boundaries) and topography. ENVIRON then applied a general overall construction equipment sound level based on the initial RCNM screening output from all active construction sources of 77 dBA at 500 feet, which equates to an overall sound power level of approximately 131 dBA. This sound power level was distributed across the site as an area source. The CadnaA model then predicted construction noise levels at the nearest off-site receivers. Results of the construction noise modeling assessment that considered cumulative noise (i.e., overall noise) from construction activities are displayed in **Table 7**.

Table 7. Projected Demolition/Site Preparation Sound Levels (Hourly Leq, dBA)				
Receiver	Existing^(a)	Construction	Overall	Increase
Nearest Residential Properties				
SLM1	57-61	47	58-61	0
SLM2	52-57	53	56-59	1-3
SLM3	54-60	48	55-61	0-1
Carson Construction Noise Limit(b)		65-70	NA	>5
Dominguez Technology Centre Properties				
NPL	NA	72	NA	NA
EPL	NA	74	NA	NA
SPL	NA	71	NA	NA
WPL	NA	74	NA	NA
Carson Construction Noise Limit(c)		85	NA	NA
Note: Any apparent calculation errors are due to rounding. (c) (a) Existing sound levels are shown for the hours between 7AM and 5PM, the expected hours of construction. (d) (b) The noise limits apply to construction activities between 7 AM and 8 PM and occurring longer than 20 days. The 65-dBA limit applies to single family residences (i.e., SLM1 and SLM3) while the 70-dBA limit applies at multi-family residences (i.e., SLM2). (e) (c) The noise limits are being applied to on-site construction (i.e., construction for more than 20 days) since no other construction noise limits are identified by the City of Carson for business structures. Noise impacts at industrial properties are not assessed by comparison with existing sound levels; "NA" indicates that the information is not applicable to this assessment.				

6.2.2 Short-term Off-site Construction

6.2.2.1 Methodology

To assess potential noise impacts from off-site construction equipment, ENVIRON first identified the types and numbers of equipment expected to be used during the various phases of construction. ENVIRON then used RCNM to estimate the overall noise levels of the equipment

at various distances representing the nearest sensitive receiving properties to the activities. The results of the analysis of off-site pipeline construction activities and off-site SCE interconnect construction activities are discussed separately below.

6.2.2.2 Off-site Pipeline Construction

New gas and oil pipelines would need to be installed and/or connected to existing pipelines as part of the Project (see Figure 4 and 5). There are three areas where pipeline installation and related facilities will be required: approximately 2,000 feet from the site to the intersection of Charles Willard Street and South Central Avenue, approximately 1,000 feet on and near the intersection of University Drive and South Central Avenue, and approximately 100 feet near the intersection of 223rd Street and Wilmington Avenue. Construction in each area would take approximately 2 to 3 weeks.

To assess potential noise impacts from off-site construction equipment, ENVIRON used equipment sound levels identified in RCNM for each of the three phases of pipeline installation: asphalt removal and ditching, pipe installation and testing, and refilling of the trench. Equipment types during the various phases of construction are displayed in **Table 8**. As shown, equipment associated with asphalt removal and ditching and with trench refilling are the same and will be considered together.

Table 8: Pipeline Installation Equipment		
Type	Number	Sound Level at 50 feet (Hourly Leq, dBA)
Ditching and Refilling		
Backhoe	1	74
Dump Truck	1	73
Total Pipeline Construction Ditching Sound Level		76
Pipe Installation and Testing		
Crane	1	73
Sideboom	2	73
Generator	2	68 ^(a)
Welder	2	70
Total Pipeline Construction Pipe Installation Sound Level		83/79
^(a) The sound level of the generators includes a 10 dBA reduction. This may be accomplished either by selecting a quieted generator meeting the above sound level specification or by using temporary/portable barriers around the generators. Source: Roadway Construction Noise Model (RCNM) version 1.1, 2008		

Construction sound levels were calculated at sensitive receivers near two of the off-site pipeline installation areas using the equipment identified in **Table 8** and RCNM. (The off-site pipeline installation areas are described in more detail below.) These levels were then added to the

measured existing sound levels to identify a range of potential noise increases due to construction activities (**Table 9**).

New pipeline installation to the intersection of Charles Willard Street and South Central Avenue: Activities in this area involve installation of over 2,000 feet of gas and oil pipeline from the site west to the intersection of Charles Willard St and South Central Avenue. The construction activities would range from 550 to over 2,000 feet from the nearest student housing units at Cal State University Dominguez Hills (SLM2), considered multi-family residential uses.

Reconnection of Crimson Pipeline at University Drive and South Central Avenue: Activities in this area involve replacement of approximately 1,000 feet of oil pipeline previously removed from the Crimson Pipeline. The pipeline replacement would occur within South Central Avenue and University Drive rights-of-way for approximately 500 feet north and 500 feet west of the intersection of the two roads. The construction activities would range from 80 to 600 feet or more to the single-family residences south of University Drive, represented by SLM3.

Connection between the Crimson Pipeline and Norwalk-Carson Pipeline: Construction activities associated with the connection of the Crimson Pipeline to the Norwalk-Carson Pipeline would not occur near any sensitive receivers and would occur 100 feet or more from any business structures.

Table 9. Projected Pipe Installation/Connection Sound Levels (Hourly Leq, dBA)					
Receiver	Existing ^(a)	Construction		Overall	Increase
New pipeline installation to the intersection of Charles Willard Street and South Central Avenue					
CSU Dominguez Hills (SLM2)	52-57	Ditch	44-55	53-59	0-4.7
		Pipeline	47-59	53-61	0-7
Carson Construction Noise Limit ^(b)		80		NA	>5, >10
Reconnection of Crimson Pipeline at University Drive and South Central Avenue					
Near University and S Central (SLM3)	54-60	Ditch	55-72	57-72	1-18
		Pipeline	58-75	59-75	2-21
Carson Construction Noise Limit ^(b)		75		NA	<=5, <=10 ^(c)
Note: Any apparent calculation errors are due to rounding.					
^(a) Existing sound levels are shown for the hours between 7AM and 5PM, the expected hours of construction.					
^(b) The noise limits apply to construction activities between 7 AM and 8 PM and occurring less than 21 days. The 75-dBA limit applies to single family residences (i.e., SLM3) while the 80-dBA limit applies at multi-family residences (i.e., SLM2).					
^(c) Construction noise increases that might occur for more than 10 days should be limited to 5 dBA or less. A noise increase of greater than 5 dBA but less than 10 dBA should be limited to no more than one day of construction.					

6.2.2.3 SCE Interconnect Construction

The electrical power supply to the proposed facility would be provided by SCE. SCE is currently evaluating an option to supply 25 MVA of power to the Project Site. The primary option would locate all the cables underground (see Figure 6) and would likely install a fenced Substation at the Project Site. The noise implications of the off-site elements of the SCE construction are considered below.

SCE would serve the facility at 16kV from the existing Jersey 66-16 kV Substation. Three new 16 kV circuits would be run underground from Jersey Substation to the Project Site, requiring approximately 8,000 feet below ground construction along the proposed route. Most of the below ground construction would consist of digging a trench, but a boring machine and associated equipment would be used to install approximately 1,000 feet of pipeline beneath I-91.

To assess potential noise impacts from off-site construction equipment, ENVIRON used equipment sound levels identified in RCNM or previous noise analyses for the three phases of conduit installation: underground conduit installation via trenching, repaving, and horizontal directional drilling (HDD). Equipment identified for the HDD operations are separated into equipment on the drilling side or on the stringing side. Equipment types during the various phases of construction are displayed in **Table 10**.

The underground conduit installation and repaving activities would occur in the same general vicinities. Since the conduit installation sound levels are higher than the repaving levels, only the conduit installation scenario was considered for assessing noise impacts at receivers nearest these activities. Similarly, since the equipment on the HDD drilling side is louder than the equipment on the HDD stringing side, only the HDD drilling side was considered in detail when assessing noise impacts at residences near this activity.

Table 10: SCE Interconnect Equipment		
Type	Number	Sound Level at 50 feet (Hourly Leq, dBA)
Underground Conduit Installation		
Loader	1	75
Backhoe	1	74
Plate Compactors	1	76
Crane	1	73
Generator	1	68 ^(a)
Air Compressor	1	74
Welder	1	70
Pickup Truck	1	71
Delivery/Dump Trucks	1	73
Total Underground Conduit Installation Sound Level		83

Table 10: SCE Interconnect Equipment		
Type	Number	Sound Level at 50 feet (Hourly Leq, dBA)
Repaving After Underground Conduit Installation		
Backhoe	1	74
Roller	1	73
Paver	1	74
Total Repaving Sound Level		78
Horizontal Directional Drilling (HDD) – Drilling Side ^(b)		
Boring Machine	1	81
Water Pump	1	72
Cuttings Separation Equipment	1	77
Slurry Pump	1	72
Total HDD Drilling Side Sound Level		83
Horizontal Directional Drilling (HDD) – Stringing Side		
Backhoe	1	74
Cranes	2	73
Total HDD Stringing Side Sound Level		78
^(a) The sound level of the generator includes a 10 dBA reduction. This could be accomplished either by selecting a quieted generator that meets the above sound level specification or by using temporary/portable barriers around the generator. ^(b) The sound levels for the HDD equipment on the drilling side were taken from data collected by ENVIRON for previous noise studies. Source: Roadway Construction Noise Model (RCNM) version 1.1, 2008; ENVIRON, 2011		

Construction sound levels were calculated at sensitive receivers nearest the underground conduit installation and HDD drilling areas using the equipment identified in **Table 10** and RCNM. These levels were then added to the measured existing sound levels to identify a range of potential noise increases due to construction activities (**Table 11**).

Underground conduit installation: The project includes the installation of cables in conduits installed underground on South Central Avenue from Greenleaf Boulevard to Victoria Street, east on Victoria Street to Bishop Avenue, south on Bishop Avenue to Charles Willard Street, and west on Charles Willard Street to the Project Site. This assessment assumed the conduit would be installed on the east side of South Central Avenue, the north side of Victoria Street, the east side of Bishop Avenue and the north side of Charles Willard Street. The underground conduit installation activities could occur as near as 130 feet from the residences on the west side of South Central Avenue (represented by SLM1), with an existing wall assumed to provide at least 5-dBA of reduction in the construction noise. The underground construction activities

Appendix D

OXY USA Inc. – Dominguez Oil Field Production Facility
Noise Technical Report

would move linearly and would be more than 400 feet from residences the vast majority of the time.

With one exception, underground conduit installation activities are expected to occur farther than 50 feet from any business structures. The exception is the business structure at 17900 South Central Avenue, which could be as near as 25 feet from some construction activities.

HDD drilling activities: Approximately 1,000 feet of horizontal directional drilling (HDD) would be required to install the conduit and cables under I-91. The equipment associated with this task would include HDD drilling equipment and HDD stringing equipment at sites approximately 500 feet north of and 500 feet south of the center of I-91. At the time of this analysis it was unknown if the HDD drilling equipment or the HDD stringing equipment would be located south of I-91 and nearest potentially affected residences. For this analysis, ENVIRON assumed the louder HDD drilling equipment would operate approximately 500 feet south of I-91 and approximately 700 feet from the nearest residences on the west side of South Central Avenue just north of Victoria Street. As previously, this analysis assumed a 5-dBA reduction in construction noise at these residences due to existing walls.

HDD drilling and HDD stringing equipment are expected to operate more than 50 feet from the nearest business structures.

Table 11. SCE Interconnect Sound Levels (Hourly Leq, dBA)					
Receiver	Existing ^(a)	Construction		Overall	Increase
West Side of S Central (SLM1)	57-61	Underground	47-69	58-70	0-12
	52-61	HDD Drilling	55	59-62	1-5
	52-61	HDD Stringing	50	54-62	0-2
Carson Construction Noise Limit	20 days or less	75-80		NA	<=5, <=10 ^(b)
	> 20 days	7 AM to 8 PM	65-70	NA	<=5, <=10 ^(b)
		8 PM to 7 AM	55-60		

Note: Any apparent calculation errors are due to rounding.

^(a) Existing sound levels for underground conduit installation are shown for the hours between 7AM and 5PM, the expected hours of construction. Existing sound levels from HDD drilling activities are shown for 24-hours a day, the expected hours of drilling.

^(b) Construction noise increases that might occur for more than 10 days should be limited to 5 dBA or less. A noise increase of greater than 5 dBA but less than 10 dBA should be limited to no more than one day of construction.

6.3 Assessment of Construction Noise Impacts

6.3.1 Impact Criterion 1

Would the project 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?

6.3.1.1 On-site Construction

The City of Carson sets daytime construction noise limits (applicable from 7 AM to 8 PM) for extended construction activities (i.e., lasting 21 days or more) of 65 and 70 dBA at single-family and multi-family residential uses, respectively. For nighttime construction (i.e., construction between 8 PM and 7 AM), the construction noise limits are 55 and 60 dBA at single and multi-family residential uses, respectively. The residences represented by SLM1 and SLM3 are single-family, and the residential uses represented by SLM2 are multi-family (i.e., college dormitories).

Construction noise levels would be fairly low at the nearest residential receivers (i.e., 50 to 53 dBA, **Table 7**) and would comply with Carson's construction noise limits during daytime or nighttime hours. Because construction activities are anticipated to occur only during daytime hours, the construction noise levels would be well below the applicable noise limits.

Carson's construction noise limit of 85 dBA at business structures applies to short-term construction activities; no construction noise limits are identified for extended activities lasting more than 21 days. In the absence of an applicable extended construction noise limit, ENVIRON applied the short-term 85 dBA construction noise threshold for this impact assessment. At the nearest potentially affected buildings in the Dominguez Technology Centre, construction noise levels would be 74 dBA or less during the most intensive demolition and site preparation phase, and would therefore be lower than the 85-dBA threshold.

While less than the construction noise threshold, the noise from the hoe rams during the first ten weeks of construction may be annoying to the nearest off-site receivers in the industrial park. Hoe rams, which are used to break concrete with a large, fast-moving metal ram or hammer produce impact noise, which is generally more disturbing than more constant construction noise sources such as engines. Use of the hoe rams would be limited to periodic use during the first ten weeks of construction and off-site noise levels will be less than modeled and reported for receivers inside buildings.

6.3.1.2 Short-term Off-site Construction

Pipeline Construction

The City of Carson sets daytime construction noise limits (applicable from 7 AM to 8 PM) for short-term construction activities (i.e., lasting less than 21 days). Given the limited duration of pipeline installation construction activities in each of the three distinct areas (2 to 3 weeks in each), the noise limits that apply to short-term construction activities would apply at the nearest residential uses and business structures. The applicable limits at residential structures are 80 dBA at multi-family residences (SLM2) and 75 dBA at single-family residences (SLM3). The limit at business structures is 85 dBA. Noise from pipeline installation is not expected to affect residences represented by SLM1.

New pipeline installation to the intersection of Charles Willard Street and South Central Avenue: The pipeline installation activities would range from 47 to 59 dBA at the university housing, and the quieter ditching and refilling activities would range from 44 to 55 dBA. Sound levels from either construction activity would fall well below the 80 dBA noise limit.

Reconnection of Crimson Pipeline at University Drive and South Central Avenue: With quieted generators (see **Table 8**), the pipeline installation activities would range from 58 to 75 dBA at the most affected residences near the intersection of University Drive and South Central Avenue, while the ditching and refilling activities would range from 55 to 72 dBA. Sound levels would just comply with the 75 dBA noise limit.

Connection between the Crimson Pipeline and Norwalk-Carson Pipeline: Construction activities associated with the connection of the Crimson Pipeline to the Norwalk-Carson Pipeline would not occur near any sensitive receivers.

Business structures would be 100 feet or farther from the nearest construction activities, with resulting levels of 73 dBA or less. These levels would easily comply with Carson's 85 dBA limit.

SCE Interconnect Construction

Underground conduit installation: The City of Carson sets daytime construction noise limits based on whether the activities are expected to be short-term (i.e., 20 days or less) or long-term (i.e., more than 20 days). The underground conduit installation would take approximately 10 weeks but would occur in a linear fashion for almost 7,000 feet. Since the construction equipment would be continually moving along the 7,000 foot installation route, each residence is expected to be exposed to elevated construction sound levels for fewer than 21 days. Therefore, the applicable limits at residential structures are the short-term construction noise limits of 75 dBA at single-family residences and 80 dBA at multi-family residences. The only potentially affected residences are the single and multi-family residences near the corner of South Central Avenue and Victoria Street represented by SLM1. The limit at business structures is 85 dBA.

With quieted generators (see **Table 10**), sound levels from the underground conduit installation equipment and activities would range from 47 to 69 dBA at the most affected residences near the intersection of South Central Avenue and Victoria Street (see **Table 11**). Such levels would easily comply with the 75 to 80 dBA noise limits applied to single and multi-family residences, respectively.

With one exception, underground conduit installation activities are expected to occur farther than 50 feet from any business structures, which would result in sound levels of 83 dBA or less and compliance with the noise limit at business structures. The exception is the building at 17900 South Central Avenue, which could be as near as 25 feet from these construction activities. The estimated sound level at this building is 89 dBA, which would exceed the 85-dBA limit.

HDD Drilling and Stringing Activities: In addition to underground cable installation using trenching methods, 1,000 feet of conduit would be installed under I-91 using horizontal directional drilling (HDD) equipment. This construction equipment would operate in the same location for a period of approximately four weeks, and the noise limits for construction activities lasting longer than 20 days would apply. During daytime hours, the long-term construction noise limits would be 65 and 70 dBA at single-family and multi-family residences, respectively. However, the HDD activities would need to operate 24-hours a day for a portion of the overall

construction period, and the applicable nighttime construction noise limits are 55 and 60 dBA at single-family and multi-family residences, respectively. The noise limit at business structures is 85 dBA no matter the time of day.

At the time of the analysis it was unknown exactly where the HDD drilling and stringing sites would be located. For purposes of this analysis, ENVIRON assumed both sites would be located on the east side of South Central Avenue approximately 500 feet from the centerline of I-91. It was also unknown whether the drilling equipment or the stringing equipment would be located north of I-91, and which would be located south.

Assuming the HDD drilling equipment were operated south of I-91 (with the stringing equipment on the north side of I-91), sound levels from the louder HDD drilling equipment and activities would be approximately 55 dBA at the residences on the west side of South Central Avenue north of Victoria Street (see **Table 11**). Such levels would just comply with the 55 dBA nighttime noise limit applied to longer-term construction. If the HDD stringing equipment were operated on the south side of I-91, the estimated sound level of 50 dBA would easily comply with the nighttime noise limit. No potentially affected residences are located near the HDD sites on the north side of I-91.

HDD drilling and string activities are expected to occur 50 feet or farther from any business structures, resulting in sound levels of 83 and 78 dBA or less for HDD drilling and HDD stringing operations, respectively. These levels would comply with the 85 dBA construction noise limit at business structures.

6.3.2 Impact Criterion 4

Would the project result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?

6.3.2.1 On-site Construction

As shown in **Table 7**, the estimated increases in sound levels at the nearest residences during demolition and site preparation range from 0 to 3 dBA. The construction sound levels and expected increases would be several decibels lower during the remaining construction activities. A substantial *temporary* noise level increase would occur if the increase in hourly Leq resulting from construction is 5 dBA or more at sensitive uses in the Project vicinity.

6.3.2.2 Short-term Off-site Construction

Pipeline Construction

New pipeline installation to the intersection of Charles Willard Street and South Central Avenue: The increase in hourly sound levels during the louder pipeline installation activities would range from 1 to 7 dBA at the nearest housing units while the increase in hourly levels during ditching is estimated to range from 1 to 4.7 dBA. Increases during construction would not exceed 10 dBA and are not expected to exceed 5 dBA for more than 10 days.

Reconnection of Crimson Pipeline at University Drive and South Central Avenue: The residences nearest the intersection would be exposed to elevated levels of construction noise for more time than residences farther west from the intersection. At the most-affected residences on the corner of University Drive and South Central Avenue, the increase in hourly

sound levels during the louder pipeline installation activities would range from 2 to 21 dBA while the increase in hourly levels during ditching is estimated to range from 1 to 18 dBA.

Connection between the Crimson Pipeline and Norwalk-Carson Pipeline: Construction activities associated with the connection of the Crimson Pipeline to the Norwalk-Carson Pipeline would not occur near any sensitive receivers.

SCE Interconnect Construction

Underground conduit installation: At the most-affected residences on the corner of University Drive and South Central Avenue (SLM1), the increase in hourly sound levels during underground conduit installation activities would range from 0 to 12 dBA, with any activities nearer than 400 feet resulting in increases greater than 5 dBA. Although the 12-dBA increase would occur for a short-period of time, it could potentially continue for more than one construction day.

HDD Drilling and Stringing Activities: Residences west of South Central Avenue north of Victoria Street, represented by SLM1, would be approximately 700 feet from either the HDD drilling or HDD stringing site, depending on which site is located south of I-91. These sites would operate in the same location for approximately four weeks and would operate 24-hours a day during a portion of the construction period. Assuming the HDD drilling equipment was located south of I-91, the increase in hourly sound levels would range from 1 to just under 5 dBA. Assuming the HDD stringing equipment was located south of I-9, the increase would range from 0 to 2 dBA.

6.4 Operation

6.4.1 Sources, Assumptions, and Methodology

The proposed facility would consist of drilling activities; slurry, oil, water, and gas handling; slop and utility systems; electrical power; flares; and truck loading racks. The noise impact assessment included drilling and slurry handling equipment and multiple pumps, compressors, blowers, and other miscellaneous equipment associated with the various handling and treatment processes. Occasional workover/maintenance activities were also considered.

Sound data for most equipment were not available and were estimated for purposes of modeling based on typical sound levels for these types of equipment taken from simple calculations or measurements of similar equipment. Equipment expected to contribute to the overall noise levels from the facility is identified in **Table 12**. The table indicates how many units might be on the site for a facility of this size and the approximate sound pressure level at 100 feet for each unit. Frequency sound level data for the various type of equipment is provided in Appendix B. Even though drilling and workover/maintenance activities are exempt from the Carson noise limits, these sources were included in the noise analysis. Regardless, they are minor noise sources that do not contribute substantially to the overall levels.

Because very few trucks are expected at the site on a daily and hourly basis (i.e., generally 2 trucks or fewer a day), truck noise would not contribute measurably to the overall noise levels and is not included in the noise study.

Appendix D

OXY USA Inc. – Dominguez Oil Field Production Facility
Noise Technical Report

Table 12. Primary Equipment Sound Levels (dBA)			
Equipment	Number of Equipment	Approximate Sound Level at 100ft (dBA)	Sound Level Data Source Reference
Drilling Equipment			
Drill Rig (Electric)	1	50	1
Metal-on-Metal Noise	Varies	100	3
Slurry Handling Equipment			
Separators/Shakers (2 units)	1	71	3
Slurry Pumps (4 pumps)	1	72	3
Pumps	5	55	4
Mud Mixer	3	75	5
Oil Handling Equipment			
Air Exchangers with Fans	2	55	4
Pumps	4	55	4
Water Handling Equipment			
Pumps	12	55	4
Large Injection Pumps	5	60	4
Gas Handling Equipment			
VRU Rotary Screw Compressors	4	60	6
Rotary Screw Compressor Air Coolers	4	60	6
Reciprocating Compressors	2	64	6
Reciprocating Compressor Air Coolers	2	59	6
LTS Pre-Coolers	2	52	4
Refrigeration Skids	2	72	6
Pumps	4	55	4
Slops System			
Pumps	8	55	4

Table 12. Primary Equipment Sound Levels (dBA)			
Equipment	Number of Equipment	Approximate Sound Level at 100ft (dBA)	Sound Level Data Source Reference
Utility System			
Pumps	9	55	4
Process Heater	1	58	2
Air Compressors	3	60	6
Miscellaneous			
Step-Down Transformers	4	54	7
Process Flare	1	55	8
Workover/Maintenance Rig	1	75	2
Note: Other pieces of equipment not included in the table are not expected to contribute substantially to the overall levels. Data Source References: 1) Based on Herrenknecht drill rig with well-insulated diesel engines. 2) ENVIRON archive of sound level measurement data for similar equipment. 3) Acoustics Group Inc. (AGI) , August 2010. 4) SPEC Services, 2011. 5) Whittier Project EIR – Public Draft, October 2010. 6) Department of Defense United Facilities Criteria (UFC), Noise and Vibration Control, Appendix C, May 2003. 7) Calculated using NEMA Standards Publication No. TR 1-1993 (R2000); Transformers, Regulators and Reactors. 8) Based on Bekaert CEB 500.			

The noise assessment included the noise-reducing effects of a proposed 30-foot high concrete wall around the majority of the site perimeter (excluding one driveway to the north and one driveway to the east).

As was done for assessing demolition/site preparation noise, ENVIRON used the CadnaA industrial noise calculation procedure (described in Section 6.2.1.1) to estimate operational sound levels from on-site equipment. The CadnaA modeling setup involved building three-dimensional maps that included intervening structures and topography, identifying the relevant noise sources (displayed in **Table 12**), inputting the locations and heights of the individual sources, and identifying the most affected residential and property boundary model receptor locations. The model receptor locations are displayed in **Figure 3**. ENVIRON considered noise from more constantly operating sources and from short-term events. The results of the modeling for each of these types of sources follow.

6.4.2 Sound Level Results

ENVIRON estimated the overall hourly sound levels (L_{eqs}) of the noise sources displayed in **Table 12** (except short-term metal-on-metal noise discussed in Section 6.4.3) at the nearest and/or most affected residential and property boundary locations. The hourly levels are also representative of the half-hourly L_{50} noise levels and were compared to the Carson L_{50} noise limits to assess compliance with the noise ordinance (**Table 13**).

Table 13. Model-Calculated Operational Sound Levels (L_{50}, dBA)		
Receiver	Operation	Limit Day/Night
Nearest Residential Properties		
SLM1	40	50/45
SLM2	43	50/45
SLM3	39	50/45
Dominguez Technology Centre Properties^(a)		
NPL	51	70
EPL	55	70
SPL	54	70
WPL	53	70
^(a) The NPL and EPL receptors are located at the nearest property boundaries north of Charles Willard Street and east of Bishop Avenue, respectively. The SPL receptor is located on the south edge of the stormwater retention basin, which abuts the southern boundary of the OXY property. These receptor placements represent the nearest potentially-affected properties to the facility.		

ENVIRON then calculated the CNEL levels using the model-calculated hourly sound levels displayed in **Table 13**. The CNEL levels due to operation of the facility were added to the existing sound levels to estimate the overall future noise levels and noise level increases at the affected properties nearest the Project Site (**Table 14**).

Table 14. Operational Sound Levels and Sound Level Increases (CNEL, dBA)				
Receiver	Existing	Operation	Overall	Increase
Nearest Residential Properties				
SLM1	63	46	63	0
SLM2	58	50	58	1
SLM3	59	45	59	0

Table 14. Operational Sound Levels and Sound Level Increases (CNEL, dBA)

Receiver	Existing	Operation	Overall	Increase
Dominguez Technology Centre Properties				
NPL	70	57	70	0
EPL	70	61	71	1
SPL	59	61	63	4
WPL	63	60	65	2
Notes:				
Any apparent calculation errors are due to rounding.				
The calculated CNEL levels assume peak 24-hour operation.				

6.4.3 Short-term Metal-on-Metal Sound Level Results

In addition to the operational noise sources expected to operate on the Project Site, drill pipe and casing handling can result in metal-on-metal contact, resulting in very short-term elevated sound levels. Metal-on-metal noise can be characterized as clanking sounds varying in duration and sound level. Because it is short in duration, it is restricted by the L_{max} noise limits identified in the Carson Municipal Code Article 5, Chapter 5, which are 20 dBA higher than the base L₅₀ noise limits.

Using the same methodology described above for operational noise, sound levels of metal-on-metal events were predicted at nearby residential and property line locations. The resulting modeled sound levels are displayed in **Table 15** and are compared to the City of Carson L_{max} limits as applied at residential and industrial properties.

Table 15. Modeled Short-term Metal-on-Metal Sound Levels (L_{max}, dBA)

Receiver	Sound Level	Noise Limit Day/Night ^(a)
Nearest Residential Properties		
SLM1	57	70/65
SLM2	62	70/65
SLM3	57	70/65
Industrial Property Lines		
NPL	72	90
EPL	72	90
SPL	70	90
WPL	73	90
^(a) Daytime hours are from 7 AM to 10 PM; nighttime hours from 10 PM to 7 AM.		

6.5 Assessment of Operational Noise Impacts

6.5.1 Impact Criterion 1

Would the project 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?

As shown in Table 13 and Table 15, the model-calculated sound levels comply with the applicable daytime noise limits at the nearest residential properties. The model-calculated sound levels also comply with the more stringent nighttime noise limits at all residential properties. The modeled property line sound levels also comply with the City of Carson's noise limits for industrial properties, which apply 24-hours a day.

6.5.2 Impact Criterion 3

Would the project result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?

A substantial permanent noise increase would occur if the noise level increase from the Project is 3 dBA CNEL or greater where the future overall noise level would be within the "normally unacceptable" or "clearly unacceptable" category (Table 3), or 5 dBA CNEL or greater otherwise.

As is shown in **Table 14**, equipment and activities related to the proposed facility would increase overall CNEL sound levels by 0 to 1 dBA at the nearest residences, which would be considered minimal increases.

At receptors in the Dominguez Technology Centre, projected increases in CNEL range from 0 to 4 dBA with resulting overall sound levels of 63 to 71 dBA. These levels are within the "normally acceptable" to "conditionally acceptable" range for both office/professional buildings and industrial/manufacturing facilities, and would not, therefore, be considered substantial increases.

6.6 Cumulative Impacts

Cumulative impacts were considered when assessing the potential changes in the overall noise environment in the Project vicinity (**Table 14**). The analysis added the Project-related noise to the existing sound levels to assess the effect on the cumulative sound levels with the Project.

6.7 Impacts and Mitigation Summary

6.7.1 Construction

6.7.1.1 On-site Construction

On-site construction noise will comply with the applicable noise limits at the nearest residential properties and at the nearest buildings in the Dominguez Technology Centre. In addition, construction noise will result in slight to moderate increases in noise at the nearest sensitive (i.e., residential) receivers.

6.7.1.2 Short-term Off-site Construction

Pipeline Construction

Short-term off-site construction noise during pipeline installation near the intersection of University Drive and South Central Avenue could result in noise impacts at the nearest residential properties due to substantial increases in noise compared to existing sound levels. However, construction noise during pipeline installation activities in all locations would comply with the applicable noise limits at the nearest residential properties and at the nearest business structures. In addition, any impacts would be temporary and fairly short in duration (i.e., less than 3 weeks).

Noise mitigation to enable compliance include use of quieted generators (or portable barriers around the generators) for all off-site pipeline construction locations.

SCE Interconnect Construction

Short-term off-site construction noise during underground conduit installation near the residences west of South Central Avenue and north of Victoria Street could result in noise impacts due to substantial increases in noise compared to existing sound levels. However, underground conduit installation activities associated with SCE Interconnect would comply with the applicable noise limits at the most affected residences west of South Central Avenue and north of Victoria Street. In addition, any impacts would be temporary and fairly short in duration.

Noise from HDD drilling and stringing equipment would be at least 700 feet from the residences west of South Central Avenue and north of Victoria Street. Although the activities would remain in the same location for approximately four weeks and could occur 24-hours a day, HDD equipment is expected to comply with the more stringent nighttime construction noise limits. In addition, noise from HDD activities is not expected to result in substantial increases in noise..

6.7.2 Operation

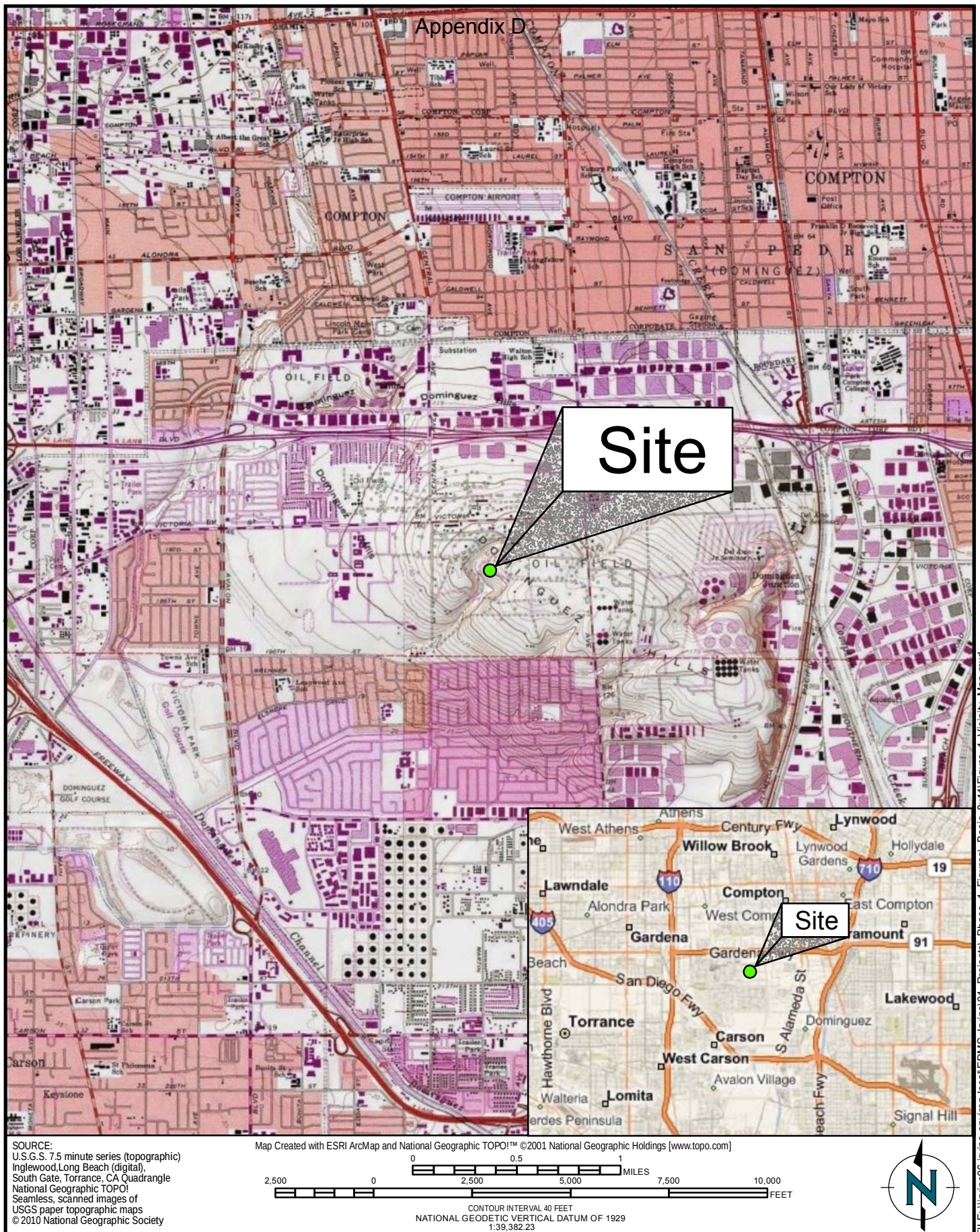
Operational noise will comply with the applicable noise limits at the nearest residential receivers and at the industrial property lines..

During operation of the facility, the predicted increases in CNEL levels at the nearest residential receivers to the site are 0 to 1 dBA. Predicted increases at the nearest affected properties in the Dominguez Technology Centre range from 0 to 4 dBA and would not be considered substantial.

7 References

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Figures



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ENVIRON

DRAFTED BY: SShin

DATE: 7/29/2010

Site Vicinity Map

Oxy Dominguez Oil Field
D-381450 Charles Willard St
Carson, CA 90746

Figure
1

PROJECT: 03-25072E



Figure

2

PROJECT: 03-25072E

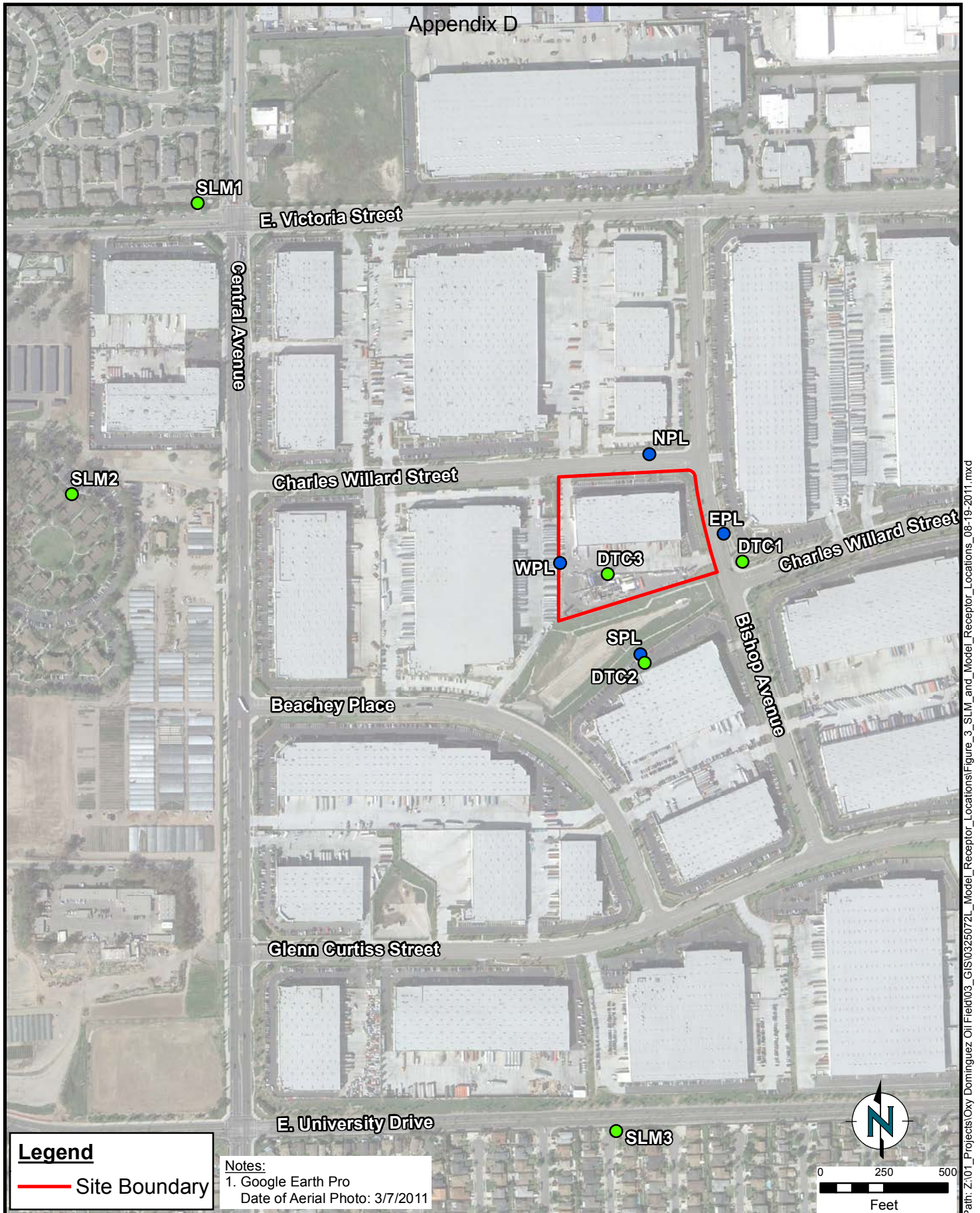
Site Detail

Oxy Dominguez Oil Field
1450 Charles Willard St
Carson, CA 90746

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DRAFTED BY: SShin

DATE: 5/4/2011



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DRAFTED BY: SShin

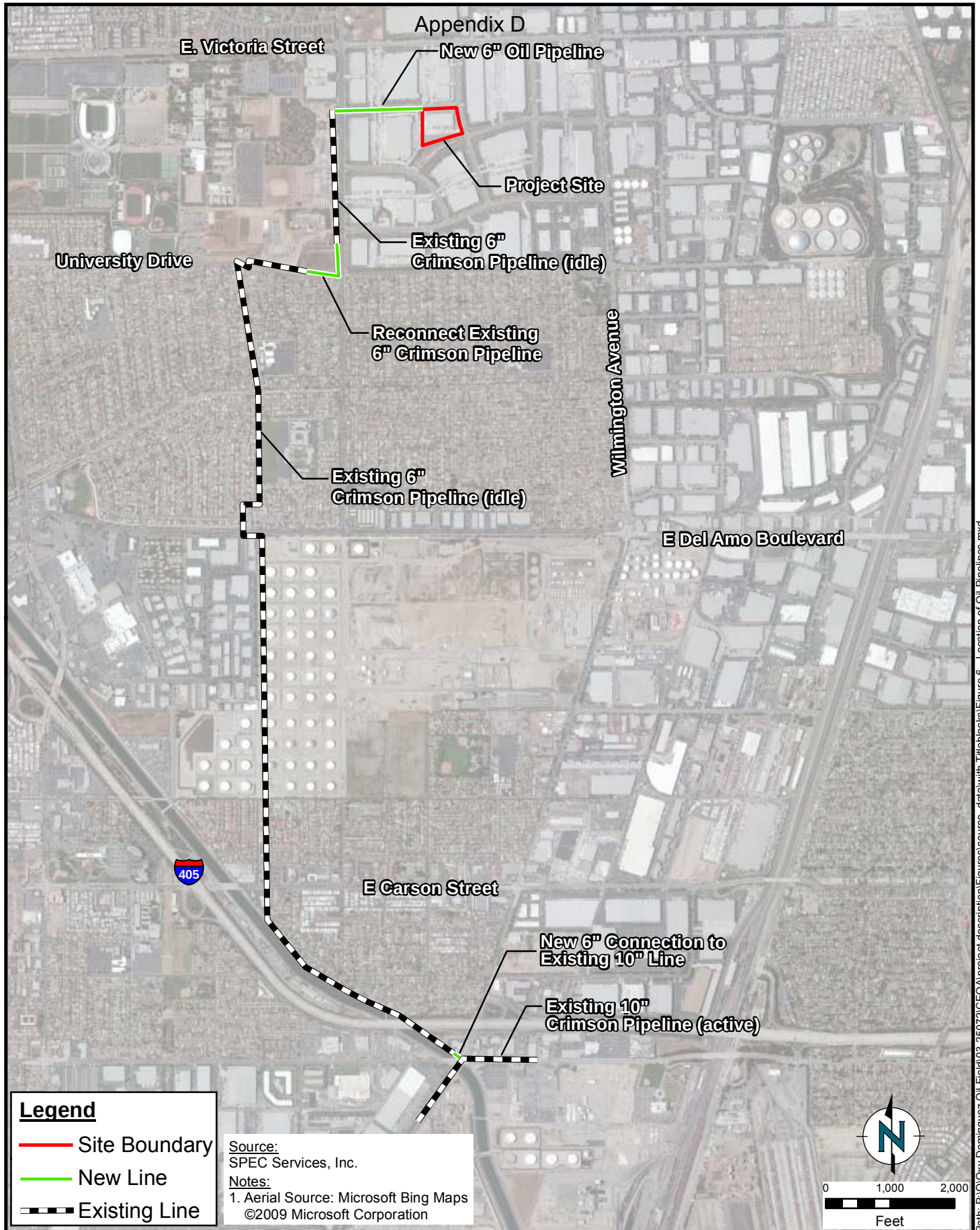
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Site Location Map and Model Receptor Locations

Oxy Dominguez Oil Field
 D-40 1450 Charles Willard St
 Carson, CA 90746

Figure
3

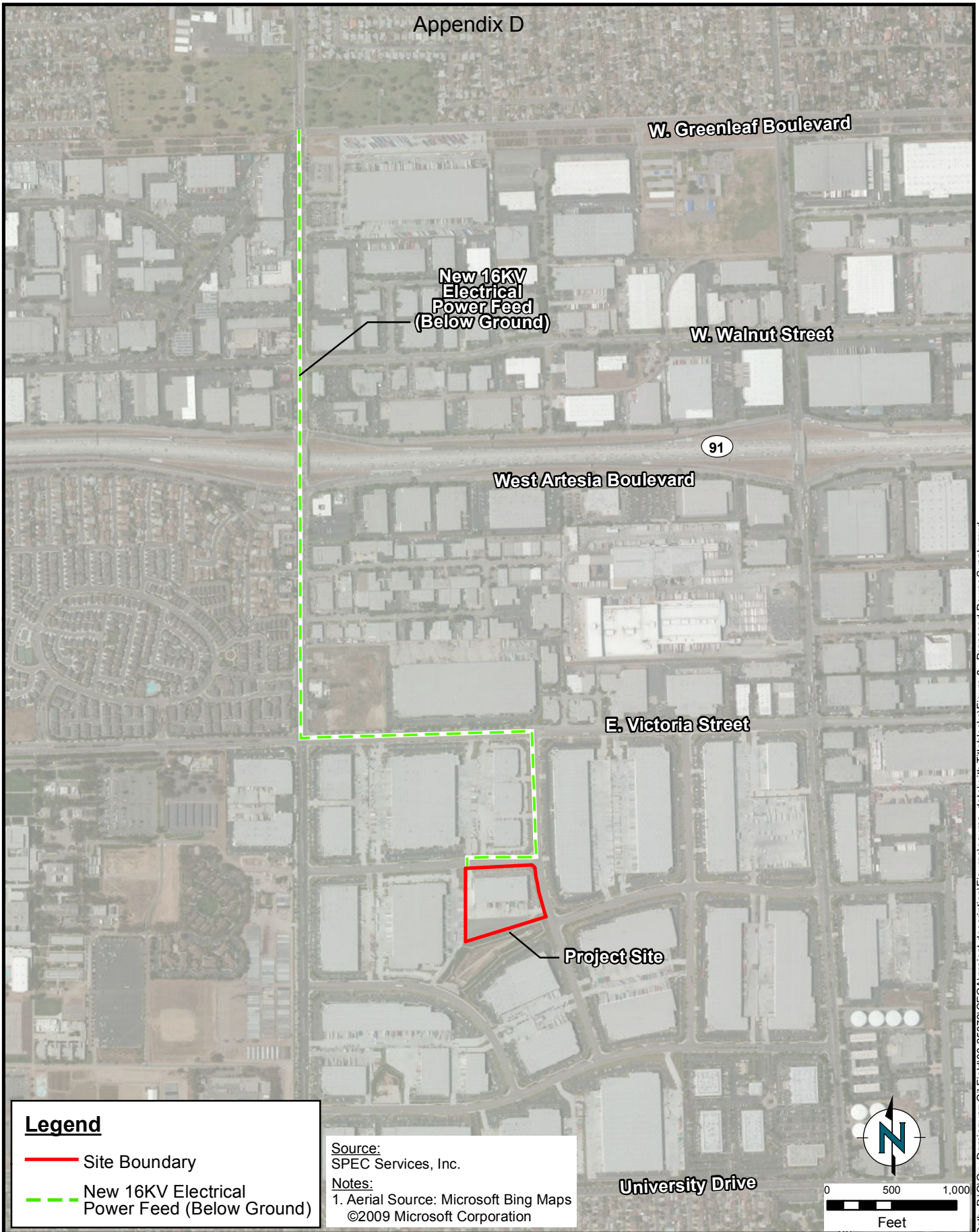
PROJECT: 03-25072



Path: P:\Oxy Dominguez Oil Field\03-25072\CEQA\project description\Figures\source_data\with Titleblocks\Figure 6 - Location of Oil Pipelines.mxd



Path: P:\Oxy Dominguez Oil Field\03-25072\CEQA\project description\Figures\source_data\with Titleblocks\Figure 7 - Location of Gas Pipelines.mxd



Path: P:\Oxy Dominguez Oil Field\03-25072\CEQA\project description\Figures\source_data\with_titleblocks\Figure 6 - Proposed Power Supply.mxd

Appendix A

Sound Level Measurement Details

Appendix D

OXY USA Inc. – Dominguez Oil Field Production Facility
Noise Technical Report

SLM1 1278 REDWOOD COURT, DOMINGUEZ VILLAGE								
Date	Time	Leq	Lmax	L2	L8	L25	L50	L90
25-Apr	11:00:00	59.4	80.4	64.1	61.7	59.5	57.7	53.9
25-Apr	12:00:00	59	77.7	63.9	61.8	59.6	57.6	54.1
25-Apr	13:00:00	57.4	68.6	62.6	60.6	58.3	56.4	52.9
25-Apr	14:00:00	57.9	71.5	63.4	61	58.6	56.7	53.4
25-Apr	15:00:00	57.2	69	62.7	60.1	58	56.1	53.4
25-Apr	16:00:00	59.5	79.6	64.9	61.4	59.4	57.5	54.1
25-Apr	17:00:00	57.6	70.7	62.7	60.5	58.3	56.6	53.9
25-Apr	18:00:00	59.3	80.2	67.2	61.8	58.5	56.4	53.6
25-Apr	19:00:00	56.5	76.3	62.9	60.1	56.5	54.3	52
25-Apr	20:00:00	55.6	77.3	61	58.1	55.1	53.5	51.2
25-Apr	21:00:00	54.7	70.8	60.6	57.9	55.3	53.1	50.6
25-Apr	22:00:00	54.9	69.1	60.8	58.2	55.4	52.8	49.9
25-Apr	23:00:00	52.7	68.3	59.2	55.9	52.8	50.8	48.3
26-Apr	0:00:00	53	67.2	59.2	56.7	53.5	51.3	48.2
26-Apr	1:00:00	51.7	65.4	58.8	54.9	51.6	49.6	47.2
26-Apr	2:00:00	51.7	66.4	59.6	54.9	51.2	49.1	47.1
26-Apr	3:00:00	52.7	71	59	55.6	52.4	49.9	47.3
26-Apr	4:00:00	53.5	68.1	58.6	56.4	53.9	52.5	50.3
26-Apr	5:00:00	58.5	70.4	65.5	62.3	58.8	56.8	52.3
26-Apr	6:00:00	59.7	73.3	64.8	62.4	60.4	58.8	55.6
26-Apr	7:00:00	60.5	73.6	64.9	63	61.3	59.7	56.9
26-Apr	8:00:00	60.6	69.4	65.8	63.7	61.3	59.6	56.4
26-Apr	9:00:00	61.3	80.6	67.8	64.1	61	59	55.3
26-Apr	10:00:00	59.6	77	65.4	62.3	60	57.9	54.3
	Ldn	62.4						
	CNEL	62.6						
The measured sound levels include percentile levels, L _n . An L _n is the sound level exceeded n% of the time. For example, the L ₅₀ is the sound level exceeded 50% of the time, or 30 minutes of an hour. Similarly, the L ₂₅ , L ₈ , and L ₂ , are the levels exceeded 25, 8, and 2 % of the time. The L ₈ and L ₂ levels are representative of the L _{8.3} and L _{1.7} percentile levels, which are used by the City of Carson for defining its noise limits. The L _{max} , also characterized as the L ₀ , is the maximum sound level, i.e., the sound level that cannot be exceeded for any portion (0%) of a time period.								

Appendix D

OXY USA Inc. – Dominguez Oil Field Production Facility
Noise Technical Report

SLM2 CAL STATE UNIVERSITY DOMINGUEZ HILLS - STUDENT HOUSING								
Date	Time	Leq	Lmax	L2	L8	L25	L50	L90
25-Apr	11:00:00	57.4	71.5	68.2	60.1	55.6	52.5	48.5
25-Apr	12:00:00	53.3	69	57.9	55.9	54.1	52.4	50.1
25-Apr	13:00:00	53.9	67	58.1	56.3	54.5	53.2	50.8
25-Apr	14:00:00	54.1	66.9	58.6	56.2	54.7	53.4	51.3
25-Apr	15:00:00	54.4	68.2	58.6	56.3	54.8	53.7	51.5
25-Apr	16:00:00	54.3	64.3	58.3	56.5	54.9	53.7	52
25-Apr	17:00:00	55.9	76.8	61.3	56.6	54.7	53.6	51.9
25-Apr	18:00:00	54.8	64.7	58.9	56.8	55.2	54.1	52.6
25-Apr	19:00:00	53.8	72.9	58.5	54.9	53.6	52.7	51.2
25-Apr	20:00:00	51.4	64.9	56.6	53.1	51.5	50.4	49.1
25-Apr	21:00:00	50.2	65.4	55.7	52.5	50.1	48.7	46.4
25-Apr	22:00:00	48.2	63.3	53.9	50.9	48.4	46.7	44.6
25-Apr	23:00:00	47.4	64.8	53.1	49.7	47.6	46.1	44.4
26-Apr	0:00:00	46.2	54.9	50.9	48.7	46.7	45.2	43.3
26-Apr	1:00:00	45.6	55.5	49.6	47.6	46.2	45.1	43.4
26-Apr	2:00:00	46.5	59.3	51	48.4	46.8	45.8	44.3
26-Apr	3:00:00	46.6	61.1	51	48.5	46.6	45.5	44.2
26-Apr	4:00:00	47.5	52.8	49.9	48.9	47.9	47.3	45.9
26-Apr	5:00:00	52.4	61.6	57.4	56	53.7	50.8	47.9
26-Apr	6:00:00	56.1	71.1	59.4	57.8	56.6	55.6	54
26-Apr	7:00:00	54.8	66	59.4	57.3	55.5	54	51.7
26-Apr	8:00:00	53	63.3	57.7	56.1	54.2	52.2	48.2
26-Apr	9:00:00	53.5	69	59.1	56.1	54	51.9	48.2
26-Apr	10:00:00	52.3	67.8	57.3	55.1	52.9	50.5	47.1
	Ldn	57.4						
	CNEL	57.7						
The measured sound levels include percentile levels, L _n . An L _n is the sound level exceeded n% of the time. For example, the L ₅₀ is the sound level exceeded 50% of the time, or 30 minutes of an hour. Similarly, the L ₂₅ , L ₈ , and L ₂ , are the levels exceeded 25, 8, and 2 % of the time. The L ₈ and L ₂ levels are representative of the L _{8.3} and L _{1.7} percentile levels, which are used by the City of Carson for defining its noise limits. The L _{max} , also characterized as the L ₀ , is the maximum sound level, i.e., the sound level that cannot be exceeded for any portion (0%) of a time period.								

Appendix D

OXY USA Inc. – Dominguez Oil Field Production Facility
Noise Technical Report

SLM3 19063 TAJAUTA AVE								
Date	Time	Leq	Lmax	L2	L8	L25	L50	L90
26-Apr	15:00:00	57.5	81.8	64.2	61.3	57.1	53.3	48.4
26-Apr	16:00:00	58.8	84.5	65.5	61.7	57.4	53.6	47.7
26-Apr	17:00:00	58.4	74.7	65.1	62.7	59.2	55.6	50.3
26-Apr	18:00:00	56.5	76.4	63.9	61	56.8	52.7	48.5
26-Apr	19:00:00	56	85.1	62.2	58.9	54.3	50.5	46.6
26-Apr	20:00:00	54.5	76.8	62.7	58.8	52.9	47.9	44.9
26-Apr	21:00:00	52.7	70.6	61.4	57.1	51.7	47.2	43
26-Apr	22:00:00	52.5	74.2	61.1	56.2	50.3	45.4	42.1
26-Apr	23:00:00	48.9	68.3	58.3	51.8	46.8	45	40.3
27-Apr	0:00:00	46.4	65.9	55.3	47.6	44.1	42.7	41.1
27-Apr	1:00:00	45.3	61.4	50.1	47.4	45	44	42.2
27-Apr	2:00:00	45.3	63	51.8	46	44.8	43.8	42.2
27-Apr	3:00:00	45.4	63.4	53.7	45.1	43.8	43	41.9
27-Apr	4:00:00	47	68	52.8	47.7	46.2	44.9	43
27-Apr	5:00:00	54	79.7	61.3	55.9	51	48.9	46.6
27-Apr	6:00:00	55.5	79.5	63.3	59.5	54.1	50.3	47.7
27-Apr	7:00:00	60.1	87.9	65	62	58.1	53.5	46.6
27-Apr	8:00:00	55.9	70.2	63.8	61.1	56.6	50.7	42.9
27-Apr	9:00:00	54.1	73	63.2	58.7	53.3	46.5	40.8
27-Apr	10:00:00	56.2	73.8	66.5	59.4	52.9	46.7	40.1
27-Apr	11:00:00	54.9	74.4	63.9	59.4	54.4	48.5	41.9
27-Apr	12:00:00	59.5	87	64.8	61.7	56.9	51.4	43.4
27-Apr	13:00:00	56.4	71.7	64.1	61	56.8	52.2	45.3
27-Apr	14:00:00	60.3	75.9	68.8	65.1	59.8	55.5	49.1
	Ldn	58.9						
	CNEL	59.3						
The measured sound levels include percentile levels, L _n . An L _n is the sound level exceeded n% of the time. For example, the L ₅₀ is the sound level exceeded 50% of the time, or 30 minutes of an hour. Similarly, the L ₂₅ , L ₈ , and L ₂ , are the levels exceeded 25, 8, and 2 % of the time. The L ₈ and L ₂ levels are representative of the L _{8.3} and L _{1.7} percentile levels, which are used by the City of Carson for defining its noise limits. The L _{max} , also characterized as the L ₀ , is the maximum sound level, i.e., the sound level that cannot be exceeded for any portion (0%) of a time period.								

Appendix B

Equipment Sound Level Data

Primary Production Facility Equipment Sound Power Levels												
Name	Frequency Spectrum (Octave Band)										A-wght	linear
	31.5	63	125	250	500	1000	2000	4000	8000			
Drill Rig	98	101.3	96.9	86.6	87.5	84.5	80.9	77.1	70.6	90	104.2	
Metal-on-metal	0	131	130	134	137	135	134	132	136	141.6	143.2	
Mud Pumps (2)	98.9	110.2	110.5	107.7	107.7	103.9	101	95.8	92.8	109.4	115.9	
Separators (3)	121.3	130.5	116	110.1	107.6	104.1	101.3	99	97	111.3	131.2	
Mud Mixer (3)	104	112.7	111.5	115.9	109.9	109.8	108.9	104	99.1	115.3	120.2	
Cementing	118.8	130.3	113.1	111.2	110.2	102.4	99.8	96.8	90.4	111.3	130.8	
Refrigerator Skid	102	103	104	105	103	108	108	103	97	112.8	114.2	
Large Rotary Screw Compressor	80	86	90	102	99	95	90	85	83	100.4	104.8	
Leroi VR compressor	80	86	90	102	99	95	90	85	83	100.4	104.8	
Ariel Recipr Comp	91	96	97	100	101	100	97	93	88	104.3	107	
Small Recipr Comp Air Cool	89	93	94	95	96	94	92	88	82	99	102.4	
Regular Pump	115.9	111.7	98.6	94.1	91.7	88.5	85.3	82.5	81.6	95	117.4	
Injection Pump	120.9	116.7	103.6	99.1	96.7	93.5	90.3	87.5	86.6	100	122.4	
Flare	107.1	109	98.6	88	87.7	87	89.7	87.2	81.9	95.1	111.5	
Oil Chiller	65	65	76	83	87	89	89	89	83	95.1	95.2	
LTS Precooler	98	98	97	94	89	87	81	75	69	92	103.3	
Fan	90.3	91.3	92.3	93.3	93.3	93.3	91.3	87.3	86.3	98	101.1	
Transformer	94.5	97.5	99.5	94.5	94.5	88.5	83.5	78.5	71.5	94.9	103.8	
Maintenance	104.1	112.8	111.5	115.9	110	109.8	108.9	104	99.1	115.3	120.2	

APPENDIX E

Hazard Analysis



WORST-CASE CONSEQUENCE ANALYSIS FOR THE PROPOSED OXY USA DOMINGUEZ OIL AND GAS PRODUCTION FACILITY

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**6850-CAS01-RevD2
April 5, 2013**

WORST-CASE CONSEQUENCE ANALYSIS FOR THE PROPOSED OXY USA DOMINGUEZ OIL AND GAS PRODUCTION FACILITY

Table of Contents

	<u>Page</u>
1.0 INTRODUCTION	1
2.0 OVERVIEW OF OXY USA DOMINGUEZ PRODUCTION FACILITY	1
2.1 Facility Location	1
2.2 Meteorological Data	3
2.3 Proposed Project	4
2.3.1 Oil and Gas Production	4
2.3.2 Oil and Gas Processing Facilities	5
2.3.2.1 Three-Phase Separation System	5
2.3.2.2 Oil Treatment System	5
2.3.2.3 Gas Compression and Treatment System	6
2.3.2.4 Water Treatment Facilities	7
2.3.3 Other Support Systems	7
2.3.3.1 Slop Oil Systems	7
2.3.3.2 Slurry Injection System	7
2.3.3.3 Electrical Substation	7
2.3.3.4 Emergency Ground Flare	8
2.3.4 Pipeline Connections	8
2.3.4.1 Crude Oil Pipeline	8
2.3.4.2 Natural Gas Pipeline	8
3.0 POTENTIAL HAZARDS	8
3.1 Hazards Identification	8
3.2 Selection of Accidental Release Case Studies	11
3.2.1 Overview of Methodology	11
3.2.2 Initial Review of Available Documentation	11
3.2.3 Detailed Review of Process Flow Diagrams	12
3.2.4 Review of Process Material Balances	12
3.2.5 Review of Available Safety Studies	12
3.2.6 Development of Hazard Scenarios	12
3.2.7 Initial Screening via Hazard Zone Analysis	13
3.2.8 Final Selection of Hazard Cases	15
4.0 WORST-CASE CONSEQUENCE MODELING RESULTS	15
4.1 Releases Resulting in the Largest Downwind Hazard Zones	15
4.2 Description of Potential Hazard Zones	15

Table of Contents

(continued)

	<u>Page</u>
4.2.1 Toxic Vapor Clouds	15
4.2.2 Flash Fires	16
4.2.3 Vapor Cloud Explosions.....	18
4.2.4 Fire Radiation.....	19
4.3 Summary of Maximum Hazard Zones	21
5.0 CONCLUSIONS.....	21
6.0 REFERENCES	24
7.0 GLOSSARY	26

1.0 INTRODUCTION

Quest Consultants Inc. was retained by Environmental Audit, Inc. and Oxy USA, Inc. to perform a worst-case consequence analysis on the proposed Oxy USA Dominguez oil and gas production facility and associated pipelines. The objective of the study was to compute the potential increase or decrease in hazards to the public due to the proposed facility.

The study was divided into three tasks.

Task 1. Determine the maximum credible potential releases, and their consequences, for existing process units, transfer systems (e.g., pipelines), and storage areas.

Task 2. Determine the maximum credible potential releases and their consequences for the modifications to the facility and pipelines which have been proposed by Oxy USA.

Task 3. Determine whether the consequences associated with the proposed modifications generate potential hazards that are larger or smaller than the potential hazards which currently exist.

Potential hazards from the existing and proposed equipment are associated with accidental releases of toxic/flammable gas, toxic/flammable liquefied gas, and flammable and combustible liquids. Hazardous events associated with gas releases include toxic gas clouds, torch fires, and vapor cloud explosions. Hazardous events associated with potential releases of toxic/flammable liquefied gases include toxic clouds, torch fires, flash fires, and vapor cloud explosions. Releases of flammable or combustible liquids may result in pool fires.

The hazard of interest for flash fires is direct exposure to the flames. Flash fire hazard zones are determined by calculating the maximum size of the flammable gas cloud prior to ignition. These hazard zones are defined by the lower flammable limit (LFL) of the released hydrocarbon mixture. The hazard of interest for torch fires and pool fires is fire radiation.

For vapor cloud explosions, the hazard of interest is the overpressure created by the blast wave. For Boiling Liquid-Expanding Vapor Explosions (BLEVEs), the hazard of interest is the radiation produced by the fireball.

For each type of hazard identified (toxic, radiant, overpressure), maximum distances to potentially injurious levels are determined. The hazard levels used are those that have been developed by the U.S. Environmental Protection Agency (EPA) and American Industrial Hygiene Association (AIHA) for risk management purposes.

2.0 OVERVIEW OF OXY USA DOMINGUEZ PRODUCTION FACILITY

2.1 Facility Location

The proposed Oxy USA, Inc. production facility will be located in the City of Carson on the southwest corner of Charles Willard Street and Bishop Avenue. The facility and a Southern California Edison (SCE) substation will occupy approximately 6.5 acres of land within the City of Carson. The production facility and all adjacent areas are zoned for commercial/light industrial use. The closest residential area is approximately 1,800 feet northeast of the facility. The layout of the facility and the major roads bounding the plant is presented in Figure 2-1.

Appendix E



Figure 2-1
Plot Plan of Oxy USA Dominguez Production Facility

In addition to the facility, natural gas and crude oil pipelines will be added that will connect with existing pipelines. A 6-inch natural gas pipeline is proposed to run east on Charles Willard Boulevard from the facility where it will connect with an existing 30-inch pipeline. A 6-inch crude oil pipeline is proposed to connect to the Crimson Oil pipeline.

2.2 Meteorological Data

Meteorological data for the Long Beach area were obtained from the National Climatic Center (NCC) for Long Beach Airport. Long Beach Airport is the nearest weather station reporting complete meteorological data. It is approximately five miles east of the plant.

A summary of the meteorological data is presented as a wind rose. Figure 2-2 presents the annual wind rose data by wind speed and direction. The length and width of a particular arm of the rose define the frequency and speed at which the wind blows from the direction the arm is pointing. Meteorological data show the wind blows predominantly from the WNW.

Although the meteorological data could be used in the calculation of the frequency associated with the release of toxic/flammable materials, it was not required for this worst-case analysis. The frequencies at which the wind blows in specific directions, with specific speed, and under specific atmospheric stabilities are often incorporated into a risk analysis. In this study, a low wind speed/stable condition (2.0 m/s, F) was evaluated for the dispersion releases, and a high wind speed condition (9.0 m/s) was used in the pool fire radiation calculations. These conditions often approximate the worst-case weather conditions for their respective hazards.

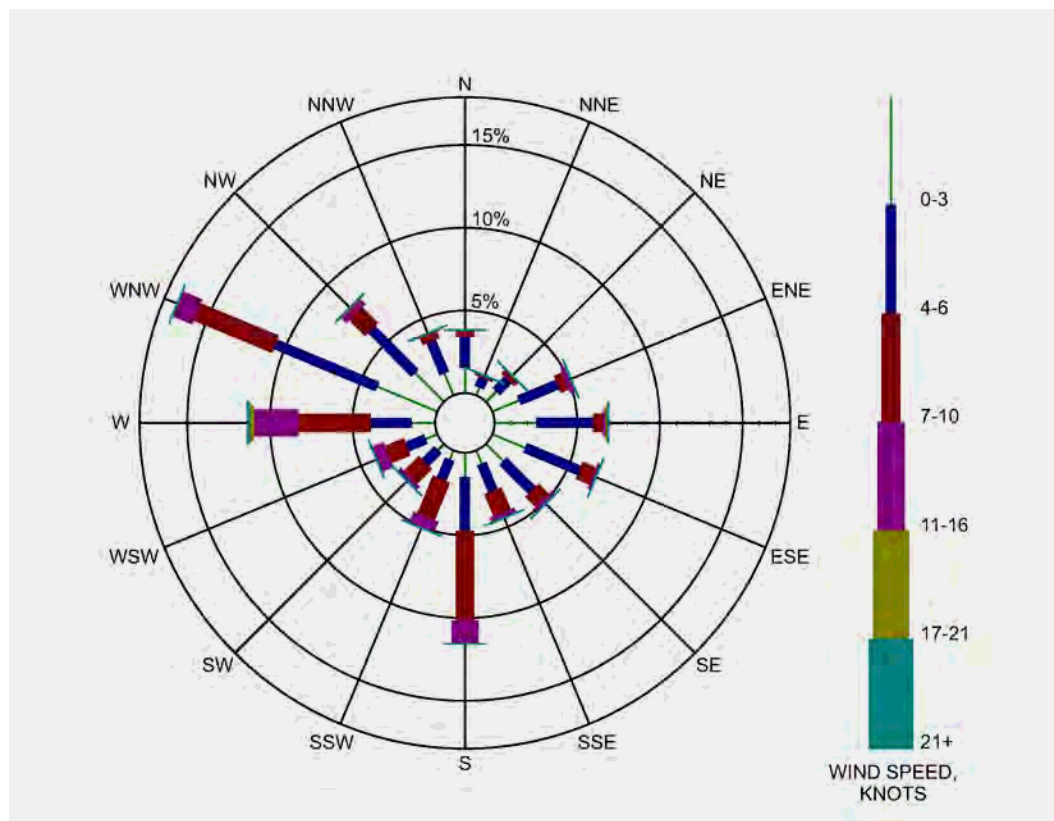


Figure 2-2
Annual Wind Rose for the Los Angeles Area

2.3 Proposed Project

OXY proposes to construct a production facility consisting of up to 200 wells, an oil and gas processing facility, water treatment, water injection operations, slurry injection or disposal operations, an electrical substation, emergency flare, and shipping and pipeline facilities to produce and transport approximately 6,000 bbl/day of oil and 3 mmscf/day of natural gas. Crude oil production results in produced fluids (oil, water, and gas liquids) and natural gas that must be processed to meet buyer and transportation specifications. Once brought to the surface, the oil, water, and gas mixture is processed to recover the salable products (crude oil and natural gas) from the water. Figure 2-3, outlines the block diagram of the process of producing crude oil produced from the wells.

Directional drilling techniques will be used in order to pinpoint oil reservoirs at depths of 4,000 to 13,500 feet. The Facility will be located in a 30-foot high, walled compound with an enclosed drilling rig mast. There will be two main gates, one located at the northwest corner to Charles Willard Street, and one located on the southeast corner to Bishop Avenue.

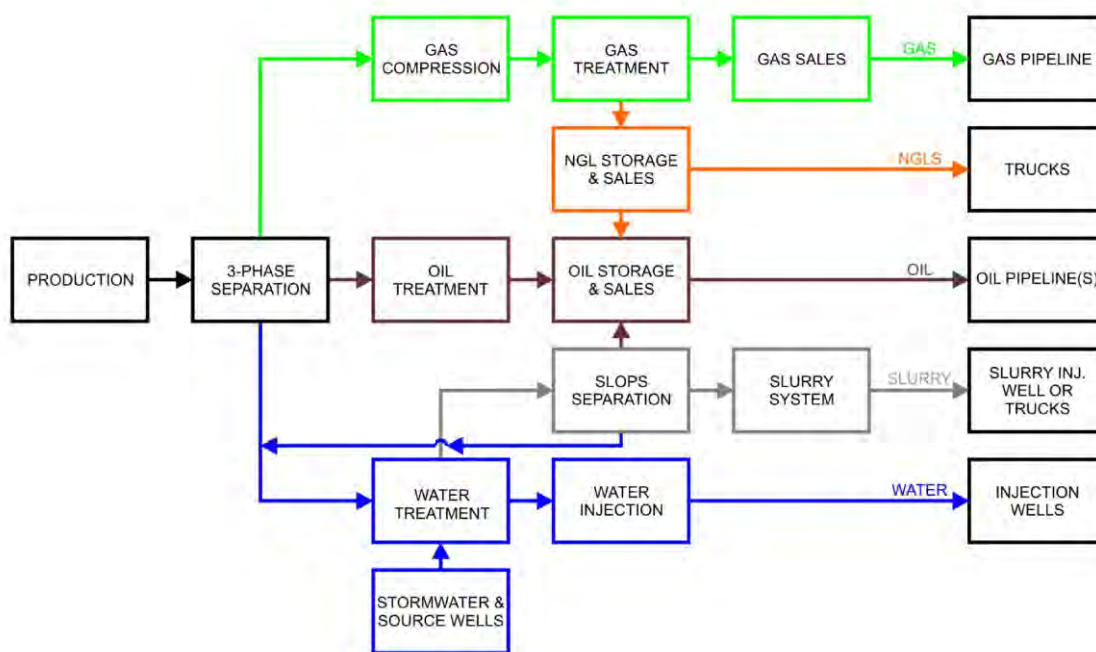


Figure 2-3
Oxy USA Dominguez Production Block Flow Diagram

2.3.1 Oil and Gas Production

The oil and gas production facilities will include up to 200 wells, well cellars, and a well drilling rig. Of the 200 wells to be installed during the life of the project, approximately 130 will be production wells, 65 salt water injection wells, four salt water production wells, and one slurry injection well. Approximately 90 percent of the produced fluids from oil and gas production are expected to be water, which will be reintroduced to the oil reservoir to improve oil recovery and maintain reservoir pressure. If the slurry injection well is not constructed, cuttings and solids from well installation will be transported off-site to an appropriately licensed

disposal facility. It is expected that up to approximately 20 wells per year will be installed. The wells will be permitted by the California Department of Conservation, Division of Oil, Gas, and Geothermal Resources (DOGGR).

All wells (except for the two existing test wells) will be located in well cellars on the north and east side of the Facility (see Figure 2-1). The well cellars are below grade and contain the wellhead, piping, and pumps. The below-grade cellars allow equipment to position over the wells without obstructions. The well cellars will be approximately eight feet deep and equipped with storm water management collection sumps and pumps.

2.3.2 Oil and Gas Processing Facilities

The oil and gas processing facilities will remove water and gas from the produced oil. The oil and natural gas will be transported via new pipeline connections to existing nearby pipelines and the produced water will be treated and returned to the oil reservoir. The Oil and Gas Processing Facilities will consist of the following systems and are described in the following subsections:

- Three-Phase Separation System;
- Oil Treatment System;
- Gas Compression and Treatment System; and,
- Water Treatment.

2.3.2.1 Three-Phase Separation System

The first step of oil processing will be designed to separate up to 6,000 bbl/day oil, 3 mmscf/day gas, and 94,000 bbl/day water (called phases). Two horizontal three-phase separator vessels (referred to as Freewater Knockouts) will use the difference in density of the phases (i.e., the gas rises and the majority of the oil floats on the water). This separation typically reduces the water content of the oil to less than 25 percent and the oil content of the water to less than one percent. The three-phase separators will typically operate at pressures between 100 and 150 pound per square inch gauge (psig).

2.3.2.2 Oil Treatment System

The oil from the three-phase separation system will be further treated to remove additional water in order to make it salable. The oil treatment system will reduce the water content of the oil from approximately 25 percent to between one and three percent. Water removal will be accomplished by using an electric field produced by grids placed perpendicular to the flow of fluids in the treatment vessel. The electric field will help break up the oil/water emulsion to provide better separation.

Oil produced for sale will be stored in a fixed-roof, gas-blanketed, 5,000-barrel oil storage tank. An additional fixed-roof, gas-blanketed, 5,000-barrel storage tank referred to as the wet oil tank will be used for off-specification oil (i.e., too much water or solids) diverted from the oil treatment system or the oil sales custody transfer equipment. The oil from the wet oil tank will be reprocessed or processed in the slops separation system.

Sales oil charge pumps will be used to transfer the oil from the oil storage tank to the pipeline in either a batch mode, where the oil accumulates in the storage tank until almost full, or a continuous mode, where the tank level will be kept relatively constant with oil being withdrawn at a rate about equal to that being placed in the tank. The operating pressure of the pumps will be compatible with the existing Crimson Pipeline, which operates at up to 720 psig.

Oil custody transfer equipment necessary to sell the oil in the pipeline will be installed. Both OXY and the customer will have the ability to shut down oil shipment either on-site or remotely.

2.3.2.3 Gas Compression and Treatment System

The gas produced from the wells will be used to blanket the storage tanks. The fixed-roof gas blanket design eliminates the direct emissions from tanks, and therefore has much lower emissions than open- or floating-roof designs, by venting the vapors to a vapor recovery system, and then using those vapors to fuel the on-site equipment.

In addition to the vapor recovery compressors, gas compressors will be used to raise the pressure of the gas from 70 psig to 550 psig. Once compressed, the gas will be treated to remove hydrogen sulfide (H_2S). The system will be designed to remove up to 75 parts per million (ppm) H_2S , which is well above the expected concentrations of H_2S which are all less than 10 ppm. The H_2S removal will be accomplished by using a catalyst in a SulfaTreat vessel. The system will be equipped with two 25-foot tall SulfaTreat vessels in series. When the first vessel is at capacity, the gas stream will be diverted from the first vessel to the second vessel. The catalyst will be changed in the first vessel and will be returned to service as the second vessel. This allows the system to remain online continuously.

The final step before gas transfer to the sales pipeline will be to remove any heavy hydrocarbons and water by using a combined refrigeration/dehydration system. Ethylene glycol will be injected to prevent freezing at low temperatures before the gas is chilled to sub-zero temperatures in the low temperature separator. At sub-zero temperatures, the heavy hydrocarbons (i.e., propane, butane, etc. (referred to as C3+ for the number of carbon atoms in the compounds)) will condense to a liquid state and will be removed in a three-phase low temperature separator. The gas will then be transferred into the sales pipeline.

The glycol/water mixture will be separated by boiling off the water in the glycol reboiler and the glycol will be recycled back to the gas chiller. The removed water will be sent to the vapor recovery compressors or to the water treatment system.

The heavy hydrocarbons (also called natural gas liquids (NGLs)), which were separated in the three-phase low temperature separator, will be sent to the NGL System to remove entrained methane, ethane, and propane, to the extent necessary to meet the specifications for NGLs to be injected into the crude oil stream. The methane, ethane, and propane will be used on-site as fuel gas to produce process heat with any excess blended into the sales gas stream as specifications allow. If no additional gas can be blended into the sales gas stream, the gas will be consumed using an existing dedicated process flare. The existing process flare was installed as part of the test well drilling activities and will be incorporated into the oil and gas processing facilities to serve the same function.

NGLs will be stored in on-site vessels and injected into the crude oil stream as necessary. Excess NGLs will be stored in a separate NGL storage vessel and transported from the Facility by truck. A maximum of approximately 150 bbl/day of NGLs could be produced.

Gas custody transfer equipment will be installed to odorize the gas, filter, meter, and regulate pressure. A shutdown valve will also be installed. The custody transfer facility will be monitored from the operations building and remotely by the Southern California Gas Company (SCGC).

2.3.2.4 Water Treatment Facilities

Water produced from the Three-Phase Separation System must be further cleaned before it can be re-injected into the oil reservoir. The water treatment facilities will remove oil and solids from the water that is generated as a byproduct of oil production (up to 94,000 bbl of water/day). All water produced as well as storm water (up to 26,000 bbl storm water/day) captured on-site will be treated and injected into the oil reservoir using the salt water injection wells. The water treatment facilities will consist of primary water treatment, secondary water treatment, and final water filtration.

Primary water treatment will remove the sand and oil droplets using four hydrocyclones – two for sand removal and two for oil removal. Secondary water treatment will treat the effluent water from the hydrocyclones by using Induced Gas Flootation (IGF) in two IGF vessels, which will reduce the total oil and grease to approximately 10 - 20 milligrams per liter (mg/l) and total suspended solids to 10 - 20 mg/l. Final water filtration will consist of nutshell filter vessels to further reduce the oil and grease concentration of the water if additional treatment is necessary to meet injection specifications.

A fixed-roof, gas-blanketed, 5,000-barrel water storage tank will be used as a surge tank between the water treatment system and the water injection pumps. The surge tank will allow for a consistent flow rate to be produced by the water injection pumps. Up to 119,500 bbl/day of water will be injected into the oil reservoir.

2.3.3 **Other Support Systems**

2.3.3.1 Slop Oil Systems

Oil-water emulsions from primary separation equipment (commonly referred to as "slops") will require further treatment to separate the oil from water. Slops (up to 500 bbl/day) that accumulate in the wet oil tank will be processed through a heat exchanger to heat the emulsion. The heated emulsion will be separated in two, vertical pressure vessels. The recovered oil will be transferred to the sales oil tank, water will be transferred to the slurry system or the secondary water treatment system, and gas will be incorporated into the vapor recovery system.

2.3.3.2 Slurry Injection System

Solids (up to approximately 250 bbl/day) generated during drilling operations and from wells during production may be re-injected into the oil reservoir via a dedicated slurry injection well. Alternatively, the solids generated may be collected in plastic lined bins and transported off-site to a licensed commercial disposal facility.

2.3.3.3 Electrical Substation

Electrical service for the Facility will be provided by Southern California Edison (SCE). The Facility will have a substation with electrical switch gear and step-down transformers to provide power for motor control centers, power and control conduits, motor operated valves, and heating, ventilation, air conditioning, and lighting for buildings. An uninterruptible power supply (UPS) and emergency generator will be installed for critical systems such as control systems, critical valves, lights, etc.

SCE will provide 25 megavolt-amperes (MVA) of power for the Facility. SCE will use the existing Jersey 66-16 kilovolt (kV) Substation, and three new 16 kV circuits.

2.3.3.4 Emergency Ground Flare

An emergency ground flare will be installed to combust gas that may be potentially released from pressure vessels during a process upset. The emergency ground flare will be a maximum of 60-feet tall.

2.3.4 **Pipeline Connections**

2.3.4.1 Crude Oil Pipeline

Crude oil will be transferred to the Phillips 66 Company (formerly known as ConocoPhillips) refinery or other local refineries via the existing 6-inch Crimson Pipeline. The proposed Project will install approximately 2,000 feet of 6-inch pipeline under Charles Willard Street to tie into the existing 6-inch Crimson Pipeline under South Central Avenue. An additional section of 6-inch pipeline will be installed at the corner of South Central Avenue and University Avenue to replace a section that was previously removed. A new section of 6-inch pipeline and a new valve box will be installed near the intersection of 223rd Street and Wilmington Avenue to tie the existing 6-inch Crimson Pipeline to the existing 10-inch Crimson East Crude Pipeline. The proposed project will also assess the existing 6-inch Crimson Pipeline to determine if additional repair or maintenance work may be required. Additional maintenance work may include short-term construction in localized areas. A "pigging" station will be installed at the Facility and a temporary pig receiver will be installed at the junction of the Crimson and Crimson East Crude Pipelines. Pigs are internal instrumented inspection tools used for pipeline data acquisition as well as line cleaning. Typically, there is a launcher at one end of the pipeline and a receiver at the other end of the pipeline. Figure 2-4 shows the locations of the proposed and existing crude oil pipelines.

2.3.4.2 Natural Gas Pipeline

A new 4- or 6-inch pipeline approximately 2,000 feet in length under Charles Willard Street will connect the Facility to the existing 30-inch SCGC Line 1014 under South Central Avenue to transfer natural gas from the proposed Project site (see Figure 2-4). The pipeline will operate at up to 200 psig and will carry odorized natural gas. Figure 2-4 shows the location of the proposed natural gas pipeline.

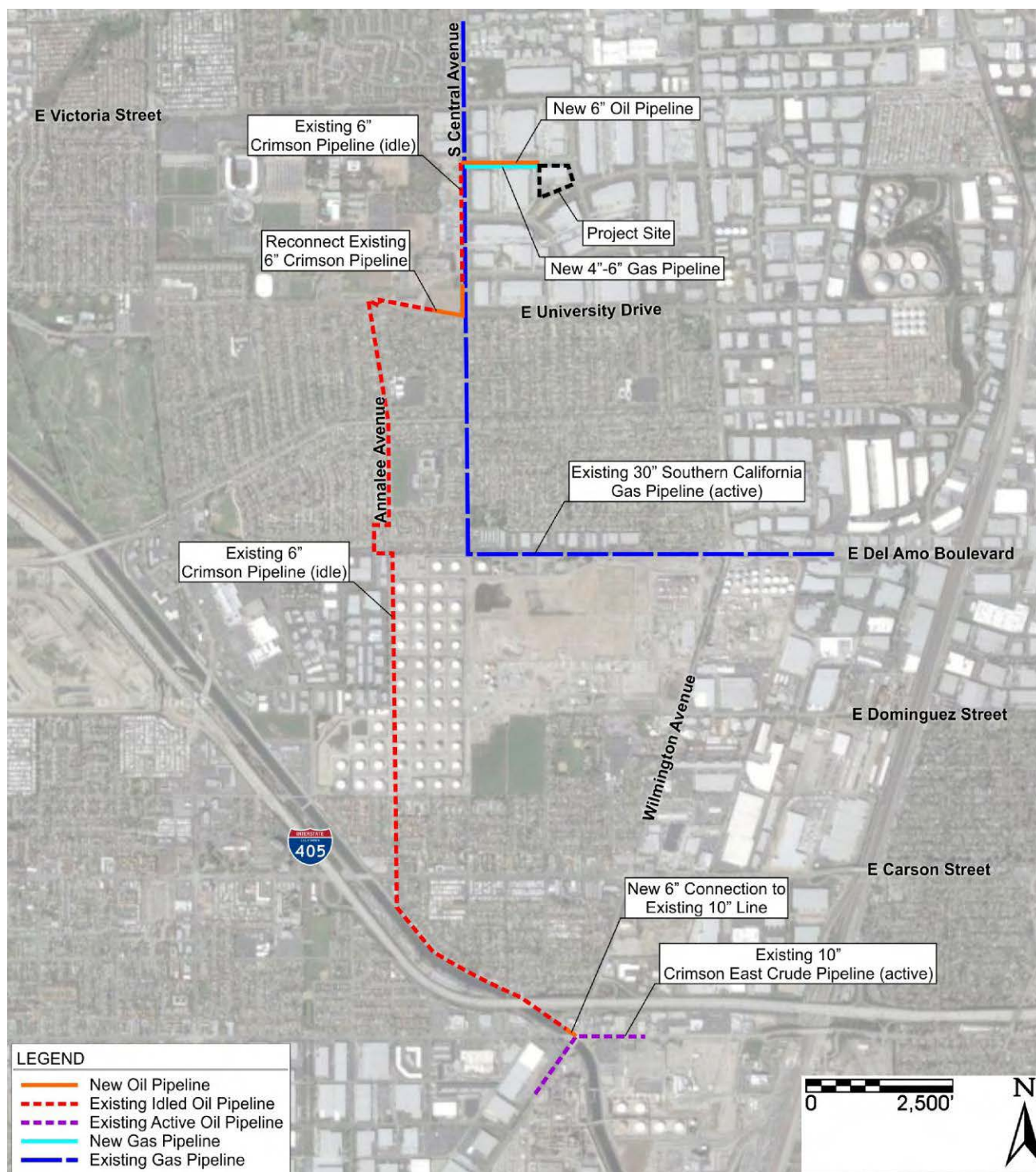
3.0 **POTENTIAL HAZARDS**

3.1 **Hazards Identification**

The potential hazards associated with the Oxy USA oil production facility are common to most oil production facilities worldwide, and are a function of the materials being processed, processing systems, procedures used for operating and maintaining the facility, and hazard detection and mitigation systems. The hazards that are likely to exist are identified by the physical and chemical properties of the materials being handled and the process conditions. For hydrocarbon fuel and petrochemical facilities, the common hazards are:

- toxic gas clouds (e.g., gas with hydrogen sulfide)
- torch fires (gas and liquefied gas releases)
- flash fires (liquefied gas releases)
- pool fires (flammable/combustible liquid releases)
- vapor cloud explosions (VCE) (gas and liquefied gas releases)
- BLEVEs (major failures of liquefied gas storage tanks)

Appendix E



The Oxy USA facility under evaluation was divided into three types of areas: process, storage, and transport. The hazards expected to be identified in each of the three areas are listed in Table 3-1.

Table 3-1
Summary of Hazards

Area Description	Type of Hazards Found in Area
Process Production 3-Phase Separation Oil Treatment Gas Compression Gas Treatment NGL Sales	Breach of liquid line or vessel resulting in: Pool fire Breach of flashing liquid line or vessel resulting in: Flash fire Pool fire Torch fire Vapor cloud explosion (VCE) Toxic cloud Breach of vapor line or vessel resulting in: Flash fire Torch fire VCE Toxic cloud
Atmospheric Storage Crude Oil Tanks	Breach of atmospheric storage tank resulting in: Tank fire
Pressurized Storage NGL Storage	Breach of pressure vessel resulting in: Flash fire Torch fire VCE BLEVE
Transport Gas Pipeline Oil Pipeline	Breach of liquid pipeline resulting in: Flash fire Pool fire Torch fire VCE Breach of vapor pipeline resulting in: Flash fire Torch fire VCE

When comparing a toxic hazard to a flammable or explosive hazard, the magnitude of the hazard's impact on humans must be identically defined. For instance, it would not be meaningful to compare human exposure to nonlethal overpressures (low overpressures which break windows) to human exposure to lethal fire radiation (34,500 Btu/(hr•ft²) for five seconds). Thus, in order to compare the hazards of toxic gases, fires, and explosions on humans, equivalent levels of hazard must be defined.

The endpoint hazard criterion defined in this study corresponds to a hazard level which might cause an injury. With this definition, the injury level must be defined for each type of hazard (toxic, radiant heat, or overpressure exposure). Fortunately, data exist which approximate an equivalent injury level for each of the hazards listed. Table 3-2 presents the endpoint hazard criteria used by federal agencies and national associations for this type of analysis.

Table 3-2
Consequence Analysis Hazard Levels
(Endpoint Criteria for Consequence Analysis)

Hazard Type	Injury Threshold		
	Exposure Duration	Hazard Level	Reference
Hydrogen sulfide inhalation	Up to 60 min	30 ppm	ERPG-2 [AIHA, 2007] 40 CFR 68 [EPA, 1996]
<i>n</i> -Butyl mercaptan	Up to 30 min	500 ppm	IDLH [NIOSH, 1995]
Radiant heat exposure	40 sec	1,600 Btu/(hr•ft ²) [†]	40 CFR 68 [EPA, 1996]
Explosion overpressure	Instantaneous	1.0 psig [‡]	40 CFR 68 [EPA, 1996]
Flash fires (fireballs)	40 sec	1,600 Btu/(hr•ft ²) [†]	40 CFR 68 [EPA, 1996]
Flash fires (flammable vapor clouds)	Instantaneous	LFL	40 CFR 68 [EPA, 1996]

ERPG-2. The maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair an individual's ability to take protective action.

IDLH. The maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 30 minutes without causing death or immediate or delayed permanent health effects or preventing escape from such an environment.

40 CFR 68. United States Environmental Protection Agency RMP endpoints.

[†] Corresponds to second-degree skin burns.

[‡] An overpressure of 1 psi may cause partial demolition of houses, which can result in serious injuries to people, and shattering of glass windows, which may cause skin laceration from flying glass.

3.2 Selection of Accidental Release Case Studies

3.2.1 Overview of Methodology

The purpose of the hazard case selection methodology is to define the maximum credible hazard scenario for each release that might result in an impact to the public. The methodology is developed in seven increments:

- Initial review of available documentation
- Detailed review of process flow diagrams (PFDs)
- Review of process material balances
- Review of available safety studies
- Development of hazard scenarios
- Screening of hazard scenarios via hazards analysis
- Final selection of hazard cases

3.2.2 Initial Review of Available Documentation

The analysis begins with a general review of the process. Any written description of the new or modified processes is studied to determine the physical and chemical transformations occurring and the general flow of

material in the unit. After the process features are known, process flow diagrams (PFDs) are reviewed and compared to the written descriptions.

3.2.3 Detailed Review of Process Flow Diagrams

The detailed review of the PFDs begins by tracing the major process flow lines. Once the major flows are identified, the material balances are reviewed for each major line to determine the exact nature of the material within the line or vessel.

Each of the major flow lines is taken individually and evaluated to determine the potential for producing a major hazard if a leak or rupture occurred. At this point in the analysis, a list of potential areas of concern is started; this list is continually refined and added to during the remaining analysis steps.

Several factors are involved in the initial selection of hazard areas:

- Flammability and/or toxic nature of the chemicals
- Potential for aerosol formation (releases of streams considerably above their atmospheric boiling point)
- Size of a line
- Normal flow rate in the line
- Severity of the process conditions

The factors described above are not weighted equally in the evaluation. The flammability and/or toxic nature, potential for aerosol formation, and process conditions are given more weight than other factors.

3.2.4 Review of Process Material Balances

Although the process material balances have been reviewed for each major process flow line, they are more thoroughly reviewed during this stage of the analysis to locate points in the process where toxic materials and/or materials sensitive to detonation are used.

A spreadsheet describing the material balances for the identified hazard locations is begun. The material balance gives the molar flows, the mass flows, and the mole fraction of each chemical. The stream temperature, pressure, and line size are also noted in the spreadsheet. As additional hazard areas are found, their stream summaries are added to the spreadsheet.

3.2.5 Review of Available Safety Studies

Available safety studies are reviewed to determine if all potential hazard areas have been adequately identified. Any potential hazards identified in these work products are added to the list of potential areas of concern that was started during the detailed review of the PFDs.

3.2.6 Development of Hazard Scenarios

The list of potential hazard areas developed in the preceding analysis stages is put into a spreadsheet. The spreadsheet contains the following information:

- Case number
- Description of the area where release originates (line, vessel, etc.)
- Stream number found on the PFDs

- Stream or vessel temperature
- Stream or vessel pressure
- Assessment of the physical state of the stream (gas, liquid, two-phase)
- Total volume of the vessel or the nearest vessel
- Liquid volume of the vessel or the nearest vessel
- Line size
- Normal flow rate of the line or vessel

3.2.7 Initial Screening via Hazard Zone Analysis

The hazard zones resulting from the worst-case releases of similar hazard scenarios are evaluated to determine the releases with a potential for public impact. When performing site-specific consequence analysis studies, the ability to accurately model the release, dilution, and dispersion of gases and aerosols is important if an accurate assessment of potential exposure is to be attained. For this reason, Quest uses a modeling package, CANARY by Quest[®], that contains a set of complex models that calculate release conditions, initial dilution of the vapor (dependent upon the release characteristics), and the subsequent dispersion of the vapor introduced into the atmosphere. The models contain algorithms that account for thermodynamics, mixture behavior, transient release rates, gas cloud density relative to air, initial velocity of the released gas, and heat transfer effects from the surrounding atmosphere and the substrate. The release and dispersion models contained in the QuestFOCUS package (the predecessor to CANARY by Quest[®]) were reviewed in a United States Environmental Protection Agency (EPA) sponsored study [TRC, 1991] and an American Petroleum Institute (API) study [Hanna, Strimaitis, and Chang, 1991]. In both studies, the QuestFOCUS software was evaluated on technical merit (appropriateness of models for specific applications) and on model predictions for specific releases. One conclusion drawn by both studies was that the dispersion software tended to overpredict the extent of the gas cloud travel, thus resulting in too large a cloud when compared to the test data (i.e., a conservative approach).

A study prepared for the Minerals Management Service [Chang, et al., 1998] reviewed models for use in modeling routine and accidental releases of flammable and toxic gases. CANARY by Quest[®] received the highest possible ranking in the science and credibility areas. In addition, the report recommends CANARY by Quest[®] for use when evaluating toxic and flammable gas releases. The specific models (e.g., SLAB) contained in the CANARY by Quest[®] software package have also been extensively reviewed.

For vapor cloud explosion calculations, Quest uses a model that is a variation of the Baker-Strehlow-Tang (BST) method. The Quest model for estimation of flame speeds (QMEFS) [Melton & Marx, 2008] is based on experimental data involving vapor cloud explosions, and is related to the amount of confinement and/or obstruction present in the volume occupied by the vapor cloud.

This model is based on the premise that the strength of the blast wave generated by a vapor cloud explosion (VCE) is dependent on the reactivity of the flammable gas involved; the presence (or absence) of structures such as walls or ceilings that partially confine the vapor cloud; and the spatial density of obstructions within the flammable cloud [Baker, et al., 1994, 1998], the average size of those obstacles, and the overall size of the vapor cloud [Mercx, 1994a, 1994b, 1997; Mercx, Van den Berg, & Van Dongen, 1996]. This model reflects the results of several international research programs on vapor cloud explosions, which show that the strength of the blast wave generated by a VCE increases as the degree of confinement and/or obstruction of the cloud increases. The following quotations illustrate this point.

“On the evidence of the trials performed at Maplin Sands, the deflagration [explosion] of truly unconfined flat clouds of natural gas or propane does not constitute a blast hazard.” [Hirst and Eyre, 1982] (Tests conducted by Shell Research Ltd., in the United Kingdom.)

“Both in two- and three-dimensional geometries, a continuous accelerating flame was observed in the presence of repeated obstacles. A positive feedback mechanism between the flame front and a disturbed flow field generated by the flame is responsible for this. The disturbances in the flow field mainly concern flow velocity gradients. Without repeated obstacles, the flame front velocities reached are low both in two-dimensional and three-dimensional geometry.” [van Wingerden and Zeeuwen, 1983] (Tests conducted by TNO in the Netherlands.)

“The current understanding of vapor cloud explosions involving natural gas is that combustion only of that part of the cloud which engulfs a severely congested region, formed by repeated obstacles, will contribute to the generation of pressure.” [Johnson, Sutton, and Wickens, 1991] (Tests conducted by British Gas in the United Kingdom.)

Researchers who have studied case histories of accidental vapor cloud explosions have reached similar conclusions.

“It is a necessary condition that obstacles or other forms of semi-confinement are present within the explosive region at the moment of ignition in order to generate an explosion.” [Wiekema, 1984]

“A common feature of vapor cloud explosions is that they have all involved ignition of vapor clouds, at least part of which have engulfed regions of repeated obstacles.” [Harris and Wickens, 1989]

The strength of the blast wave predicted by the QMEFS VCE model is directly related to the size of the obstructed or partially confined volume that is assumed to be filled with a flammable mixture of gas and air, and five additional parameters.

Fuel Reactivity: A fuel’s reactivity is characterized by its laminar flame speed. Because the QMEFS model is based on the BST model, flame speeds correlate to the BST categories of high, medium, and low. For example, ethylene, with a flame speed of approximately 76 cm/s was explicitly defined as a high reactivity fuel in the BST test series that defined that model. Most other fuels (propane, natural gas) have a flame speed between 40 and 45 cm/s, making them medium reactivity fuels.

Volume Blockage Ratio (VBR): The density of obstacles within the flammable cloud influences the peak overpressure due to the generation of turbulence along the flame front. VBR is defined as the fraction of a particular volume that is occupied by obstacles.

Number of Confining Planes: The number of confining planes affects the strength of an explosion, potentially limiting the expansion of the flame front. The number of planes can be any number from 0 to 6, but is typically limited to values of 1 (“3-D” flame expansion with ground reflection), 2 (“2-D” expansion, or what occurs between flat, parallel surfaces), or 1.5 (“2½-D”, for situations that begin as 2-D and quickly transition to 3-D, or have one confining plane that is semi-porous or frangible).

Flame Run-up Distance: This dimension is a descriptor for the maximum distance which a flame front can travel within the burning cloud. As this dimension increases, the peak overpressure increases to a limiting value. This distance is typically limited to the longest horizontal dimension of the congested area.

Average Obstacle Diameter: As the size of obstacles decreases, the turbulence generated in a burning cloud increases, increasing the peak overpressure that is produced. The default value, from the BST test series is 2 inches (0.0508 m).

Technical descriptions of the CANARY models used in this study are presented in Appendix A.

3.2.8 Final Selection of Hazard Cases

Using the hazard area spreadsheet, the material balance spreadsheet, and the initial screening hazard zone calculations, a final selection of hazard cases is made. These selections generally define the maximum extent of any credible potential hazard that could occur in the process being evaluated.

4.0 WORST-CASE CONSEQUENCE MODELING RESULTS

The results of the worst-case consequence modeling calculations for the existing and proposed processes are presented in this section. In addition, for several processes, the hazard zone which extends the greatest distance from the point of release is overlaid onto the local area in order to determine the possible public exposure to the defined hazard levels.

4.1 Releases Resulting in the Largest Downwind Hazard Zones

With the completion of the hazard identification and consequence modeling calculations described in Section 3 for both the existing pipelines and proposed pipelines and production facility, the releases which generate the largest hazard zones can be defined for the facility and associated pipelines. Table 4-1 lists the potential releases identified and Table 4-2 summarizes the maximum hazard zones for each identified release.

4.2 Description of Potential Hazard Zones

4.2.1 Toxic Vapor Clouds

H₂S and an odorant are the only toxic components in any of the processed hydrocarbon fluids in the facility. One possible result of release of a stream containing H₂S is a toxic vapor cloud. The hazard zone of a toxic vapor cloud containing H₂S is defined by the ERPG-2 concentration level (30 ppm H₂S). The highest concentration of H₂S in the facility is expected to be less than 10 ppm. Once released the concentration of H₂S will dilute to a lower concentration. Therefore, the 30 ppm H₂S concentration level cannot be reached by a release from a stream with no more than 10 ppm H₂S. Thus no H₂S toxic hazard zones exist at this facility.

One possible odorant is *n*-Butyl mercaptan. The Immediately Dangerous to Life or Health Concentrations (IDLH) for *n*-Butyl mercaptan is 500 ppm [NIOSH]. A toxic concentration of *n*-Butyl mercaptan could exist above a liquid spill on site, but does not have any potential to produce an impact outside the facility walls.

Table 4-1
Potential Accidents Resulting in Maximum Potential Hazard

Area	Status of Potential Hazard (E) Existing (P) Proposed	Description of Maximum Potential Release
Oil Storage	P	Oil storage tank top fire
Oil Pumps	P	Rupture of oil storage transfer pumps
Gas Compression	P	Rupture of gas compressor lines to pipeline
3-Phase Separation	P	Rupture of low temperature separator
NGL Storage	P	BLEVE of NGL storage tank
NGL Transfer	P	BLEVE of NGL transport truck
Oil Pigging Station	P	Rupture of crude oil pipeline pigging station
6-inch Oil Pipeline	P	Rupture of 6-inch crude oil pipeline
10-inch Oil Pipeline	E	Rupture of 10-inch crude oil pipeline
6-inch Gas Pipelines	P	Rupture of 6-inch natural gas pipeline
30-inch Gas Pipelines	E	Rupture of 30-inch natural gas pipeline

4.2.2 Flash Fires

Flash fires are the result of a release, formation of a flammable vapor cloud and ignition of the cloud. Flash fire hazard zones are defined by the maximum extent of the LFL portion of the vapor cloud. For example, a release from the 6-inch crude oil pipeline could result in a flash fire. Because the flash fire is the maximum hazard from this accident, the vulnerability corridor along the crude oil pipeline is defined by the extent of the flash fire. The hazard footprint and associated vulnerability corridor associated with this “worst case” event are illustrated in Figure 4-1. The vulnerability corridor (the light cross-hatching) depicts the potential area that could be affected along the pipeline route. This presentation is misleading since all locations within this corridor cannot be simultaneously exposed to potential flash fire hazard from any single accident. The hazard footprint (the heavy cross-hatching) presents the maximum potential flash fire hazard zone associated with a release from a single location along the crude oil pipeline. In addition, there are other possible hazard zones following a release from the pipeline that form smaller footprints. The scenario that creates the maximum hazard footprint is just one of the many possible outcomes found when considering variables such as hole size, orientation, wind speed, atmospheric stability, and wind direction. The hazard footprint in Figure 4-1 shows what would be expected if the pipe were to rupture, and the wind is blowing perpendicular to the pipeline, and the release is oriented at approximately 18E from horizontal to escape the crater, and the gas is ignited after reaching a maximum extent.

Table 4-2
Maximum Hazard Distances for Maximum Credible Events

Release Event	Status of Potential Hazard (E) Existing (P) Proposed	Maximum Distance (ft) from Center of Unit to			
		Flash Fire (LFL)	Explosion Overpressure (1.0 psig)	Pool/Torch Fire Thermal Radiation (1,600 Btu/(hr≡ft ²))	BLEVE (1,600 Btu/(hr≡ft ²))
Oil storage tank top fire	P	NA	NA	+	NA
Rupture of oil storage transfer pumps	P	-	-	+	NA
Rupture of gas compressor lines to pipeline	P	+	-	-	NA
Rupture of low temperature separator	P	+	-	-	NA
BLEVE of NGL storage tank	P	NA	NA	NA	880
BLEVE of NGL transport truck	P	NA	NA	NA	1,250
Rupture of crude oil pipeline pigging station	P	-	-	+	NA
Rupture of 6" crude oil pipeline	P	205	*	75	NA
Rupture of 10" crude oil pipeline	E	205	*	75	NA
Rupture of 6" natural gas pipeline	P	10	*	185	NA
Rupture of 30" natural gas pipeline	E	50	*	800	NA

Does not extend beyond facility boundary

Not the maximum hazard

Hazard not applicable to release event

Does not reach the 1 psig overpressure level

+

-

NA

*

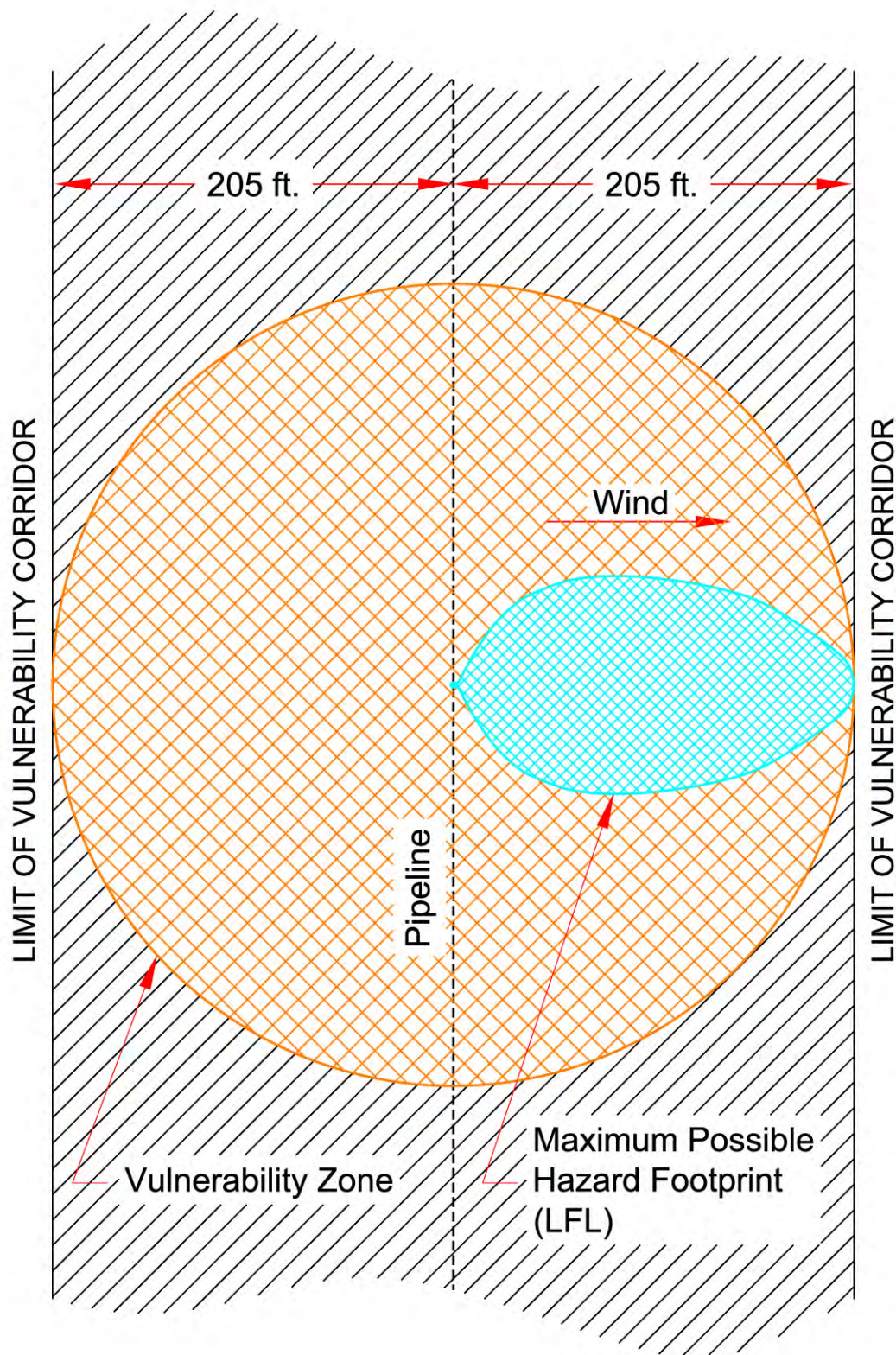


Figure 4-1
Oil Pipeline Hazard Corridor

4.2.3 Vapor Cloud Explosions

One of the possible results of a flammable fluid or gas release is the potential ignition of the vapor which could then result in a VCE. The resulting hazard from a VCE is an overpressure. An example of an event tree for flammable fluid release, showing the sequence of events which could lead to a VCE is presented in Figure 4-2.

All of the accidents resulted in an overpressure less than 1 psig outside of the facility walls. As an example, a release from the crude oil pipeline will result in a maximum overpressure of 0.38 psig. Therefore the 1 psig overpressure hazard zone does not exist outside the facility walls.

4.2.4 Fire Radiation

Fire radiation hazards exist for accidental releases resulting in pool fires, torch fires, and/or BLEVEs. The largest fire radiation hazard following a worst-case release is from a BLEVE fireball. Fire radiation hazards are also a result of torch fires or pool fires. Unlike the dispersion calculations, the worst-case atmospheric conditions for torch and pool fire radiation calculations occur when the winds are high, allowing the flame to “bend” downwind.

The maximum hazard extent from a BLEVE results from a catastrophic failure of a tank truck in the NGL loading area. Besides BLEVEs, radiation hazards were calculated for torch and pool fires. The project calls for the construction of a 6-inch crude oil pipeline which has the potential for a pool fire. The pipeline will transport crude oil from the facility to the existing 10-inch Crimson pipeline. The radiant vulnerability zone from the largest pool fire following a rupture of the 6-inch crude oil pipeline extends 75 feet.

Appendix E

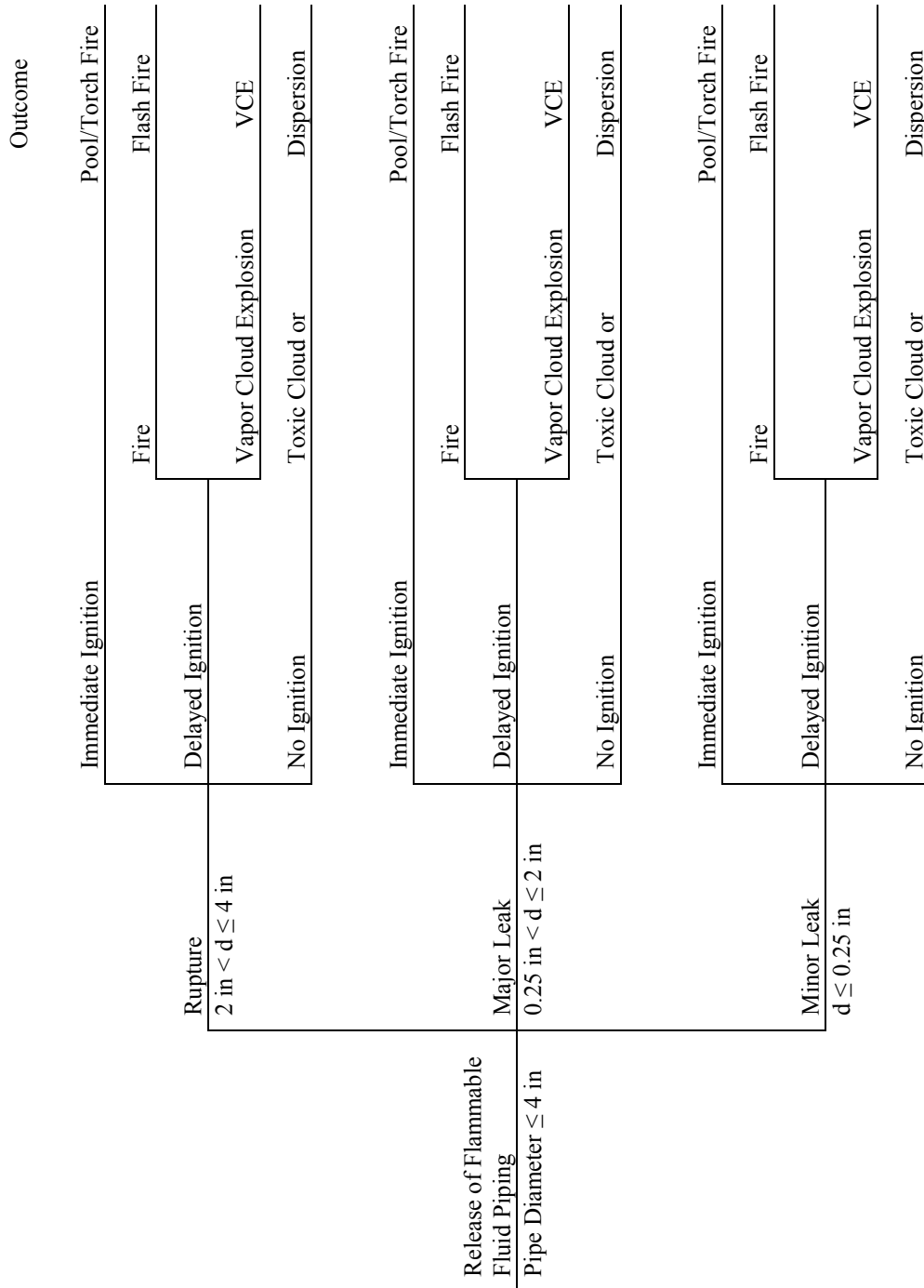


Figure 4-2
Event Tree for a Flammable/Toxic Release

4.3 Summary of Maximum Hazard Zones

Table 4-2 presents a listing of the type and size of potential hazards which dominate each of the units/areas evaluated. Note that for each process or pipeline, the status is defined as E or P (existing or proposed). The largest hazards are listed for releases from the existing pipelines, and the proposed pipelines and facility. The hazard zones for the existing pipelines are presented in Figure 4-3. The hazard zones for the proposed facility and proposed pipeline routes are presented in Figures 4-4 and 4-5.

Most of the potential hazards are new because the facility and associated pipelines are new. The proposed pipelines increase the potential hazard zones only when they are located outside the existing 30-inch gas pipeline corridor. The largest potential hazard zone resulting from a proposed pipeline is a potential flash fire extending 205 feet due to a rupture of the 6-inch crude oil pipeline. The potential hazard zones from releases originating inside the facility are dominated by potential hazards from the NGL storage and truck transfer areas. The largest potential hazard zone within the NGL storage and transfer area is a BLEVE fireball resulting in 1,600 Btu/(hr•ft²) extending 1,250 feet.

5.0 CONCLUSIONS

The primary conclusion that can be drawn from the worst-case consequence modeling results is that for most potential releases, the proposed additions result in similar or smaller potential hazard zones than those posed by the existing pipeline configuration, in the locations near existing pipelines. Outside of the current pipeline hazard zone, the proposed additions result in an increased potential hazard compared to those posed by the existing pipeline configuration.

With the maximum hazard zones defined for each release evaluated under pre- or post-project configurations, the areas and pipelines can be divided into four categories, dependent on their potential to impact the public. The categories are defined as:

- Areas with no potential off-site impacts (hazard zones are contained onsite within the facility walls).
 - Oil Storage
 - Oil Pumps
 - Gas Compression
 - 3-Phase Separation
 - Oil Pigging Station (launcher)
- Areas with potential off-site impacts, but no public residential exposure under pre- or post-project configuration (hazard levels extend offsite, but census data indicate no public residential exposure).
 - NGL Storage
 - NGL Transfer
- Areas with potential off-site impacts and potential public residential exposure to defined hazard levels, but project modified impacts are similar to existing impacts.
 - 10-inch Oil Pipeline
 - 30-inch Natural Gas Pipeline
- Areas with potential off-site impacts and potential public residential exposure to defined hazard levels. Post-project impacts are larger than existing impacts.
 - 6-inch Oil Pipeline
 - 6-inch Natural Gas Pipeline

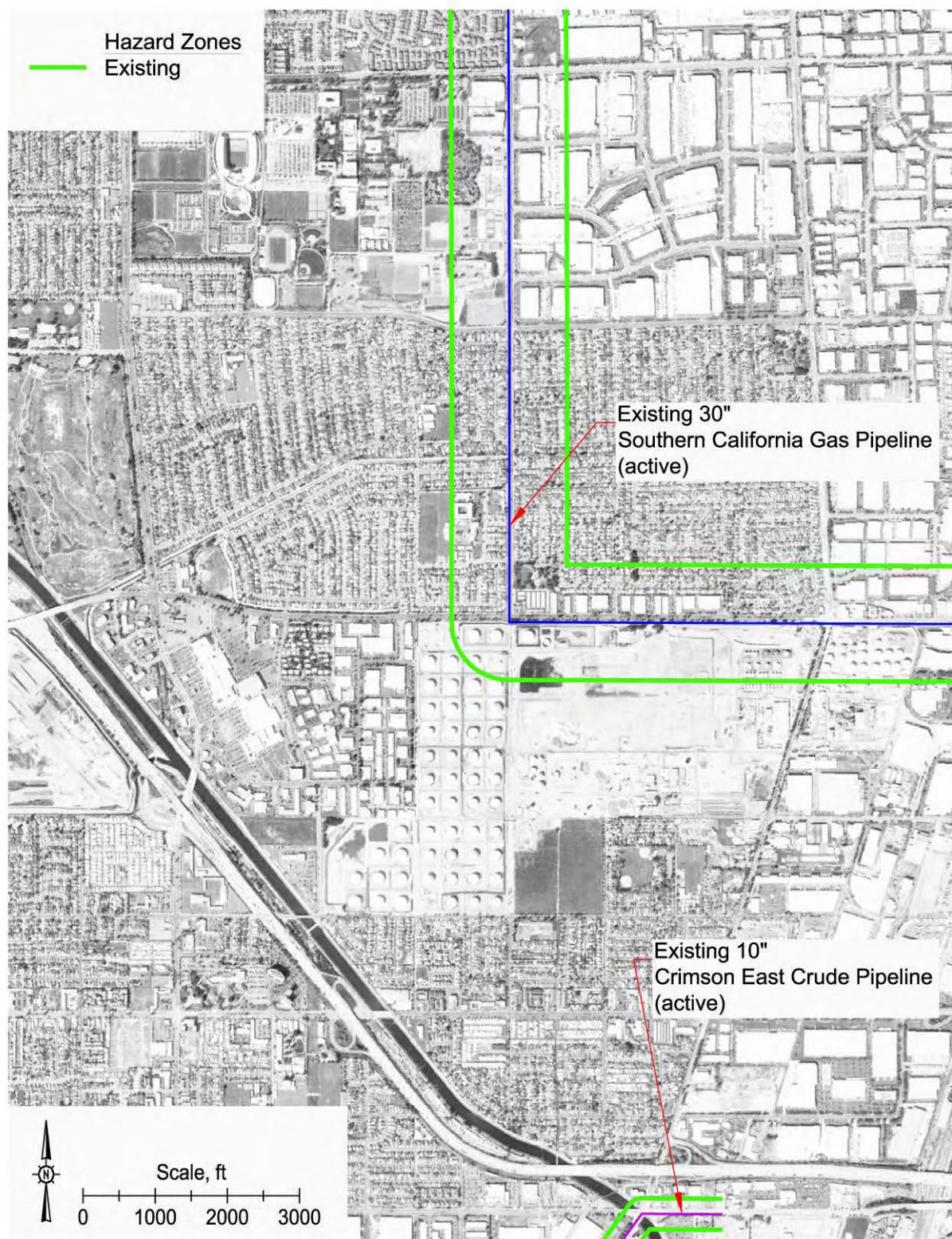


Figure 4-3
Existing Hazard Zones

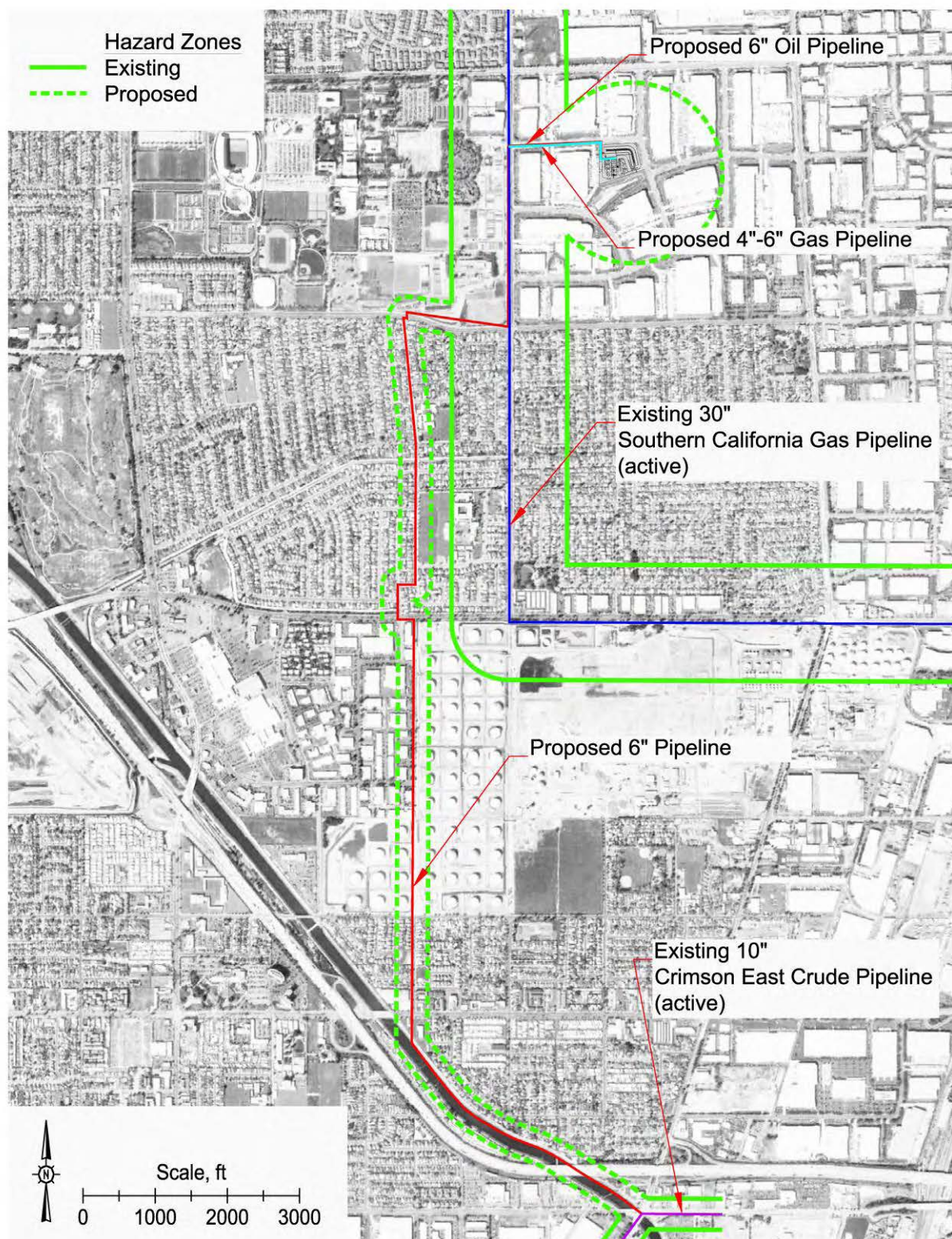


Figure 4-4
Proposed Facility and Pipeline Hazard Zones



Figure 4-5
Large Scale Map of Proposed Facility and Pipeline Hazard Zones

These conclusions are driven by the nature of the proposed Oxy USA, Inc. production facility. The consequences are driven by the process conditions at the time of release. The proposed Oxy USA, Inc. production facility is not expected to significantly change those conditions. Thus, for the purposes of this study, using the hazard endpoints developed by the U.S. EPA, the off-site hazard increases associated with the proposed project are limited to adjacent residential areas near the proposed 6-inch oil pipeline and industrial areas near the facility.

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7.0 GLOSSARY

The following definitions are intended to apply to Consequence Analysis and Quantitative Risk Analysis studies of facilities that produce, process, store, or transport hazardous materials. Due to the limited scope of such studies, some of these definitions are more narrow than the common definitions.

ACCIDENT. An unplanned event that interrupts the normal progress of an activity and has undesirable consequences, and is preceded by an unsafe act and/or an unsafe condition.

ACCIDENT EVENT SEQUENCE. A specific series of unplanned events that has specific undesirable consequences (e.g., a pipe ruptures, allowing flammable gas to escape, the gas forms a flammable vapor cloud that ignites after some delay, resulting in a flash fire).

ACCIDENT SCENARIO. The detailed description of an accident event sequence.

AIR DISPERSION MODELING. The use of mathematical equations (models) to predict the rate at which vapors or gases released into the air will be diluted (dispersed) by the air. The purpose of air dispersion modeling is to predict the extent of potentially toxic or flammable gas concentrations, in air, by calculating the change in concentration of the vapor or gas in the air as a function of distance from the source of the vapor or gas.

BLAST WAVE. An atmospheric pressure pulse created by an explosion.

BLEVE (Boiling LiquidBExpanding Vapor Explosion). The sudden, catastrophic failure of a pressure vessel at a time when its liquid contents are well superheated. (BLEVE is normally associated with the rupture, due to fire impingement, of pressure vessels containing liquefied gases.)

CONSEQUENCES. The expected results of an incident outcome.

CONSEQUENCE ANALYSIS. Selection and definition of specific accident event sequences, coupled with consequence modeling.

CONSEQUENCE ANALYSIS. Evaluation of the adverse effects that are predicted as a result of a hazardous event. It is a quantitative measure of short-term impact; it is not a measure of the long-term result (e.g., health effects, economic loss).

CONSEQUENCE MODELING. The use of mathematical models to predict the potential extent of specific hazard zones or effect zones that would result from specific accident event sequences.

DEFLAGRATION. See explosion.

DETONATION. See explosion.

EFFECT ZONE. The area over which the airborne gas concentration, radiant heat flux, or blast wave overpressure is predicted to equal or exceed some specified value. In contrast to a hazard zone, the endpoint for an effect zone need not be capable of producing injuries or damage.

ENDPOINT. The specified value of airborne gas concentration, radiant heat flux, or blast wave overpressure used to define the outer boundary of an effect zone or hazard zone. Endpoints typically correspond to specific levels of concern (e.g., IDLH, LFL, onset of fatality, 50% mortality, odor threshold, etc.).

EVENT TREE. A diagram that illustrates accident event sequences. It begins with an initiating event (e.g., a release of hydrogen sulfide gas), passes through one or more intermediate events (e.g., ignition or no ignition), resulting in two or more incident outcomes (e.g., flash fire or toxic vapor cloud).

EXPLOSION. A rapid release of energy, resulting in production of a blast wave. There are two common types of explosions: physical explosions (sudden releases of gas or liquefied gas from pressurized containers) and chemical explosions (rapid chemical reactions, including rapid combustion). Chemical explosions can be further subdivided into deflagrations and detonations. In a deflagration, the velocity of the blast wave is lower than the speed of sound in the reactants. In a detonation, the velocity of the blast wave exceeds the speed of sound in the reactants. For a given mass of identical reactants, a detonation is capable of producing more damage than a deflagration. Solid and liquid explosives, such as dynamite and nitroglycerine, typically detonate, whereas vapor cloud explosions are nearly always deflagrations.

FIRE RADIATION. See thermal radiation.

FLAMMABLE VAPOR CLOUD. A vapor cloud consisting of flammable gas and air, within which the gas concentration equals or exceeds its lower flammable limit.

FLASH FIRE. Transient combustion of a flammable vapor cloud.

HAZARD. A chemical or physical condition that presents a potential for causing injuries or illness to people, damage to property, or damage to the environment.

HAZARD ZONE. The area over which a given incident outcome is capable of producing undesirable consequences (e.g., skin burns) that are equal to or greater than some specified injury or damage level (e.g., second-degree skin burns). (Sometimes referred to as a hazard footprint.)

INCIDENT OUTCOME. The result of an accident event sequence. The incident outcomes of interest in a typical study are toxic vapor clouds; fires (flash fire, torch fire, pool fire, or fireball); and explosions (confined, unconfined, or physical).

LOWER FLAMMABLE LIMIT. The lowest concentration of flammable gas in air that will support flame propagation.

POOL FIRE. Continuous combustion of the flammable gas emanating from a pool of liquid.

RISK. A measure of economic loss or human injury in terms of both the incident likelihood and the magnitude of the loss or injury.

SUPERHEATED LIQUID. A liquid at a temperature greater than its atmospheric pressure boiling point.

THERMAL RADIATION. The transfer of heat by electromagnetic waves. This is how heat is transferred from flames to an object or person not in contact with or immediately adjacent to the flames. This is also how heat is transferred from the sun to the earth.

TORCH FIRE. Continuous combustion of a flammable fluid that is being released with considerable momentum.

TOXIC. Describes a material with median lethal doses and/or median lethal concentrations.

TOXIC VAPOR CLOUD. A vapor cloud consisting of toxic gas and air, within which the gas concentration equals or exceeds a concentration that could be harmful to humans exposed for a specific time.

VAPOR CLOUD. A volume of gas/air mixture within which the gas concentration equals or exceeds some specified or defined concentration limit.

VAPOR CLOUD EXPLOSION. Extremely rapid combustion of a flammable vapor cloud, resulting in a blast wave.

VULNERABILITY ZONE. The area within the circle created by rotating a hazard zone around its point of origin. Any point within that circle could, under some set of circumstances, be exposed to a hazard level that equals or exceeds the endpoint used to define the hazard zone. However, except for accidents that produce circular hazard zones (e.g., BLEVEs and confined explosions), only a portion of the area within the vulnerability zone can be affected by a single accident.

APPENDIX A

CANARY BY QUEST[®] MODEL DESCRIPTIONS

The following model descriptions are taken from the CANARY by Quest User Manual.

Section A	Engineering Properties
Section B	Pool Fire Radiation Model
Section C	Torch Fire and Flare Radiation Model
Section D	Fireball Model
Section E	Fluid Release Model
Section F	Momentum Jet Dispersion Model
Section G	Heavy Gas Dispersion Model
Section I	Vapor Cloud Explosion Model

Engineering Properties

Purpose

The purpose of this model is to provide an accurate means of computing physical and thermodynamic properties of a wide range of chemical mixtures and pure components using a minimum of initial information.

Required Data

- (a) Fluid composition
- (b) Temperature and pressure of the fluid prior to release

Methodology

Basic thermodynamic properties are computed using the Peng-Robinson equation of state [Peng and Robinson, 1976]. The necessary physical and thermodynamic properties are calculated in the following manner.

Step 1: The temperature and pressure of the fluid at storage conditions and the identity and mole fraction of each component of the fluid are obtained. Mixture parameters are determined using data from the extensive properties data base within CANARY.

Step 2: Each calculation begins with the computation of the vapor and liquid fluid composition. For cases where the temperature and pressure result in only one phase being present, the vapor or liquid composition will be the same as the initial feed composition. The composition calculation is an iterative procedure using a modification of the techniques described by Starling [1973].

Step 3: Once the vapor and liquid compositions are known, the vapor and liquid densities, enthalpies, entropies, and heat capacities can be computed directly. Other physical properties (viscosity, thermal conductivity, surface tension, etc.) are computed using correlations developed in Reid, Prausnitz, and Poling [1987].

Step 4: A matrix of properties is computed over a range of temperatures and pressures. Physical and thermodynamics properties required by other models within CANARY are then interpolated from this table.

Basic Thermodynamic Equations

$$Z^3 - (1 - B) \cdot Z^2 + (A - 3 \cdot B^2 - 2 \cdot B) \cdot Z - (A \cdot B - B^2 - B^3) = 0 \quad (1)$$

where: Z = fluid compressibility factor, $\frac{P \cdot V}{R \cdot T}$, dimensionless

P = system pressure, kPa

V = fluid specific volume, m³/kmol

R = gas constant, $8.314 \text{ m}^3 \cdot \text{kPa}/(\text{kmol} \cdot \text{K})$

T = absolute temperature, K

$$A = \frac{a \cdot P}{R^2 \cdot T^2}$$

$$a = 0.45724 \cdot \frac{R^2 \cdot T_c^2}{P_c} \cdot \alpha$$

$$\alpha = \left[1 + m \cdot (1 - T_r^{0.5})^2 \right]$$

$$m = 0.37464 + 1.54226 \cdot \omega - 0.26992 \cdot \omega^2$$

ω = acentric factor

$$T_r = \frac{T}{T_c}$$

T_c = pseudo-critical temperature, K

P_c = pseudo-critical pressure, kPa

$$B = \frac{b \cdot P}{R \cdot T}$$

$$b = 0.0778 \cdot R \cdot \frac{T_c}{P_c}$$

$$H = H^o + \frac{P}{\rho} - R \cdot T + \int_0^P \left[P - T \cdot \left(\frac{\partial P}{\partial T} \right)_\rho \right] \cdot \left(\frac{d\rho}{\rho^2} \right) \quad (2)$$

where: H = enthalpy of fluid at system conditions, kJ/kg

H^o = enthalpy of ideal gas at system temperature, kJ/kg

$$S = S^o - R \cdot \ln(\rho \cdot R \cdot T) + \int_0^P \left[\rho \cdot R - \left(\frac{\partial P}{\partial T} \right)_\rho \right] \cdot \left(\frac{d\rho}{\rho^2} \right) \quad (3)$$

where: S = entropy of fluid at system conditions, kJ/(kg · K)

S^o = entropy of ideal gas at system temperature, kJ/(kg · K)

$$R \cdot T \cdot \ln \left(\frac{f_i}{f_i^o} \right) = \left[(H_i - H_i^o) - T \cdot (S_i - S_i^o) \right] \quad (4)$$

where: f_i = fugacity of component i , kPa

f_i^o = standard state reference fugacity, kPa

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Starling, K. E., *Fluid Thermodynamic Properties for Light Petroleum Systems*. Gulf Publishing Company, Houston, Texas, 1973.

Pool Fire Radiation Model

Purpose

The purpose of this model is to predict the impact of fire radiation emitted by flames that are fueled by vapors emanating from liquid pools. Specifically, the model predicts the maximum radiant heat flux incident upon a target as a function of distance between the target and the flame.

Required Data

- (a) Composition of the liquid in the pool
- (b) Temperature of the liquid in the pool
- (c) Wind speed
- (d) Air temperature
- (e) Relative humidity
- (f) Elevation of the target (relative to grade)
- (g) Elevation of the pool (relative to grade)
- (h) Dimensions of the free surface of the pool
- (i) Orientation of the pool (relative to the wind direction)
- (j) Spill surface (land or water)

Methodology

Step 1: The geometric shape of the flame is defined. The flame column above a circular pool, square pool, or rectangular pool is modeled as an elliptical cylinder.

Step 2: The dimensions of the flame column are determined. The dimensions of the base of the flame are defined by the pool dimensions. An empirical correlation developed by Thomas [1965] is used to calculate the length (height) of the flame.

$$L = 42 \cdot D_h \cdot \left(\frac{\dot{m}}{\rho_a \cdot (g \cdot D_h)^{0.5}} \right)^{0.61}$$

where: L = length (height) of the flame, m
 D_h = hydraulic diameter of the liquid pool, m
 $\dot{m}$ = mass burning flux, kg/(m²•s)
 ρ_a = density of air, kg/m³
 g = gravitational acceleration, 9.8 m/s²

Notes: Mass burning fluxes used in the Thomas equation are the steady-state rates for pools on land (soil, concrete, etc.) or water, whichever is specified by the user.

For pool fires with hydraulic diameters greater than 100 m, the flame length, L , is set equal to the length calculated for $D_h = 100$ m.

Step 3: The angle (Φ) to which the flame is bent from vertical by the wind is calculated using an empirical correlation developed by Welker and Sliepcevich [1970].

$$\frac{\tan(\Phi)}{\cos(\Phi)} = 3.2 \cdot \left(\frac{D_h \cdot u \cdot \rho_a}{\mu_a} \right)^{0.07} \cdot \left(\frac{u^2}{g \cdot D_h} \right)^{0.7} \cdot \left(\frac{\rho_v}{\rho_a} \right)^{-0.6}$$

where: Φ = angle the flame tilts from vertical, degrees

u = wind speed, m/s

μ_a = viscosity of air, kg/(m • s)

ρ_v = density of fuel vapor, kg/m³

Step 4: The increase in the downwind dimension of the base of the flame (flame drag) is calculated using a generalized form of the empirical correlation Moorhouse [1982] developed for large circular pool fires.

$$D_w = 1.5 \cdot D_x \cdot \left(\frac{u^2}{g \cdot D_x} \right)^{0.069}$$

where: D_w = downwind dimension of base of tilted flame, m

D_x = downwind dimension of the pool, m

Step 5: The flame is divided into two zones: a clear zone in which the flame is not obscured by smoke; and a smoky zone in which a fraction of the flame surface is obscured by smoke. The length of the clear zone is calculated by the following equation, which is based on an empirical correlation developed by Pritchard and Binding [1992].

$$L_c = 55.05 \cdot D_h^{-0.6} \cdot \left(\frac{\dot{m}}{\rho_a} \right)^{1.13} \cdot (u+1)^{0.179} \cdot \left(\frac{C}{H} \right)^{-2.49}$$

where: L_c = length of the clear zone, m

$\frac{C}{H}$ = carbon/hydrogen ratio of fuel, dimensionless

Step 6: The surface flux of the clear zone is calculated using the following equation.

$$q_{cz} = q_{sm} \cdot (1 - e^{-b \cdot D_h})$$

where: q_{cz} = surface flux of the clear zone, kW/m²

q_{sm} = maximum surface flux, kW/m²

b = extinction coefficient, m⁻¹

Average surface flux of the smoky zone, q_{sz} , is then calculated, based on the following assumptions.

- The smoky zone consists of clean-burning areas and areas in which the flame is obscured by smoke.
- Within the smoky zone, the fraction of the flame surface that is obscured by smoke is a function of the fuel properties and pool diameter.
- Smoky areas within the smoky zone have a surface flux of 20 kW/m² [Hagglund and Persson, 1976].
- Clean-burning areas of the smoky zone have the same surface flux as the clean-burning zone.
- The average surface flux of the smoky zone is the area-weighted average of the surface fluxes for the smoky areas and the clean-burning areas within the smoky zone.

(This two-zone concept is based on the Health and Safety Executive POOLFIRE6 model, as described by Rew and Hulbert [1996].)

Step 7: The surface of the flame is divided into numerous differential areas. The following equation is then used to calculate the view factor from a differential target, at a specific location outside the flame, to each differential area on the surface of the flame.

$$F_{dA_t \rightarrow dA_f} = \frac{\cos(\beta_t) \cdot \cos(\beta_f)}{\pi \cdot r^2} \cdot dA_f \quad \text{for } [\beta_t] \text{ and } [\beta_f] < 90^\circ$$

where: $F_{dA_t \rightarrow dA_f}$ = view factor from a differential area on the target to a differential area on the surface of the flame, dimensionless

dA_f = differential area on the flame surface, m²

dA_t = differential area on the target surface, m²

r = distance between differential areas dA_t and dA_f , m

β_t = angle between normal to dA_t and the line from dA_t to dA_f , degrees

β_f = angle between normal to dA_f , and the line from dA_t to dA_f , degrees

Step 8: The radiant heat flux incident upon the target is computed by multiplying the view factor for each differential area on the flame by the appropriate surface flux (q_{cz} or q_{sz}) and by the appropriate atmospheric transmittance, then summing these values over the surface of the flame.

$$q_{ai} = \sum_{A_f} q_{sf} \cdot F_{dA_t \rightarrow dA_f} \cdot \tau$$

where: q_{ai} = attenuated radiant heat flux incident upon the target due to radiant heat emitted by the flame, kW/m²

A_f = area of the surface of the flame

q_{sf} = radiant heat flux emitted by the surface of the flame, kW/m² (q_{sf} equals either q_{cz} or q_{sz} , as appropriate)

τ = atmospheric transmittance, dimensionless

Atmospheric transmittance, τ , is a function of absolute humidity and r , the path length between differential areas on the flame and target [Wayne, 1991].

Step 9: Steps 7 and 8 are repeated for numerous target locations.

Validation

Several of the equations used in the Pool Fire Radiation Model are empirical relationships based on data from medium- to large-scale experiments, which ensures reasonably good agreement between model predictions and experimental data for variables such as flame length and tilt angle. Comparisons of experimental data and model predictions for incident heat flux at specific locations are more meaningful and of greater interest. Unfortunately, few reports on medium- or large-scale experiments contain the level of detail required to make such comparisons.

One source of detailed test data is a report by Welker and Cavin [1982]. It contains data from sixty-one pool fire tests involving commercial propane. Variables that were examined during these tests include pool size (2.7 to 152 m²) and wind speed. Figure B-1 compares the predicted values of incident heat flux with experimental data from the sixty-one pool fire tests.

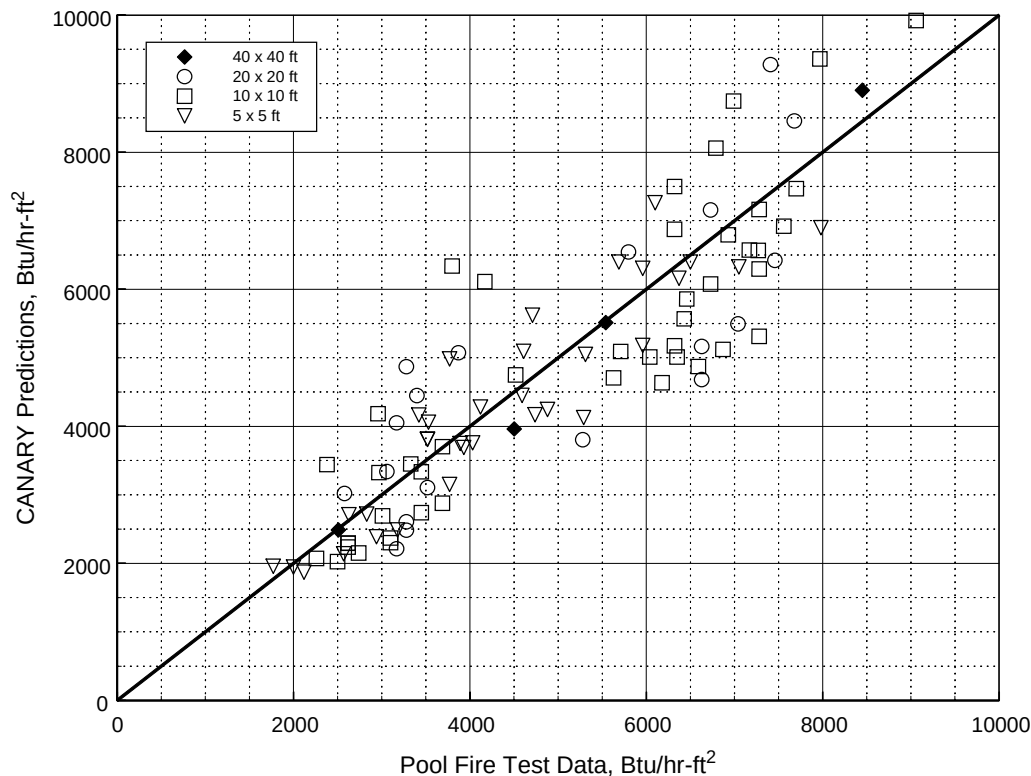


Figure B-1

In another series of tests, fire radiation measurements were taken for large liquefied natural gas (LNG) pool fires. The Montoir tests are the largest tests of LNG fires, involving pools up to 35 meters in diameter [Nédelka, Moorhouse, and Tucker, 1989]. Figure B-2 compares the radiation isopleths predicted by CANARY with the actual measurements taken in Test 2 of the Montoir series.

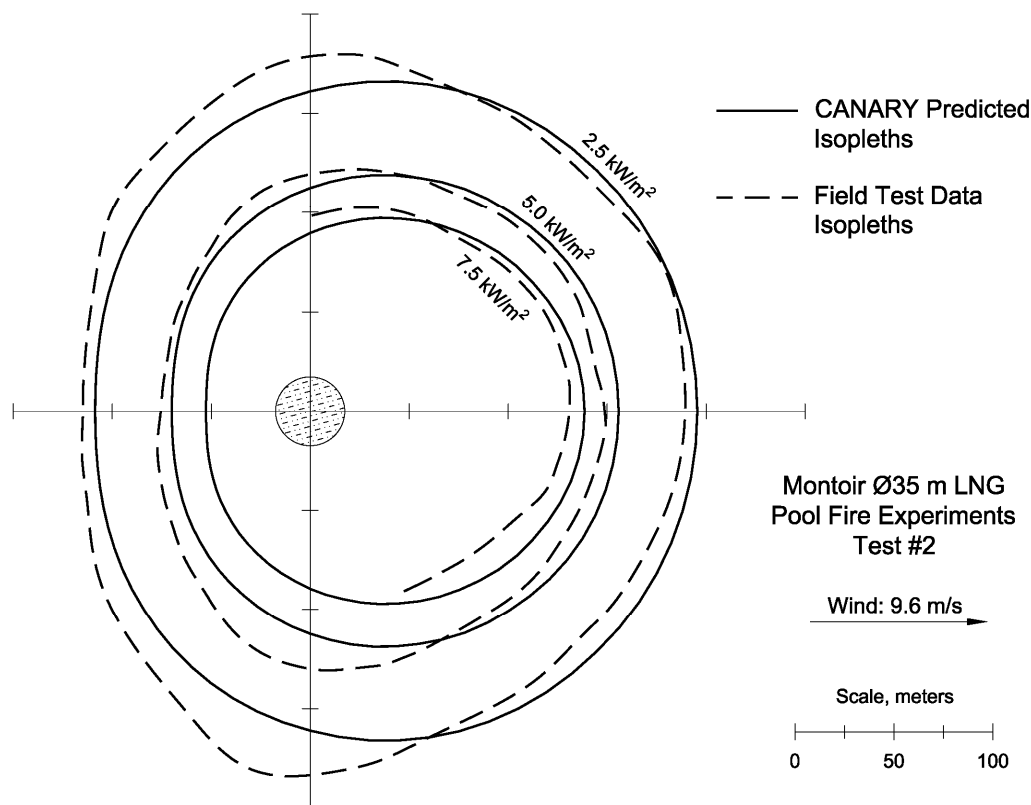


Figure B-2

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Welker, J. R., and C. M. Sliepceвич, *Susceptibility of Potential Target Components to Defeat by Thermal Action*. University of Oklahoma Research Institute, Report No. OURI-1578-FR, Norman, Oklahoma, 1970.

Torch Fire and Flare Radiation Model

Purpose

The purpose of this model is to predict the impact of fire radiation emitted by burning jets of vapor. Specifically, the model predicts the maximum radiant heat flux incident upon a target as a function of distance between the target and the point of release.

Required Data

- (a) Composition of the released material
- (b) Temperature and pressure of the material before release
- (c) Mass flow rate of the material being released
- (d) Diameter of the exit hole
- (e) Wind speed
- (f) Air temperature
- (g) Relative humidity
- (h) Elevation of the target (relative to grade)
- (i) Elevation of the point of release (relative to grade)
- (j) Angle of the release (relative to horizontal)

Methodology

Step 1: A correlation based on a Momentum Jet Model is used to determine the length of the flame. This correlation accounts for the effects of:

- composition of the released material,
- diameter of the exit hole,
- release rate,
- release velocity, and
- wind speed.

Step 2: To determine the behavior of the flame, the model uses a momentum-based approach that considers increasing plume buoyancy along the flame and the bending force of the wind. The following equations are used to determine the path of the centerline of the flame [Cook, et al., 1987].

$$\Phi_X = (\rho_{ja})^{0.5} \cdot \bar{u} \cdot \sin(\theta) \cdot \cos(\varphi) + (\rho_{\infty})^{0.5} \cdot u_{\infty} \quad (\text{downwind})$$

$$\Phi_Y = (\rho_{ja})^{0.5} \cdot \bar{u} \cdot \sin(\theta) \cdot \sin(\varphi) \quad (\text{crosswind})$$

$$\Phi_Z = (\rho_{ja})^{0.5} \cdot \bar{u} \cdot \cos(\theta) + (\rho_{\infty})^{0.5} \cdot u_b \cdot \frac{(i+1)}{n} \quad (\text{vertical})$$

where: Φ_{XYZ} = momentum flux in X, Y, Z direction

ρ_{ja} = density of the jet fluid at ambient conditions, kg/m³

$\bar{u}$	= average axial velocity of the flame, m/s
θ	= release angle in $X-Z$ plane (relative to horizontal), degrees
φ	= release angle in $X-Y$ plane (relative to downwind), degrees
ρ_{∞}	= density of air, kg/m ³
u_{∞}	= wind speed, m/s
ρ_b	= density of combustion products, kg/m ³
u_b	= buoyancy velocity, m/s
n	= number of points taken along the flame length

These correlations were developed to predict the path of a torch flame when released at various orientations. The model currently does not allow a release angle in a crosswind direction; the release angle is confined to the downwind/vertical plane (i.e., $\varphi = 0$).

Step 3: The angle of flame tilt is defined as the inclination of a straight line between the point of release and the end point of the flame centerline path (as determined in Step 2).

Step 4: The geometric shape of the flame is defined as a frustum of a cone (as suggested by several flare/fire researchers [e.g., Kalghatgi, 1983, Chamberlain, 1987]), but modified by adding a hemisphere to the large end of the frustum. The small end of the frustum is positioned at the point of release, and the centerline of the frustum is inclined at the angle determined in Step 3.

Step 5: The surface emissive power is determined from the molecular weight and heat of combustion of the burning material, the release rate and velocity, and the surface area of the flame.

Step 6: The surface of the flame is divided into numerous differential areas. The following equation is then used to calculate the view factor from a differential target, at a specific location outside the flame, to each differential area on the surface of the flame.

$$F_{dA_t \rightarrow dA_f} = \frac{\cos(\beta_t) \cdot \cos(\beta_f)}{\pi \cdot r^2} \cdot dA_f \quad \text{for } [\beta_t] \text{ and } [\beta_f] < 90^\circ$$

where: $F_{dA_t \rightarrow dA_f}$ = view factor from a differential area on the target to a differential area on the surface of the flame, dimensionless

dA_f = differential area on the flame surface, m²

dA_t = differential area on the target surface, m²

r = distance between differential areas dA_t and dA_f , m

β_t = angle between normal to dA_t and the line from dA_t to dA_f , degrees

β_f = angle between normal to dA_f and the line from dA_t to dA_f , degrees

Step 7: The radiant heat flux incident upon the target is computed by multiplying the view factor for each differential area on the flame by the surface emissive power and by the appropriate atmospheric transmittance, then summing these values over the surface of the flame.

$$q_{ai} = \sum_{A_f} q_{sf} \cdot F_{dA_t \rightarrow dA_f} \cdot \tau$$

where: q_{ai} = attenuated radiant heat flux incident upon the target due to radiant heat emitted by the flame, kW/m²

A_f = area of the surface of the flame

q_{sf} = radiant heat flux emitted by the surface of the flame, kW/m²

τ = atmospheric transmittance, dimensionless

Atmospheric transmittance, τ , is a function of absolute humidity and r , the path length between differential areas on the flame and target [Wayne, 1991].

Step 8: Steps 6 and 7 are repeated for numerous target locations.

Validation

Several of the equations used in the Torch Fire and Flare Radiation Model are empirical relationships based on data from medium- to large-scale experiments, which ensures reasonably good agreement between model predictions and experimental data for variables such as flame tilt angle. Comparisons of experimental data and model predictions for incident heat flux at specific locations are more meaningful and of greater interest. Unfortunately, few reports on medium- or large-scale experiments contain the level of detail required to make such comparisons.

One reasonable source of test data is a report by Chamberlain [1987]. It contains data from seven flare tests involving natural gas releases from industrial flares, with several data points being reported for each test. Variables that were examined during these tests include release diameter (0.203 and 1.07 m), release rate and velocity, and wind speed. Figure C-1 compares the predicted values of incident heat flux with experimental data from the seven flare tests.

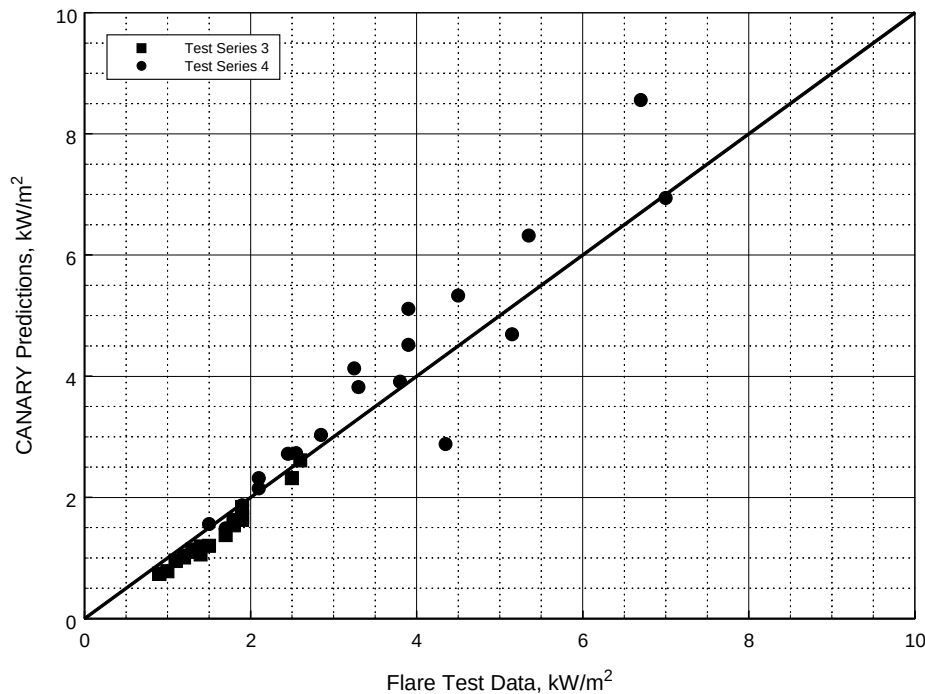


Figure C-1

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Fireball Model

Purpose

The purpose of the Fireball Model is to predict the impact of thermal radiation emitted by fireballs that result from catastrophic failures of pressure vessels containing superheated liquids. Specifically, the model predicts the average radiant heat flux incident upon a grade-level target as a function of the horizontal distance between the target and the center of the fireball.

Required Data

- (a) Composition of flammable liquid within the pressure vessel
- (b) Mass of flammable liquid within the pressure vessel
- (c) Pressure within vessel just prior to rupture
- (d) Temperature of the liquid within the vessel just prior to rupture
- (e) Air temperature
- (f) Relative humidity

Methodology

Step 1: Calculate the mass of fuel consumed in the fireball. The mass of fuel in the fireball is equal to the smaller of the mass of fuel in the vessel (as specified by the user), or three times the mass of fuel that flashes to vapor when it is released to the atmosphere [Hasegawa and Sato, 1977].

Step 2: Calculate the maximum diameter of the fireball using the empirical correlation from Roberts [1981/82].

$$D_{\max} = 5.8 \cdot M_f^{1/3}$$

where: $D_{\max}$ = maximum diameter of the fireball, m

M_f = mass of fuel in the fireball, kg

Step 3: Calculate fireball duration using the following empirical correlation [Martinsen and Marx, 1999].

$$t_d = 0.9 \cdot M_f^{1/4}$$

where: t_d = fireball duration, s

M_f = mass of fuel in the fireball, kg

Step 4: Calculate the size of the fireball and its location, as a function of time. The fireball is assumed to grow at a rate that is proportional to the cube root of time, reaching its maximum diameter, $D_{\max}$, at the time of liftoff, $t_d/3$. During its growth phase, the fireball remains tangent to grade. After liftoff, it rises at a constant rate [Shield, 1994].

Step 5: Estimate the surface flux of the fireball. The fraction of the total available heat energy that is emitted as radiation is calculated using the equation derived by Roberts [1981/82].

$$f = 0.0296 \bullet P^{0.32}$$

where: f = fraction of available heat energy released as radiation, dimensionless

P = pressure in vessel at time of rupture, kPa

The total amount of energy emitted as radiation is then calculated.

$$E_r = f \bullet M_f \bullet \Delta H_c$$

where: E_r = energy emitted as radiation, kJ

ΔH_c = heat of combustion, kJ/kg

The surface flux is estimated by dividing E_r by the average surface area of the fireball and the fireball duration, but it is not allowed to exceed 400 kW/m².

Step 6: Calculate the maximum view factor from a differential target (at specific grade level locations outside the fireball) to the fireball, using the simple equation for a spherical radiator [Howell, 1982].

$$F = \frac{R^2}{H^2}$$

where: F = view factor from differential area to the fireball, dimensionless

R = radius of the fireball, m

H = distance between target and the center of the fireball, m

R and H vary with time due to the growth and rise of the fireball. Therefore, the duration of the fireball is divided into time intervals and a view factor is calculated at the end of each interval.

Step 7: Compute the attenuated radiant heat flux at each target location, at the end of each time interval, by multiplying the appropriate view factor by the surface flux of the fireball and by the appropriate atmospheric transmittance. The transmittance of the atmosphere is a function of the absolute humidity and path length from the fireball to the target [Wayne, 1991]. For each target location, calculate the average attenuated heat flux over the duration of the fireball.

Step 8: Calculate the absorbed energy at each target location. For a given location, the energy absorbed during each time interval is computed by multiplying the length of the interval by the average attenuated radiant heat flux for that interval. The absorbed energies for all time intervals are then summed to determine the radiant energy absorbed over the duration of the fireball.

Step 9: Calculate the integrated dosage at each target location. This is computed in the same manner as absorbed energy is computed in Step 8, except that the average attenuated radiant heat flux for each time interval is taken to the 4/3rds power before it is multiplied by the time interval. This allows the dosage to be used in the probit equation for fatalities from thermal radiation [Eisenberg, Lynch, and Breeding, 1975].

$$Pr = -38.4785 + 2.56 \cdot \ln(q^{4/3} \cdot t)$$

where: Pr = probit

q = radiant heat flux, W/m^2

t = exposure time, s

Validation

Several of the equations used in the Fireball Model are empirical relationships based on data from small- to medium-scale experiments, which ensures reasonably good agreement between model predictions and experimental data for variables such as maximum fireball diameter. Comparisons of experimental data and model predictions for average incident heat flux, absorbed energy, or dosage are more meaningful and of greater interest. Unfortunately, very few reports on small- or medium-scale fireball experiments contain the level of detail required to make such comparisons, and no such data are available for large-scale experiments.

One of the most complete sources of test data for medium-scale fireball tests is a report by Johnson, Pritchard, and Wickens [1990]. It contains data on five BLEVE tests that involved butane and propane, in quantities up to 2,000 kg. Figure D-1 compares the predicted values of absorbed energy with experimental data from those five BLEVE tests.

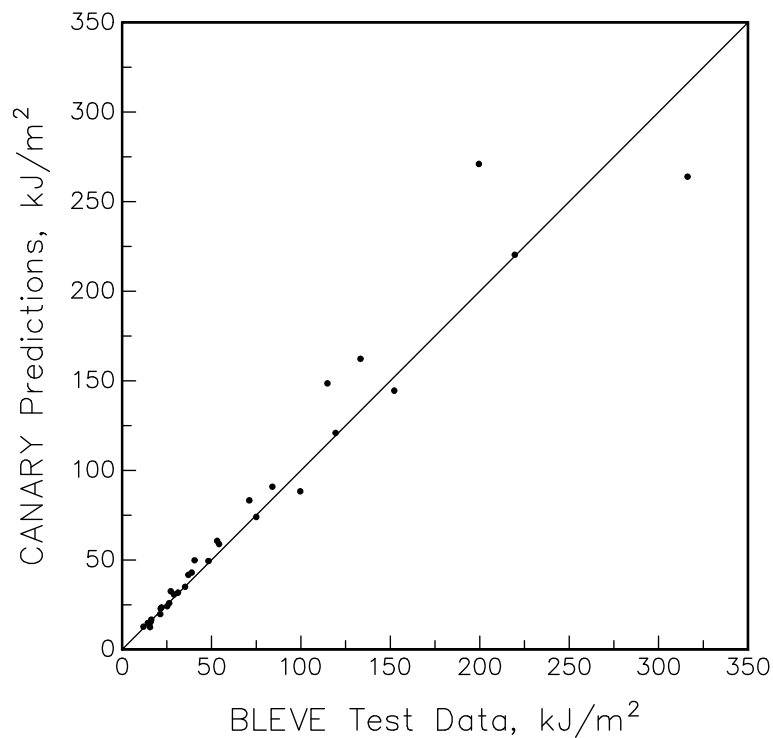


Figure D-1

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Fluid Release Model

Purpose

The purpose of the Fluid Release Model is to predict the rate of mass release from a breach of containment. Specifically, the model predicts the rate of flow and the physical state (liquid, two-phase, or gas) of the release of a fluid stream as it enters the atmosphere from a circular breach in a pipe or vessel wall. The model also computes the amount of vapor and aerosol produced and the rate at which liquid reaches the ground.

Required Data

- (a) Composition of the fluid
- (b) Temperature and pressure of the fluid just prior to the time of the breach
- (c) Normal flow rate of fluid into the vessel or in the pipe
- (d) Size of the pipe and/or vessel
- (e) Length of pipe
- (f) Area of the breach
- (g) Angle of release relative to horizontal
- (h) Elevation of release point above grade

Methodology

Step 1: Calculation of Initial Flow Conditions

The initial conditions (before the breach occurs) in the piping and/or vessel are determined from the input data, coupled with a calculation to determine the initial pressure profile in the piping. The pressure profile is computed by dividing the pipe into small incremental lengths and computing the flow conditions stepwise from the vessel to the breach point. As the flow conditions are computed, the time required for a sonic wave to traverse each section is also computed. The flow in any length increment can be all vapor, all liquid, or two-phase (this implies that the sonic velocity within each section may vary). As flow conditions are computed in each length increment, checks are made to determine if the fluid velocity has exceeded the sonic velocity or if the pressure in the flow increment has reached atmospheric. If either condition has been reached, an error code is generated and computations are stopped.

Step 2: Initial Unsteady State Flow Calculations

When a breach occurs in a system with piping, a disturbance in flow and pressure propagates from the breach point at the local sonic velocity of the fluid. During the time required for the disturbance to reach the upstream end of the piping, a period of highly unsteady flow occurs. The portion of the piping that has experienced the passage of the pressure disturbance is in accelerated flow, while the portion upstream of the disturbance is in the same flow regime as before the breach occurred.

To compute the flow rate from the breach during the initial unsteady flow period, a small time increment is selected and the distance that the pressure disturbance has moved in that time increment is computed using the sonic velocity profile found in the initial pressure profile calculation. The

disturbed length is subdivided into small increments for use in an iterative pressure balance calculation. A pressure balance is achieved when a breach pressure is found that balances the flow from the breach and the flow in the disturbed section of piping. Another time increment is added, and the iterative procedure continues. The unsteady period continues until the pressure disturbance reaches the upstream end of the pipe.

Step 3: Long-Term Unsteady State Flow Calculations

The long-term unsteady state flow calculations are characterized by flow in the piping system that is changing more slowly than during the initial unsteady state calculations. The length of accelerated flow in the piping is constant, set by the user input pipe length. The vessel contents are being depleted, resulting in a potential lowering of pressure in the vessel. As with the other flow calculations, the time is incremented and the vessel conditions are computed. The new vessel conditions serve as input for the pressure drop calculations in the pipe. When a breach pressure is computed that balances the breach flow with the flow in the piping, a solution for that time is achieved. The solution continues until the ending time or other ending conditions are reached.

The frictional losses in the piping system are computed using the equation:

$$h = \left(\frac{4 \bullet f \bullet L \bullet U^2}{2 \bullet g_c \bullet D_e} \right) \quad (1)$$

where: h = head (pressure) loss, ft of fluid

f = friction factor

L = length of system, ft

U = average flowing velocity, ft/sec

g_c = gravitational constant, 32.2 lb_m • ft/(lb_f • sec²)

D_e = equivalent diameter of duct, ft

The friction factor is computed using the following equation:

$$\frac{1}{\sqrt{f}} = 1.74 - 2.0 \bullet \log_{10} \left[\frac{2 \bullet \varepsilon}{D_e} + \frac{18.7}{Re \bullet \sqrt{f}} \right] \quad (2)$$

where: ε = pipe roughness, ft

Re = Reynolds number, $D_e \bullet U \bullet \rho / \mu$, dimensionless

ρ = fluid density, lb/ft³

μ = fluid viscosity, lb/(ft • sec)

Equations (1) and (2) are used for liquid, vapor, and two-phase flow regimes. Since the piping is subdivided into small lengths, changes in velocity and physical properties across each segment are assumed to be negligible. At each step in the calculation, a check is made to determine if the fluid velocity has reached or exceeded the computed critical (sonic) velocity for the fluid. If the critical velocity has been exceeded, the velocity is constrained to the critical velocity and the maximum mass flow rate in the piping has been set.

If the fluid in the piping is in two-phase flow, the Lockhart and Martinelli [1949] modification to Equation (1) is used. The Lockhart and Martinelli equation for head loss is shown below:

$$h_{TP} = \Phi^2 \cdot \left(\frac{4 \cdot f \cdot L \cdot U_{ls}^2}{2 \cdot g_c \cdot D_e} \right) \quad (3)$$

where: h_{TP} = head loss for two-phase flow, ft of fluid

Φ = empirical parameter correlating single- and two-phase flow, dimensionless

U_{ls} = superficial liquid velocity (velocity of liquid if liquid filled the pipe), ft/sec

This equation is valid over short distances where the flowing velocity does not change appreciably.

Validation

Validation of fluid flow models is difficult since little data are available for comparison. Fletcher [1983] presented a set of data for flashing CFC-11 flowing through orifices and piping. Figures E-1 through E-4 compare calculations made using the Fluid Release Model with the data presented by Fletcher. Figure E-1 compares fluid fluxes for orifice type releases. These releases had length-to-diameter (L/D) ratios less than 0.88. Figure E-2 compares computed and experimental release fluxes for an L/D ratio of 120 at several levels of storage pressure. Figure E-3 compares similar releases for an L/D of 37.5. Figure E-4 shows predicted and experimental release fluxes at a given pressure for L/D ratios from 1 to 200.

Figures E-5 and E-6 compare computed and experimental gas discharge rates for the complete breach of two pipes. One pipe had an internal diameter of 6.2 inches (0.157 m); the other had a diameter of 12 inches (0.305 m). These pipes were initially pressurized to 1,000 psia with air and then explosively ruptured. The experimental values were reported in a research paper for Alberta Environment, authored by Wilson [1981].

Aerosols and Liquid Droplet Evaporation

Liquids stored at temperatures above their atmospheric pressure boiling point (superheated liquids) will give off vapor when released from storage. If the temperature of storage is sufficiently above the normal boiling point, the energy of the released vapor will break the liquid stream into small droplets. If these droplets are small enough, they will not settle, but remain in the vapor stream as aerosol droplets. The presence of aerosol droplets in the vapor stream changes its apparent density and provides an additional source of vapor. Droplets large enough to fall to the ground will lose mass due to evaporation during their fall.

The prediction of aerosol formation and amount of aerosol formed is based on the theoretical work performed for the Center for Chemical Process Safety (CCPS) by CREARE. CREARE's work has been extended and corrected by Quest. The extension to the model computes the non-aerosol drop evaporation. In Figure E-7, the four experimental data sets available for comparison (chlorine (Cl₂), methylamine (MMA), CFC-11, and cyclohexane) are compared to the values computed by the CANARY Aerosol Model.

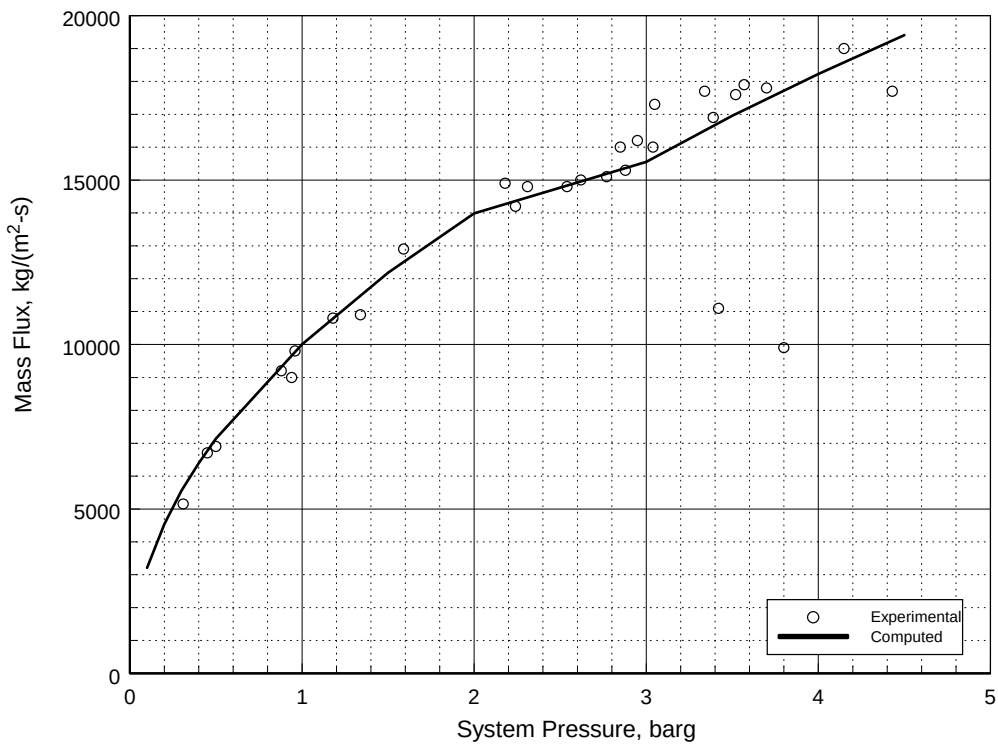


Figure E-1
Comparison of CFC-11 Orifice Releases as a Function of System Pressure

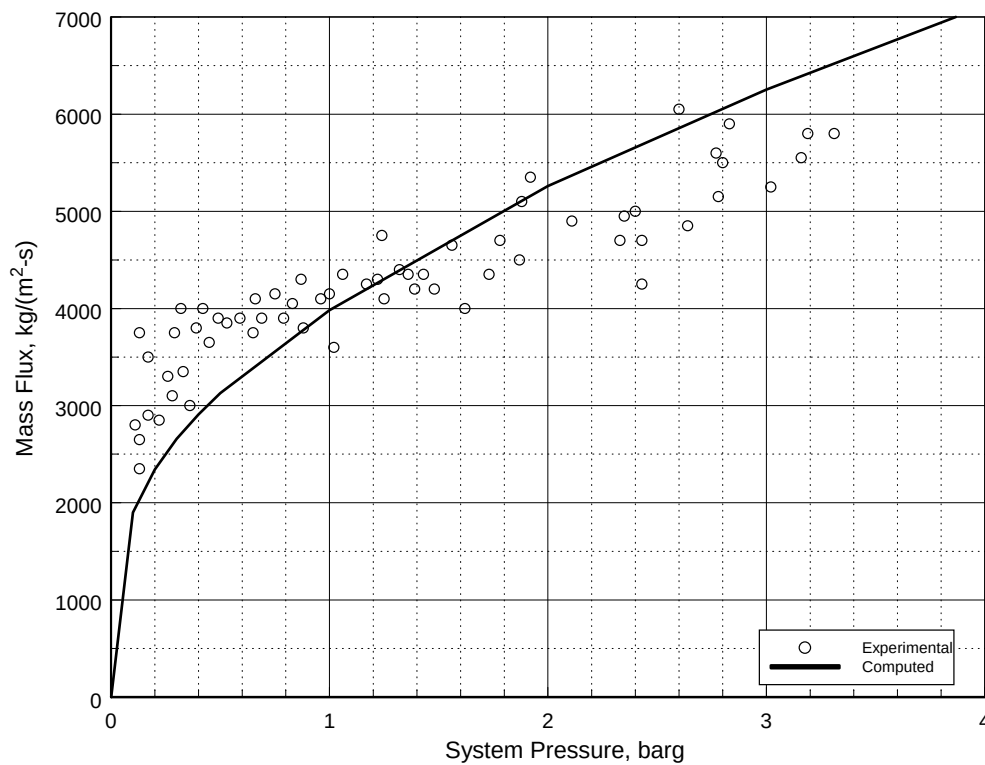


Figure E-2
CFC-11 Release Rate Comparison with L/D of 120

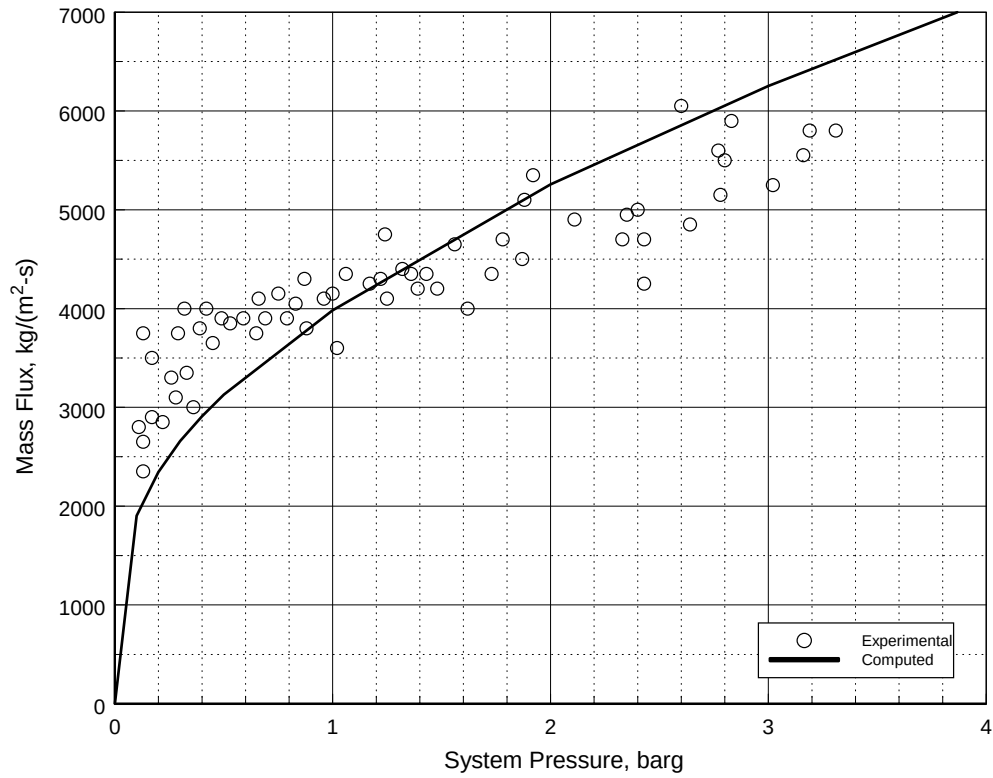


Figure E-3
CFC-11 Release Rate Comparison with L/D of 37.5

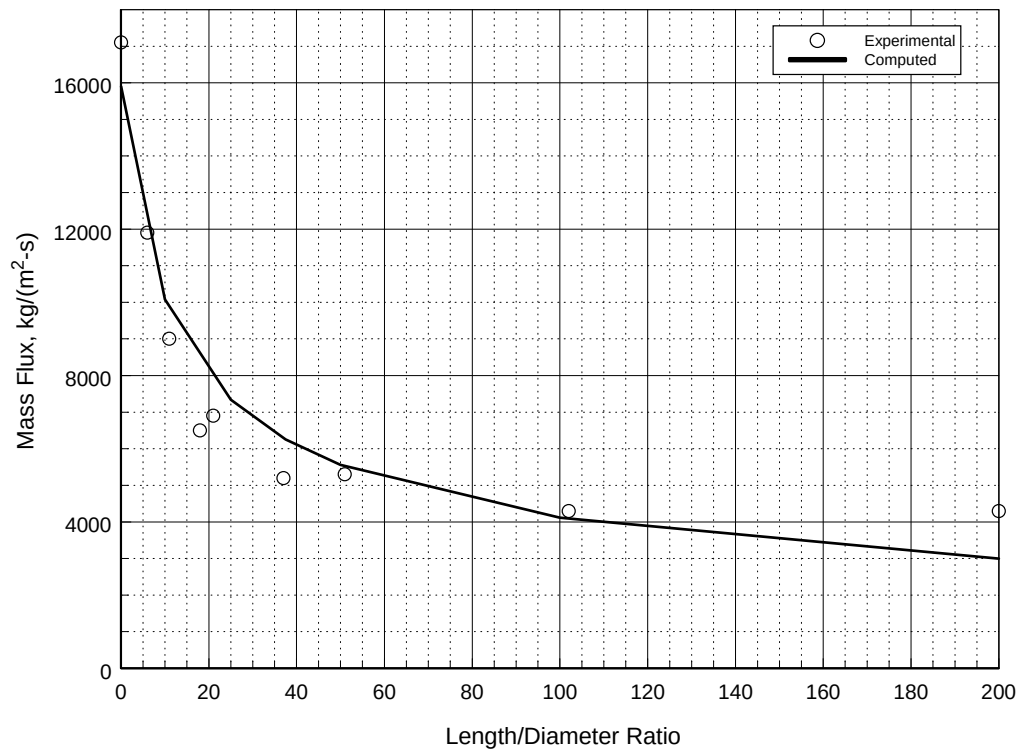


Figure E-4
CFC-11 Release Rate Comparison at Varying L/D Ratios

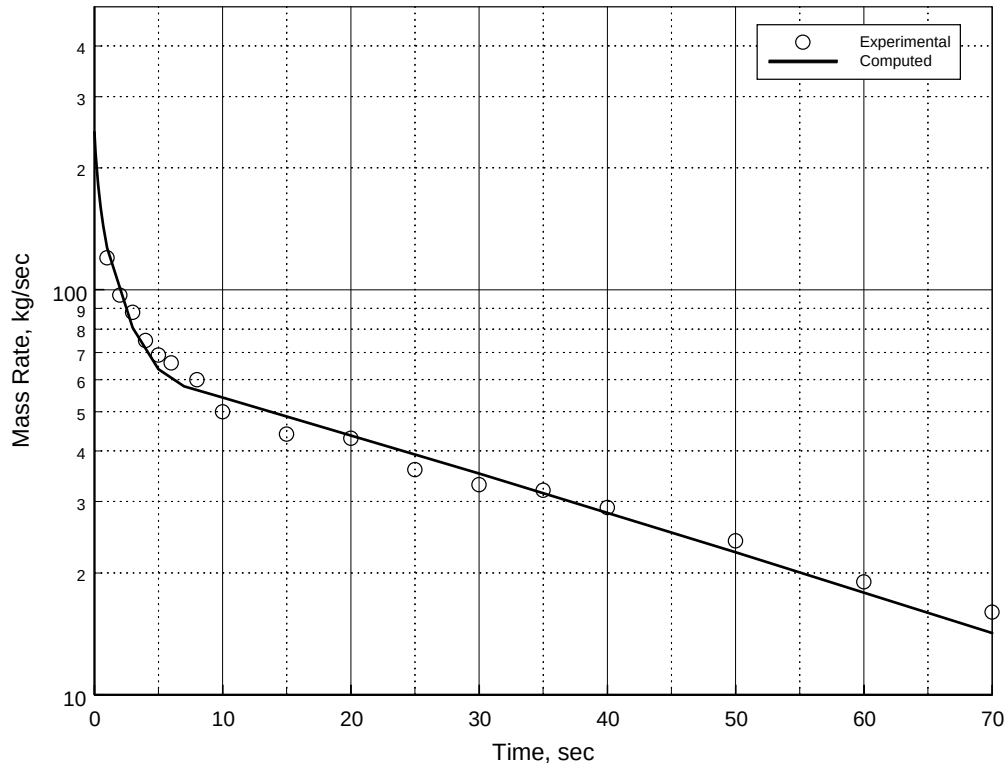


Figure E-5
Air Discharge Rates for 0.157 m Diameter Piping

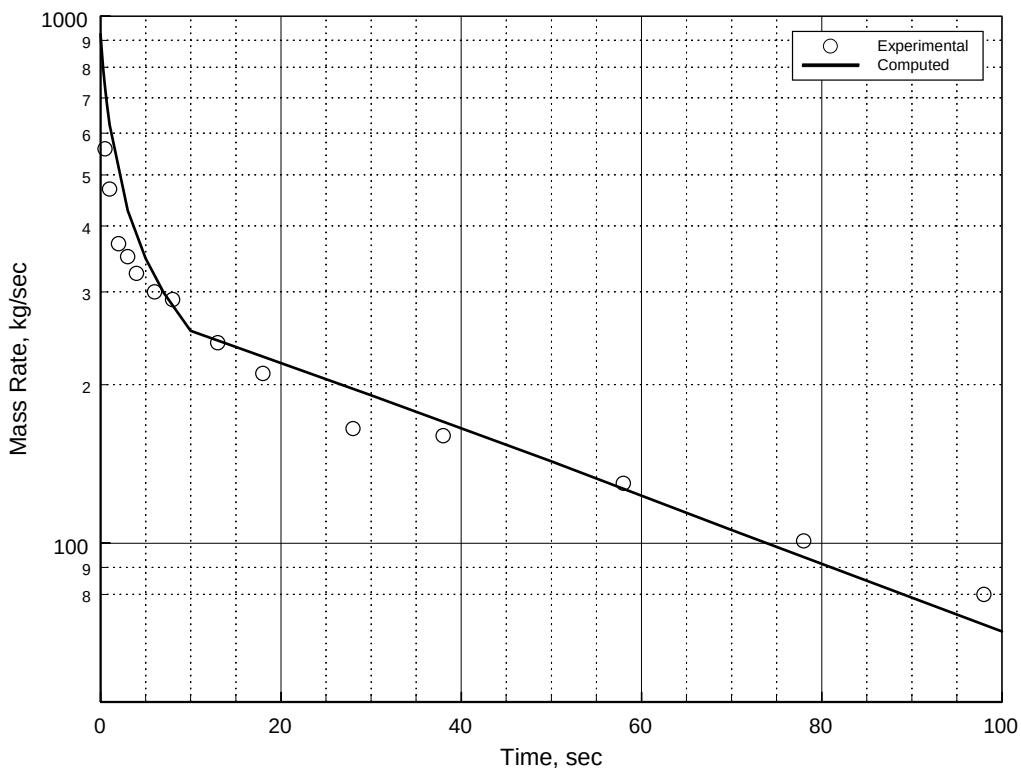


Figure E-6
Air Discharge Rates for 0.305 m Diameter Piping

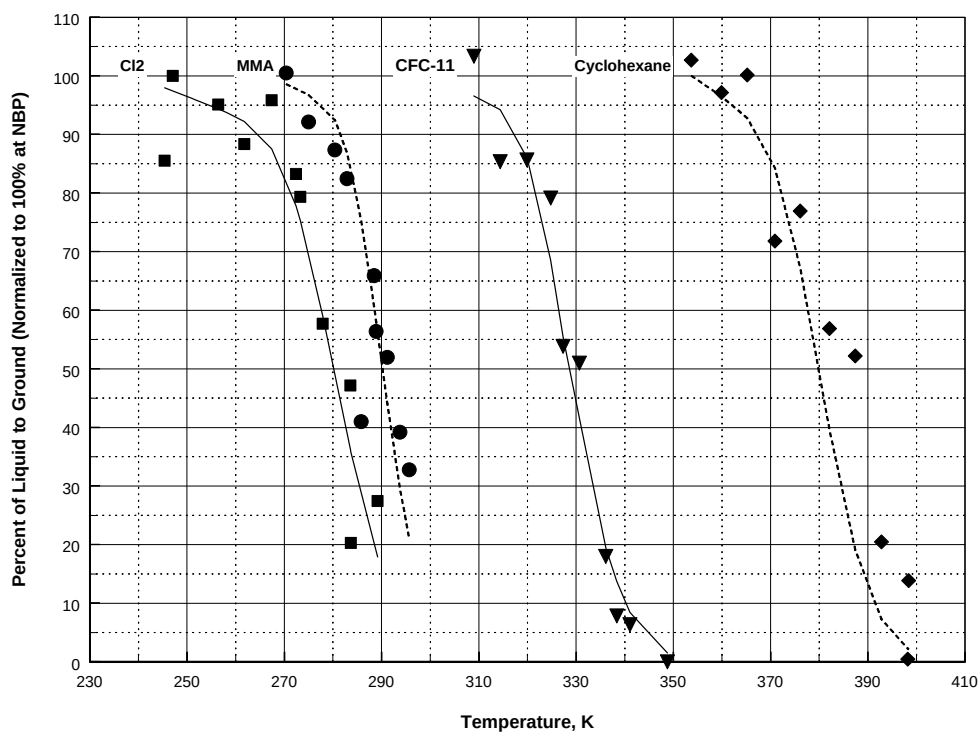


Figure E-7
Aerosol Formation as a Function of Storage Temperature

References

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Momentum Jet Dispersion Model

Purpose

The purpose of this model is to predict the dispersion of a jet release into ambient air. It is used to predict the downwind travel of a flammable or toxic gas or aerosol momentum jet release.

Required Data

- (a) Composition and properties of the released material
- (b) Temperature of released material
- (c) Release rate of material
- (d) Vertical release angle relative to wind direction
- (e) Height of release
- (f) Release area
- (g) Ambient wind speed
- (h) Ambient Pasquill-Gifford stability class
- (i) Ambient temperature
- (j) Relative humidity
- (k) Surface roughness scale

Methodology

Step 1: An assumption is made that flow perpendicular to the main flow in the plume is negligible, that the velocity and concentration profiles in the jet are similar at all sections of the jet, that molecular transport in the jet is negligible, and that longitudinal turbulent transport is negligible when compared to longitudinal convective transport. The coordinate system is then defined in s and r , where s is the path length of the plume and r is the radial distance from the plume centerline. The angle between the plume axis and horizontal is referred to as θ . Relationships between the downwind coordinate, x , vertical coordinate, y , and plume axis are given simply by:

$$\frac{dx}{ds} = \cos(\theta) \quad (1)$$

and

$$\frac{dy}{ds} = \sin(\theta) \quad (2)$$

Step 2: Velocity, concentration, and density profiles are assumed to be cylindrically symmetric about the plume axis and are assumed to be Gaussian in shape. The three profiles are taken as:

$$u(s, r, \theta) = U_a \bullet \cos(\theta) + u^*(s) \bullet e^{\frac{-r^2}{b^2(s)}} \quad (3)$$

where: u = plume velocity, m/s
 U_a = ambient wind speed, m/s

u^* = plume velocity relative to the wind in the downwind direction at the plume axis, m/s

$b(s)$ = characteristic width of the plume at distance s from the release, m

$$\rho(s, r, \theta) = \rho_a + \rho^*(s) \cdot e^{\frac{-r^2}{\lambda^2 \cdot b^2(s)}} \quad (4)$$

where: ρ = plume density, kg/m³

ρ_a = density of ambient air, kg/m³

$\rho^*(s)$ = density difference between plume axis and ambient air, kg/m³

λ^2 = turbulent Schmidt number, 1.35

$$c(s, r, \theta) = c^*(s) \cdot e^{\frac{-r^2}{\lambda^2 \cdot b^2(s)}} \quad (5)$$

where: c = pollutant concentration in the plume, kg/m³

$c^*(s)$ = pollutant concentration at plume centerline, kg/m³

Step 3: The equation for air entrainment into the plume and the conservation equations can then be solved. The equation for air entrainment is:

$$\begin{aligned} \frac{d}{ds} \left(\int_0^{b\sqrt{2}} \rho \cdot u \cdot 2 \cdot \pi \cdot dr \right) \\ = 2 \cdot \pi \cdot b \cdot \rho_a \cdot \left\{ \alpha_1 \cdot |u^*(s)| + \alpha_2 \cdot U_a \cdot |\sin(\theta)| \cos(\theta) + \alpha_3 \cdot u' \right\} \end{aligned} \quad (6)$$

where: α_1 = entrainment coefficient for a free jet, 0.057

α_2 = entrainment coefficient for a line thermal, 0.5

α_3 = entrainment coefficient due to turbulence, 1.0

u' = turbulent entrainment velocity (root mean square of the wind velocity fluctuation is used for this number), m/s

Step 4: The equations of conservation of mass, momentum, and energy are given as:

$$\frac{d}{ds} \left(\int_0^{b\sqrt{2}} c \cdot u \cdot 2 \cdot \pi \cdot dr \right) = 0 \quad (7)$$

$$\begin{aligned} \frac{d}{ds} \left(\int_0^{b\sqrt{2}} (\rho \cdot u^2 \cdot \cos(\theta)) \cdot 2 \cdot \pi \cdot dr \right) \\ = 2 \cdot \pi \cdot b \cdot \rho_a \cdot \left\{ \alpha_1 \cdot |u^*(s)| + \alpha_2 \cdot U_a \cdot |\sin(\theta)| \cos(\theta) + \alpha_3 \cdot u' \right\} \\ + C_d \cdot \pi \cdot b \cdot \rho_a \cdot U_a^2 \cdot |\sin(\theta)| \end{aligned} \quad (8)$$

$$\begin{aligned} \frac{d}{ds} \left(\int_0^{b\sqrt{2}} \rho \cdot u^2 \cdot \cos(\theta) \cdot 2 \cdot \pi \cdot dr \right) \\ = \int_0^{b\sqrt{2}} g \cdot (\rho_a - \rho) \cdot \pi \cdot r \cdot dr \pm C_d \cdot \pi \cdot b \cdot \rho_a \cdot U_a^2 \cdot \sin(\theta) \cdot \cos(\theta) \end{aligned} \quad (9)$$

$$\frac{d}{ds} \left(\int_0^{b\sqrt{2}} \rho \cdot u \cdot \left(\frac{1}{\rho} - \frac{1}{\rho_{a0}} \right) \cdot 2 \cdot \pi \cdot r \cdot dr \right) \quad (10)$$

$$= \rho_a \bullet 2 \bullet \pi \bullet b \left(\frac{1}{\rho_a} - \frac{1}{\rho_{a0}} \right) \bullet \left\{ \alpha_1 \bullet |u^*(s)| + \alpha_2 \bullet U_a \sin(\theta) \bullet \cos(\theta) + \alpha_3 \bullet \dot{u} \right\}$$

The subscript 0 refers to conditions at the point of release. These equations are integrated along the path of the plume to yield the concentration profiles as a function of elevation and distance down-wind of the release.

Step 5: After the steady-state equations are solved, an along-wind dispersion correction is applied to account for short-duration releases. This is accomplished using the method outlined by Palazzi, et al. [1982].

Step 6: If the plume reaches the ground, it is coupled to the Heavy Gas Dispersion Model (described in Section G) and the dispersion calculations continue.

Validation

The Momentum Jet Dispersion Model used in CANARY was validated by comparing results obtained from the model with experimental data from field tests. Data used for this comparison and the conditions used in the model were taken from an American Petroleum Institute (API) study [Hanna, Strimaitis, and Chang, 1991]. For this model, comparisons were made with the Desert Tortoise, Goldfish, and Prairie Grass series of dispersion tests. Results of these comparisons are shown in Figure F-1.

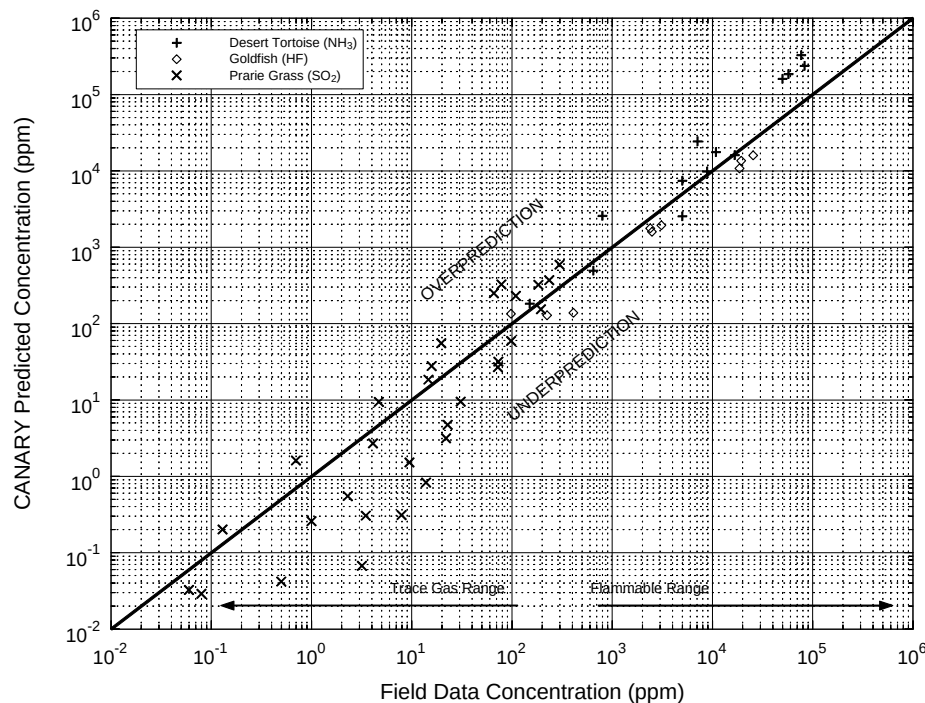


Figure F-1

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Heavy Gas Dispersion Model

Purpose

The purpose of this model is to predict the dispersion and gravity flow of a heavy gas released into the air from liquid pools or instantaneous gas releases. It is used to predict the downwind travel of a flammable or toxic vapor cloud.

Required Data

- (a) Composition and properties of the released material
- (b) Temperature of released material
- (c) Vapor generation rate
- (d) Vapor source area
- (e) Vapor source duration
- (f) Ambient wind speed
- (g) Ambient Pasquill-Gifford atmospheric stability class
- (h) Ambient temperature
- (i) Relative humidity
- (j) Surface roughness scale

Methodology

Step 1: For a steady-state plume, released from a stationary source, the Heavy Gas Dispersion Model solves the following equations:

$$\frac{d}{dx}(\rho \bullet U \bullet B \bullet h \bullet m) = \rho_s \bullet W_s \bullet B_s \quad (1)$$

$$\frac{d}{dx}(\rho \bullet U \bullet B \bullet h) = \rho_a \bullet (V_e \bullet h + W_e \bullet B) + \rho_s \bullet W_s \bullet B_s \quad (2)$$

$$\frac{d}{dx}(\rho \bullet U \bullet B \bullet h \bullet C_p \bullet T) = \rho_a \bullet (V_e \bullet h + W_e \bullet B) \bullet C_{pa} \bullet T_a + \rho_s \bullet W_s \bullet B_s \bullet C_{ps} \bullet T_s + f_t \quad (3)$$

$$\frac{d}{dx}(\rho \bullet U \bullet B \bullet h \bullet U) \quad (4)$$

$$= -0.5 \bullet \alpha_g \bullet g \bullet \frac{d}{dx}[(\rho - \rho_a) \bullet B \bullet h^2] + \rho_a \bullet (V_e \bullet h + W_e \bullet B) \bullet U_a + f_u$$

$$\frac{d}{dx}(\rho \bullet U \bullet B \bullet h \bullet V_g) = g \bullet (\rho - \rho_a) \bullet h^2 + f_{vg} \quad (5)$$

$$U \bullet \frac{dZ_c}{dx} = -V_g \bullet \frac{Z_c}{B} \quad (6)$$

$$U \bullet \frac{dB}{dx} = \frac{\rho_a}{\rho} \bullet V_e + V_g \quad (7)$$

$$\rho \bullet T = \frac{\rho_a \bullet T_a \bullet M_s}{[M_s + (M_a - M_s) \bullet m]} \quad (8)$$

where: x = downwind distance, m
 ρ = density, kg/m³
 U = velocity in the direction of the wind, m/s
 B = cloud width parameter, m
 h = cloud height parameter, m
 m = mass fraction of source gas
 T = temperature, K
 C_p = specific heat, J/(kg • K)
 f_t = ground heat flux, J/(m • s)
 f_u = downwind friction term, kg/s²
 f_v = crosswind friction term, kg/s²
 V_e = horizontal entrainment rate, m/s
 V_g = horizontal crosswind gravity flow velocity, m/s
 W_e = vertical entrainment rate, m/s
 W_s = vertical source gas injection velocity, m/s
 M = molecular weight, kg/kmole
 s = refers to source properties
 a = refers to ambient properties

The first six equations are crosswind-averaged conservation equations. Equation (7) is the width equation, and Equation (8) is the equation of state.

Step 2: All of the gas cloud properties are crosswind averaged. The three-dimensional concentration distribution is calculated from the average mass concentration by assuming the following concentration profile:

$$C(x, y, z) = C(x) \bullet C_1(y) \bullet C_2(z) \quad (9)$$

$$C(x) = \frac{M_a \bullet m(x)}{M_s + (M_a - M_s) \bullet m(x)} \quad (10)$$

$$C_1(y) = \frac{1}{4 \bullet b} \bullet \left\{ \operatorname{erf} \left(\frac{y+b}{2 \bullet \beta} \right) - \operatorname{erf} \left(\frac{y-b}{2 \bullet \beta} \right) \right\} \quad (11)$$

$$B^2 = b^2 + 3 \bullet \beta^2 \quad (12)$$

$$C_2(z) = \left(\frac{6}{\pi}\right)^{1/2} \cdot \frac{1}{h} \cdot \exp\left(\frac{-3 \cdot z^2}{2 \cdot h^2}\right) \quad (13)$$

where: $C(x, y, z)$ = concentration in plume at x, y, z , kg/m³

y = crosswind coordinate, m

z = vertical coordinate, m

b, B, β = half-width parameters, m

Step 3: As there are now two parameters used to define $C_1(y)$, the following equation is needed to calculate b :

$$U \cdot \left(\frac{db}{dx}\right) = V_g \cdot \frac{b}{B} \quad (14)$$

Step 4: The vertical entrainment rate is defined to be:

$$W_e = \frac{\sqrt{3} \cdot a \cdot k \cdot U_* \cdot \delta\left(\frac{h}{H}\right)}{\Phi_h\left(\frac{h}{L}\right)} \quad (15)$$

where: a = constant, 1.5

k = constant, 0.41

U_* = friction velocity, m/s

L = Monin-Obukhov length derived from the atmospheric stability class

Step 5: The profile function δ is used to account for the height of the mixing layer, H , and to restrict the growth of the cloud height to that of the mixing layer. H is a function of stability class and is defined as:

$$\delta\left(\frac{h}{H}\right) = 1 - \frac{h}{H} \quad (16)$$

The Monin-Obukhov function, Φ_h , is defined by:

$$\Phi_h\left(\frac{h}{L}\right) = \begin{cases} 1 + 5 \cdot \frac{h}{L} & L \geq 0 \text{ (stable)} \\ \left[1 - 16 \cdot \frac{h}{L}\right]^{-1/2} & L < 0 \text{ (unstable)} \end{cases} \quad (17)$$

Step 6: After the steady-state equations are solved, an along-wind dispersion correction is applied to account for short-duration releases. This is accomplished using the method outlined by Palazzi, et al. [1982]

Validation

The Heavy Gas Dispersion Model used in CANARY was validated by comparing results obtained from the model with experimental data from field tests. Data used for this comparison and the conditions used in the

model were taken from an American Petroleum Institute (API) study [Hanna, Strimaitis, and Chang, 1991]. For this model, comparisons were made with the Burro, Maplin Sands, and Coyote series of dispersion tests. Results of these comparisons are shown in Figure G-1.

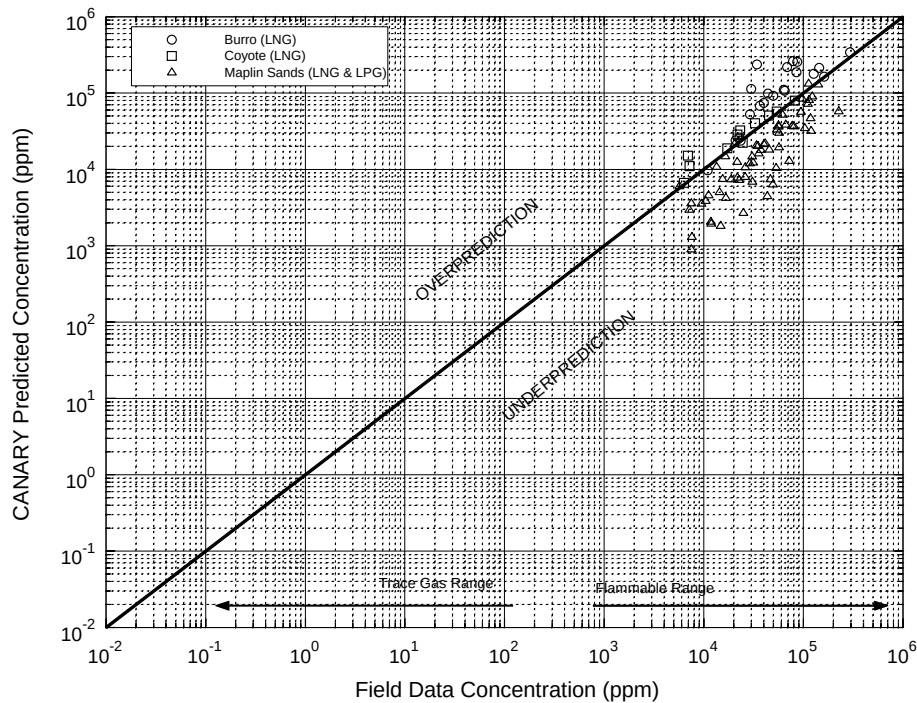


Figure G-1

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Vapor Cloud Explosion Model

Purpose

The purpose of this model is to predict the overpressure field that would be produced by the explosion of a partially confined and/or obstructed fuel-air cloud, based on the Baker-Strehlow-Tang methodology. Specifically, the model predicts the magnitude of the peak side-on overpressure and specific impulse as a function of distance from the source of the explosion.

Required Data

- (a) Composition of the fuel (flammable fluid) involved in the explosion
- (b) Total mass of fuel in the flammable cloud at the time of ignition or the volume of the partially-confined/obstructed area
- (c) Fuel reactivity (high, medium, or low)
- (d) Obstacle density (high, medium, or low)
- (e) Flame expansion (1-D, 2-D, 2½-D, or 3-D)
- (f) Reflection factor

Methodology

Step 1: The combustion energy of the cloud is estimated by multiplying its mass by the heat of combustion. If the volume of the flammable cloud is input, the mass is estimated by assuming that a stoichiometric mixture of gas and air exists within that volume.

Step 2: The combustion energy is multiplied by the reflection factor to account for blast reflection from the ground or surrounding objects.

Step 3: Flame speed is determined from the fuel reactivity, obstacle density, and flame expansion parameters, as presented in Baker, et al. [1994, 1998, 1999, 2005].

Fuel reactivity and obstacle density each have low, medium, and high choices. The flame expansion parameter allows choices of 1-D, 2-D, 2.5-D, and 3-D. The choices for these three parameters create a matrix of 36 possibilities, thus allowing locations that have differing levels of congestion or confinement to produce different overpressures. Each matrix possibility corresponds to a flame speed, and thus a peak (source) overpressure. The meanings of the three parameters and their options are:

Fuel Reactivity (High, Medium, or Low). Some of the fuels considered to have high reactivity are acetylene, ethylene oxide, propylene oxide, and hydrogen. Low reactivity fuels are (pure) methane and carbon monoxide. Most other fuels are medium reactivity. If fuels from different reactivity categories are mixed, the model recommends using the higher category unless the amount of higher reactivity fuel is less than 2% of the mixture.

Obstacle Density (High, Medium, or Low). High obstacle density is encountered when objects in the flame's path are closely spaced. This is defined as multiple layers of obstruction resulting in at least a 40% blockage ratio (i.e., 40% of the area is occupied by obstacles). Low density areas are defined as having a blockage ratio of less than 10%. All other blockage ratios fall into the medium category.

Flame Expansion (1-D, 2-D, 2.5-D, or 3-D). The expansion of the flame front must be characterized with one of these four descriptors. 1-D expansion is likened to an explosion in a pipe or hallway. 2-D expansion can be described as what occurs between flat, parallel surfaces. An unconfined (hemispherical expansion) case is described as 3-D. The additional descriptor of 2.5-D is used for situations that begin as 2-D and quickly transition to 3-D or situations where the confinement is made by either a frangible panel or by a nearly-solid confining plane.

Step 4: Based on the calculated flame speed, appropriate blast curves are selected from the figures in Baker, et al., 1999. For flame speeds not shown on the graph, appropriate curves are prepared by interpolation between existing curves.

Step 5: The Sachs scaled distance, $\bar{R}$, is calculated for several distances using the equation:

$$\bar{R} = \frac{R}{\left(\frac{E}{P_0}\right)^{1/3}}$$

where: R = distance from the center of the explosion

E = total energy calculated in step 2, above

P_0 = atmospheric pressure

Step 6: The peak side-on overpressure and specific impulse at each scaled distance are determined from the blast curves in Baker, et al., 1999.

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