OCS Study
BOEM 2019-016

Air Emissions Associated with Decommissioning Operations for Pacific Outer Continental Shelf Oil and Gas Platforms

Volume I: Final Report

US Department of the Interior
Bureau of Ocean Energy Management
Pacific OCS Region

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DISCLAIMER

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ABOUT THE COVER

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List of Abbreviations and Acronyms

ACM	Asbestos-Containing Materials
AQRV	Air Quality Related Values
ATC	Authority to Construct
ATCM	Airborne Toxic Control Measures
BACT	Best Available Control Technology
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
BAU	Business-As-Usual
CAAQS	California Ambient Air Quality Standards
CARB	California Air Resources Board
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CH_4	Methane
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO2e	Carbon dioxide equivalent
COA	Corresponding Onshore Area
CSLC	California State Lands Commission
DB	Derrick Barge
DEEP	Decommissioning Emissions Estimation for Platforms
DES	Division of Environmental Sciences
DOI	US Department of the Interior
DPM	Diesel Particulate Matter
EIR	Environmental Impact Report
Field	An area consisting of a single reservoir or multiple reservoirs all grouped on, or related to, the same general geologic structural feature and/or stratigraphic trapping condition
GHG	Greenhouse Gas
GOM	Gulf of Mexico
GVWR	Gross Vehicle Weight Rating
HC	Hydrocarbons
HRA	Health Risk Assessment
ESP	Environmental Studies Program
LNG	Liquefied Natural Gas
N_2O	Nitrogen Dioxide
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NMHC	Non-Methane Hydrocarbons
NOI	Notice of Intent
NO_X	Oxides of Nitrogen

NRLM	Non-Road, Locomotive and Marine
OCS	Outer Continental Shelf
P&A	Well plugging and abandonment
PC	Permit to Construct
PERP	Portable Equipment Registration Program
PM	Particulate Matter
PM10	Particulate Matter less than 10 microns
PM2.5	Particulate Matter less than 2.5 microns
POLA	Port of Los Angeles
POLB	Port of Long Beach
PSD	Prevention of Significant Deterioration
PTO	Permit to Operate
RICE	Reciprocating Internal Combustion Engines
ROC	Reactive Organic Carbon
ROV	Remotely Operated Vehicle
SBCAPCD	Santa Barbara County Air Pollution Control District
SCAQMD	South Coast Air Quality Management District
Sox	Sulfur Dioxide
TAC	Toxic Air Contaminant
Unit	Unified development and operation of an oil field or reservoir as a single entity by one operator
VCAPCD	Ventura County Air Pollution Control District
VOC	Volatile Organic Compound
VSR	Vessel Speed Reduction

Executive Summary

Since 1968, offshore oil and gas production platforms have been present off the Southern California coast. Currently, there are 23 offshore platforms located in Federal waters, installed between 1968 and 1989 and operating in water depths ranging between 96 and 1,197 ft. These platforms have finite economic life spans and at the end of their productive life will eventually be decommissioned and removed. Current regulations require the complete removal of platform structures and associated debris and site clearance following decommissioning of the offshore oil and gas facilities.

One of the most significant potential environmental impacts from Pacific Outer Continental Shelf (OCS) Region offshore oil and gas decommissioning activities would be from air emissions resulting from the use of heavy equipment and the effects of those operations on regional air quality. Pacific OCS facilities are located adjacent to onshore areas that are in violation of some State and Federal air quality standards and are required to improve air quality by the earliest practicable date. Local air quality regulations require projects that exceed air quality standards to mitigate project emissions below emission thresholds and to assure a net air quality benefit from the project. The rules define net air quality benefit as a net improvement in air quality resulting from actual emission reductions that are quantifiable and enforceable consistent with reasonable further progress toward the attainment of air quality standards.

This study presents the results of an in-depth analysis examining the potential air quality emissions associated with decommissioning the Pacific OCS platforms. Previous studies examined the air emissions impacts utilizing a general, order-of-magnitude approach appropriate for approximating the emissions from decommissioning. This analysis examines the air emissions to a permit-level-of-detail to examine the activities producing the largest impacts, as well as the feasibility and availability of mitigation strategies to reduce air emissions.

The process of decommissioning the Pacific OCS platforms is approaching for a number of the facilities, and planning for the detailed air quality impacts, including equipment, equipment availability and permitting issues, associated with the level of effort is important for the process to proceed smoothly. This study provides detailed air quality emissions estimates and equipment assessments in line with current permit levels of detail as well as incorporating discussions with air districts, operators and equipment providers on the current state of the air permitting and level of effort needed to decommission the large number of platforms located in the Pacific OCS. Timing of subtasks has been confirmed with a comparison to other studies and projects as well as discussions with platform operators, some of which are currently in the decommissioning planning stages.

The estimates included in this analysis include many assumptions based on the current platform arrangements and potential decommissioning equipment characteristics. As more detailed decommissioning estimates and quotes are developed by the operators, more accurate estimates can be developed.

The emissions levels as estimated in this assessment are substantial and range into the hundreds of tons of pollutants associated with a single platform decommissioning effort if higher-polluting equipment is used. These emissions are summarized below:

- Total emissions from all platforms are over 10,000 tons of NOx for full abandonment for the uncontrolled case, reduced to about 7,500 tons of NOx under the partial jacket abandonment scenario.

- Use of clean diesel engines reduces emissions to about 1,200 tons and 900 tons, for the full and partial jacket abandonment scenarios for all platforms combined, respectively.
- The Santa Ynez Unit (Platforms Harmony, Heritage and Hondo) produces about 30 percent of the total emissions from all platform decommissioning activities.
- Shallow water platforms (less than 250 feet deep) produce on average about 300 tons of NOx per decommissioning project, whereas deep water platforms produce on average more than 1,000 tons of NOx.

Conclusions associated with the study include the following:

- Cleaner engines and technologies, such as the clean tug boats currently located along the west coast, are available or could be commissioned that could result in substantial emission reductions.
- Partial removal of the jackets provides for substantial reductions in emissions for deep water platforms.
- Partial removal of the jackets for facilities located in shallower depth (less than 190 feet) provided minimal reductions from the complete removal of the facilities.
- With the implementation of available clean technologies, emissions levels of pollutants associated with the average platform decommissioning construction project would generally be below the current emissions levels associated with the permitted operations of the average platform,
- For some platforms, the average platform decommissioning project emissions could be below the actual historical operational emissions for those facilities under the partial removal scenario.
- Thus, a net air quality benefit to the region could be realized through the removal of these ongoing emissions sources through a decommissioning process that could produce less than the annual operational permitted emissions levels of the operating platform.
- Additional mitigation strategies primarily associated with vessels supporting and conducting decommissioning operations could further reduce the emission potentials associated with the combustion intensive decommissioning operations.
- There are substantive challenges and issues associated with these decommissioning activities, such as locations for disposal of materials, marine growth odor, effective use and selection of large equipment, coordination of decommissioning efforts between operators and whether federal facilities use of the California regulations for partial decommissioning (“rigs-to-reef”) are feasible.

1 Introduction

Since 1968, offshore oil and gas production platforms have been present off the Southern California coast. Currently, there are 23 offshore platforms located in Federal waters, installed between 1968 and 1989 and operating in water depths ranging between 96 and 1,197 feet. These platforms have finite economic life spans and at the end of their productive life will eventually be decommissioned and removed. Current regulations require the complete removal of platform structures and associated debris and site clearance following decommissioning of the offshore oil and gas facilities.

One of the most significant potential environmental impacts from Pacific OCS offshore oil and gas decommissioning activities would be from air emissions resulting from the use of heavy equipment and the effects of those operations on regional air quality. Pacific OCS facilities are located adjacent to onshore areas that are in violation of some State and Federal air quality standards and are required to improve air quality by the earliest practicable date. Local air quality regulations require projects that exceed air quality standards to mitigate project emissions below emission thresholds and to assure a net air quality benefit from the project. The rules define net air quality benefit as a net improvement in air quality resulting from actual emission reductions that are quantifiable and enforceable consistent with reasonable further progress toward the attainment of air quality standards.

Future oil and gas OCS platform decommissioning projects will be required to estimate the equipment and emissions from those operations and be subject to the rules and regulations of the corresponding onshore air pollution control agencies. As such, the types and quantities of vessels and equipment, potential emissions, and the ability to demonstrate net air quality benefits from these decommissioning operations are unknown. As part of the permitting process for decommissioning, Bureau of Ocean Energy Management (BOEM), and State and local agencies, will need this air emission information to support environmental evaluations and analyses under the National Environmental Policy Act (NEPA) and possibly the California Environmental Quality Act (CEQA).

This study presents the results of an in-depth analysis examining the potential air quality emissions associated with decommissioning the Pacific OCS platforms. Previous studies examined the air emissions impacts utilizing a general, order-of-magnitude approach appropriate for approximating the emissions from decommissioning. This analysis examines the air emissions to a permit-level-of-detail to examine the areas producing the largest impacts, as well as the feasibility and availability of mitigation strategies to reduce air emissions.

An air quality spreadsheet tool, titled Decommissioning Emissions Estimation for Platforms (DEEP), was developed which allows for the selection of a large range of variables to estimate the emissions from decommissioning of the platforms. Several stakeholders, including the respective air districts, equipment suppliers and those companies responsible for the decommissioning, were consulted for input and feedback on various elements of the emissions estimates in an effort to develop a detailed analysis that is useful to all stakeholders involved in decommissioning.

This report is composed of several different sections as described below:

Section 2: Air Regulations, provides an overview of the local, State and Federal air regulations that would apply to the OCS platform decommissioning effort. This section also addresses the possible permitting requirements as described by the respective air districts as well as the compliance requirements and control technology expectations.

Section 3: Decommissioning Requirements and Operations, provides detailed information on the tasks that will be required for decommissioning along with timing and capacity estimates. These estimates are based on previous Bureau of Safety and Environmental Enforcement (BSEE) studies as well as discussions with vendors, ports and oil companies. These include estimates of platform and pipeline characteristics for all OCS facilities as well as the timing of tasks are compiled into DEEP.

Section 4: Vessel and Equipment Requirements, details the vessel and equipment specifics including type, number, and potential emission control technologies.

Section 5: Emission Estimates, provides emission estimates for the range of platform decommissioning scenarios, including full and partial jacket decommissioning. A number of options are included in DEEP, including the option for removal of the state water pipelines and power cables. Emission estimates are capable of being categorized by the individual phases and by the applicable air district.

Section 6: Analysis and Conclusions, presents a summary of the major findings and the influence of various different factors and components on the potential emissions and air quality impacts.

1.1 Platform Arrangements

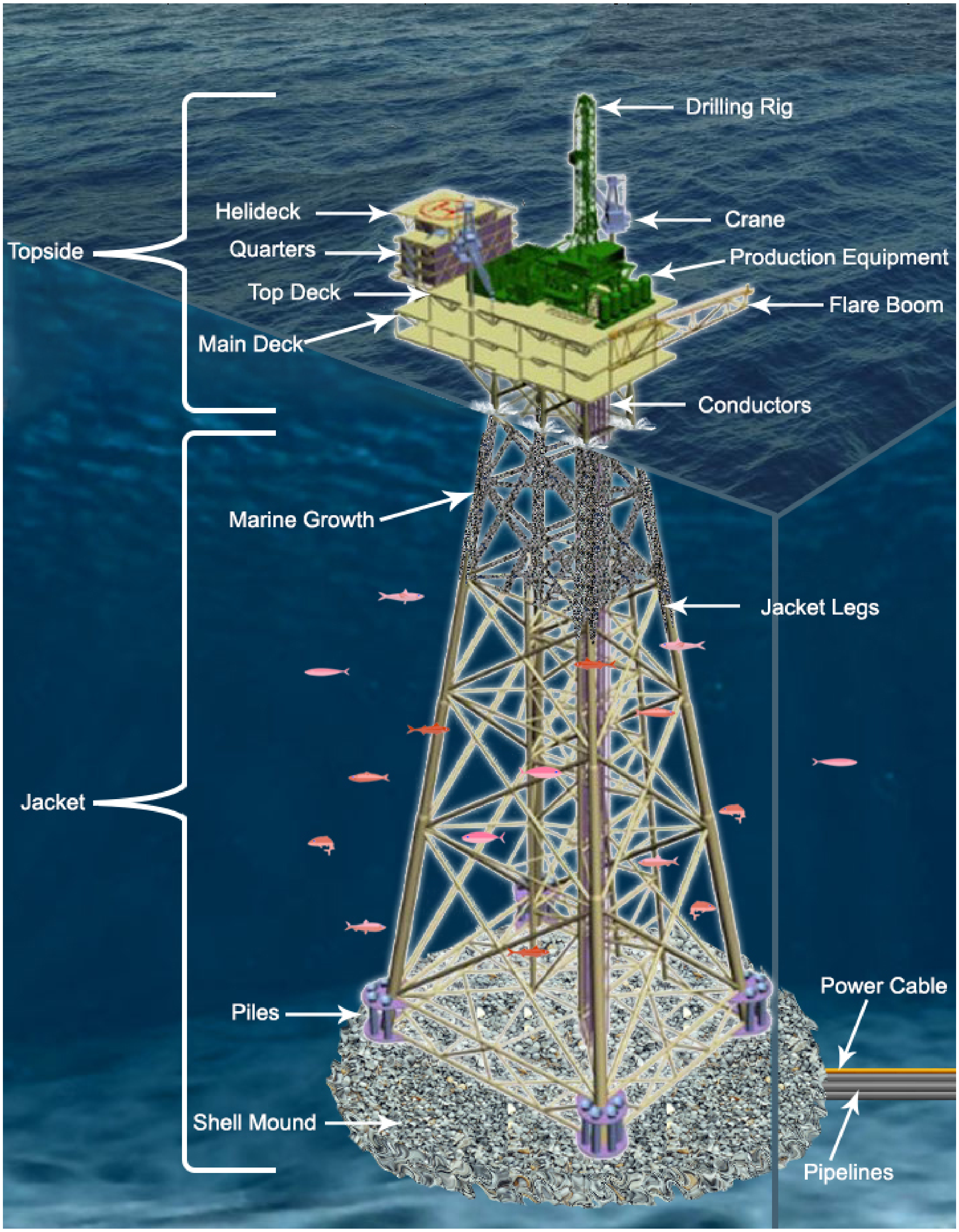
All the platforms in the Pacific OCS are fixed-leg platforms with pipeline connections to onshore processing facilities. Some of the platforms have extensive processing, including gas processing, whereas others primarily just perform gas and liquids separation and transportation of the production fluids to shore. Some platforms have power cable connections to shore that allow for electricity to be delivered to the platforms, whereas others utilize on-platform electrical generation with gas-powered or diesel-powered generators.

Figure 1 provides a schematic of a fixed-leg platform showing the different components.

A fixed-leg platform is composed of a topside and a jacket. The topside is the portion of the platform above the water; the topside contains facilities for employees, well drilling equipment, and all the equipment for processing and transporting the produced gas and fluids to shore. The topside is generally composed of a series of “modules” that are made separately and connected when the platform topside was installed. Total deck/topside weights range up to more than 9,800 tons for the Pacific OCS platforms, with the number of modules ranging up to 13.

The jacket is the portion that holds the topside and is positioned on the ocean floor. The jacket can be extensive, with some of the Pacific OCS platform jackets reaching more than 1,000 feet deep. Pacific OCS jackets have 8-12 legs and weigh up to 43,000 tons. The piles are the connections that are driven in to the ocean floor to hold the platforms to the ocean floor.

The wells that are drilled from the platform decks pass through conductor “pipes” which are placed between the deck and the ocean floor to protect the well piping. There is a single conductor for each well on the platform. The number of wells on a single platform range up to 63 in the Pacific OCS.



Source: Smith 2016 Figure 13-1, modified by MRS Environmental, Inc

Figure 1. Typical fixed leg platform arrangement

1.2 Decommissioning Phases

Removal of a Pacific OCS platform would involve several distinct phases. These would include the following:

- Pre-Abandonment (well-plugging & abandonment, platform preparation, marine growth removal, removal of conductors, etc.)
- Topside Removal
- Jacket Removal
- Debris Removal (shell mounds and surveys)
- Pipelines and Power Cable Removal
- Processing/Disposal (transfer components to shore (tugs/cargo barges), processing, recycling, shipment, disposal of materials onshore, etc.)

Platform preparation would include the cleaning of equipment and the purging of hydrocarbons. The detailed air emission estimates in this study follow this phase grouping, although some phases may be performed in parallel, such as pipeline removal and jacket removal. Emissions associated with the transportation of equipment and materials to the site are divided into emissions that would occur in California air districts (Santa Barbara, Ventura and South Coast). Emissions associated with bringing a large, heavy-lift derrick barge (DB) to California from the Gulf of Mexico (GOM), Asia, or Europe are a substantial portion of the emissions, but are not associated with emissions within California that would be required to be quantified for obtaining a permit from an air district.

The primary source of emissions from decommissioning would be internal combustion engines in the form of diesel engines, associated with construction equipment (compressors, generators, cranes, etc.), crew and supply boats, tugboats used to transport cargo barges and other barges, and generators and propulsion and generator engines associated with derrick barges.

Details on the specific phases are discussed in section 3.

2 Air Regulations

The decommissioning and removal of the offshore platforms will be subject to air quality regulations and associated permitting under local, State, and Federal air districts. Each of these are discussed in the sections below in summary. Details on the regulations are included in Appendix A.

2.1 Federal

Federal regulations related to air quality are listed below and define the air quality standards, prevention and control, thresholds for environmental review, performance standards, standards for marine engines, and decommissioning activities.

Clean Air Act: The Federal Clean Air Act of 1970 and 1990 Clean Air Act Amendments provide provisions for the attainment and maintenance of the National Ambient Air Quality Standards (NAAQS).

Title 42 – Air Pollution Prevention and Control: Section 7627, Air Pollution from Outer Continental Activities, defines an OCS source as any equipment, facility or activity that:

- emits or has the potential to emit any air pollutant;
- is regulated or authorized under the Outer Continental Shelf Lands Act; and
- is located on the OCS or in or on waters above the OCS.

The definition further delineates "activities" to include, but not be limited to, platform and drill ship exploration, construction, development, production, processing, and transportation. OCS vessel emissions under Section 7627 are defined as emissions from any vessel servicing or associated with an OCS source, including while at the OCS source or en route to or from the OCS source within 25 miles of the OCS source, and are considered direct emissions from the OCS source.

Ambient Air Quality Standards: The Clean Air Act sets NAAQS (40 CFR part 50) for pollutants considered harmful to public health and the environment. The Clean Air Act identifies two types of NAAQS. Primary standards provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

NEPA Thresholds: An air quality assessment to include modeling is required to assess impacts to air quality and/or Air Quality Related Values (AQRV) if a proposed project meets the criteria below:

- Emissions/Impacts - the proposed action:
  - Is anticipated to cause a substantial increase in emissions based on the emissions inventory; or
  - Will materially contribute to potential adverse cumulative air quality impacts as determined under NEPA.
- The geographic location of the proposed action is in:
  - Proximity to a Class I or sensitive Class II Area; or
  - A non-attainment or maintenance Area; or
  - An area expected to exceed the NAAQS or PSD increment based on monitored or previously modeled values for the area, proximity to designated non-attainment or maintenance areas, or emissions for the proposed action based on the emissions inventory.

New Source Review/Prevention of Significant Deterioration (40 CFR 51/52): regulations apply to new major sources or major modifications at existing sources for pollutants where the area the source is located is in attainment, non-attainment, or unclassifiable with the NAAQS.

OCS Air Regulations (40 CFR 55): The OCS air regulations establish the requirements to control air pollution from OCS sources to attain and meet the Federal NAAQS and State CAAQS. These requirements are delegated to, and enforced by, the local air pollution control districts through equivalent permits as discussed in Section 2.5.

Part 55 (40CFR55.2) defines an OCS source as any equipment, activity, or facility which:

- emits or has the potential to emit any air pollutant;
- is regulated or authorized under the Outer Continental Shelf Lands Act; and
- is located on the OCS or in or on waters above the OCS.

The definition includes vessels in two cases:

- only when they are permanently or temporarily attached to the sea bed and used to explore, develop, or produce resources; and
- physically attached to an OCS facility, in which case only the stationary source aspects of the vessels will be regulated.

Potential emissions are defined (40CFR55.2) as the maximum emissions of any pollutant from an OCS source at its design capacity. The definition further notes emissions from vessels servicing or associated with an OCS source shall be considered direct emissions from such a source while at the source. Emissions from vessels en route to or from the source within 25 miles of the source are to be included in the potential to emit calculation for the OCS source.

New Source Performance Standards (40 CFR 60): The use of tier-certified engines demonstrates compliance with the emissions limits of the New Source Performance Standards. Local air quality districts enforce this requirement using analogous rules and regulations.

Emission Standards for Hazardous Air Pollutants (40 CFR 61 and 63): establish are stationary source standards for hazardous air pollutants.

Operating Permits (40 CFR 70): All OCS platforms have Part 70 permits as required under Title V of Clean Air Act.

Fuel Sulfur Content (40 CFR 80): Part 80 addresses diesel fuel sulfur requirements. Beginning in 2010-2012, diesel fuel sulfur for non-road, locomotive and marine (NRLM) engines was limited to 15 ppm sulfur.

Emissions from Marine Engines (40 CFR 94 and 1094): The diesel marine engine regulations address control of emissions from new and in-use marine compress-ignition (diesel) and vessels.

Decommissioning Activities (30 CFR 250 Subsection Q): Part 30 CFR 250, Oil and Gas and Sulphur Operations in the OCS, provides requirements for decommissioning of OCS platforms:

Many aspects of these requirements could affect air emissions, such as removal or abandonment in place of pipelines, removal depth requirements and post-removal survey and trawling requirements.

Additionally, the requirements allow for a pipeline to be decommissioned in place, as approved by BSEE, if the pipeline does not constitute a hazard to navigation or commercial fishing operations, does not interfere with other uses of the OCS, or have adverse environmental effects.

Depending on the age, depth and slope and the associated permitted discharges from the platform, shell mounds have formed under some of the OCS facilities and consist of drill muds and drill cuttings with the shell material providing a cap like cover. Currently no regulations require the removal of the shell mounds except for the Federal requirements in 30 CFR 250 that ensure that decommissioning is done in a manner that does not unreasonably interfere with other uses of the OCS and does not cause undue or serious harm or damage to the human, marine, or coastal environment.

Additional provisions require the removal of all platforms and facilities to at least 15 feet below the mudline. Therefore, casings are required to be removed to 15 feet below the mudline as well as pilings, which would affect the amount of material removed and transported. Removal of some portion of the muds under a platform could be associated with removal of the shell mounds, but there are no regulatory requirements to do so.

2.2 State of California Rules and Regulations

The State of California has many regulations that may be applicable to decommissioning activities. These are summarized below and discussed in more detail in Appendix A.

California Air Resources Board (CARB): The CARB establishes the California Ambient Air Quality Standards.

California Health and Safety Code – Air Resources (Division 26): The CARB has established standards for diesel fuel, on-road diesel engines, off-road (non-highway) diesel engines, portable equipment, marine engines, and air toxics. These standards are applicable to many of the equipment types required for the decommissioning of the OCS platforms and are discussed in the following sections.

California Diesel Fuel Regulations: With the California Diesel Fuel Regulations, the CARB set sulfur limitations for diesel fuel sold in California for use in on-road and off-road motor vehicles. The rule initially excluded harbor craft and intrastate locomotives, but it later included them with a 2004 rule amendment. Under this rule, diesel fuel used in motor vehicles, except harbor craft and intrastate locomotives, has been limited to 500-ppm sulfur since 1993. This sulfur limit was later reduced to 15-ppm, effective September 1, 2006, for all source types.

Off-Road Diesel Fueled Fleets: Off road equipment would be used at the ports for breaking apart the materials and possibly on barges located offshore, such as cranes and generators. On July 26, 2007, the CARB adopted a regulation to reduce diesel PM and NOx emissions from in-use (existing) off-road heavy-duty diesel vehicles in California. Applicable vehicles include those used in construction, mining, industrial operations, and include work over rigs and have a number of requirements including reporting, labeling and fleet average emissions levels. Implementation of the requirements are a function of the fleet sizes and horsepower and are phased in over a period of years, with prohibitions on the addition of any Tier 0 or Tier 1 equipment after 2014, prohibitions on the addition of Tier 2 equipment after 2018 for large fleets and 2023 for small fleets.

California Statewide Portable Equipment Registration Program (PERP): allows for owners or operators of portable engines and certain other types of equipment to register their units with CARB to operate their equipment throughout California without having to obtain individual permits from local air districts. Certain engines registered in the PERP program are also subject to the Airborne Toxic Control Measures (ATCM) for diesel particulate matter (DPM).

California Code Diesel Engine Requirements Marine Craft: Title 13, Section 2299.5 provides a low sulfur fuel requirement, emission limits and other requirements for commercial harbor craft. Title 17, Section 93118.5 provides emission limits for marine engines by size and Tier level as shown in the Appendix A tables.

AB 2503 Rigs to Reef: Rigs to Reef established the California Artificial Reef Program and is administered by the Department of Fish & Wildlife Service. The Rigs to Reef program allows for consideration for partial removal oil & gas platforms if, compared to full removal, there is a net environmental benefit and substantial cost savings.

H&SC Section 42301 - Emission Offsets: Assembly Bill 3047 added to Section 42301.13 of the California Health and Safety Code pertaining to the demolition or removal of stationary sources. Section 42301.13 prohibits an air district from requiring, as part of its permit system or otherwise, that any form of emission offset or emission credit be provided to offset emissions resulting from any activity related to, or involved in, the demolition or removal of a stationary source.

California Environmental Quality Act (CEQA) Thresholds: requires State and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible.

2.3 Local Air Districts

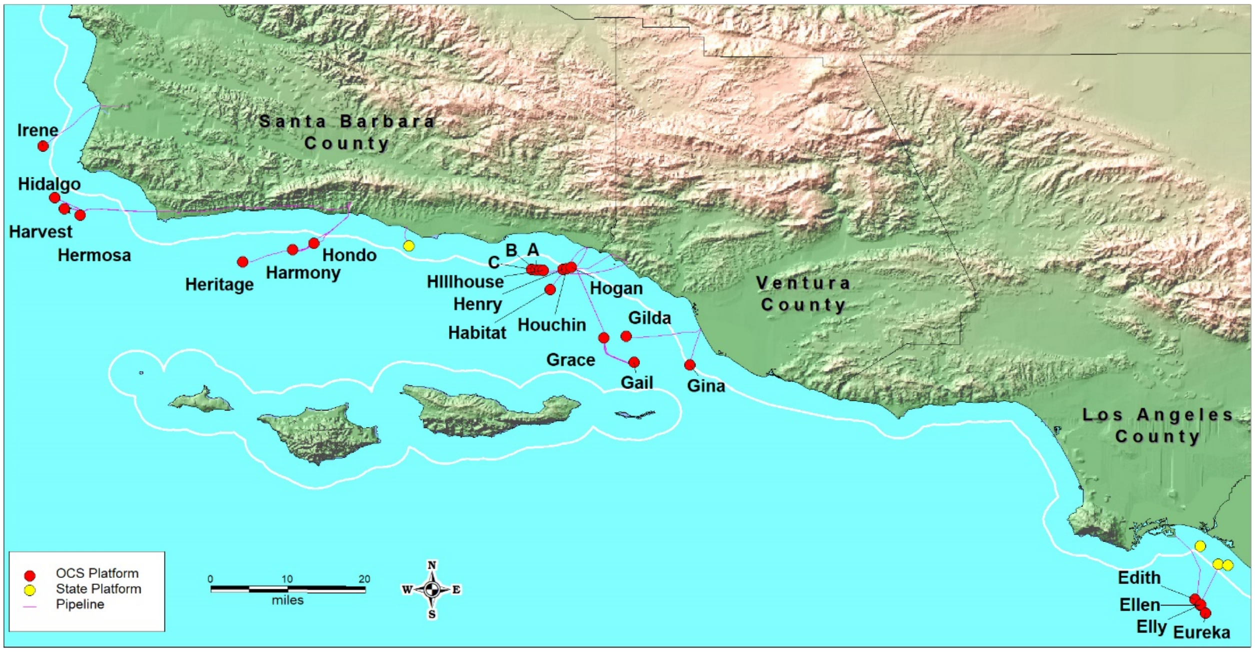
Local air districts in which Pacific OCS platforms reside are the Santa Barbara County Air Pollution Control District (SBCAPCD), the Ventura County Air Pollution Control District (VCAPCD), and the South Coast Air Quality Management District (SCAQMD) operating in Los Angeles County. The decommissioning of each OCS platform will require coordination with the applicable local air quality agency. Applicable agencies for each platform are shown in **Table 1** and in **Figure 2**. The three agencies all have similar but separate permit application processes and requirements. However, the specific requirements for decommissioning of the OCS platforms have only preliminarily been determined (See Appendix C). The following sections present an overview of potential applicable rules, permit requirements, and thresholds of significance for each local agency. The information in this section has been augmented by correspondence and interaction with the three air districts. Input on applicable rules and regulations, permit types and process, impact thresholds, the PERP program, mitigation measures, and applicability and use of offsets was discussed with staff at each air district.

2.3.1 Santa Barbara County Air Pollution Control District (SBCAPCD)

The SBCAPCD has local jurisdiction over 15 of the California OCS platforms. The platforms along with the associated permit numbers are listed in **Table 1**.

2.3.1.1 Rules and Regulations

SBCAPCD issues and enforces the applicable local, State, and Federal air quality regulations. Potentially applicable SBCAPCD rules (March 2018) for decommissioning activities are summarized in Appendix A. These District rules are also contained in 40 CFR part 55 Appendix A.



Source: MRS Environmental, Inc.

Figure 2. Map of OCS platforms and pipelines

2.3.1.2 General Permit Approach

For new or modified stationary sources, SBCAPCD typically issues an Authority to Construct (ATC), and a Permit to Operate (PTO). The ATC is required before construction begins, and consistent with the Federal 40 CFR Part 55 NOI process, should be submitted well in advance of the project start date. For abandonment work, the District would issue an ATC or possibly a PTO. Section 2.3.1.4 provides more detailed information on the likely permitting process for decommissioning activities.

2.3.1.3 Potential Permit Exemption Options

Certain activities and operations may be exempt from SBCAPCD rules and regulations and therefore permitting requirements. Rule 202 provides the following potential rules exemptions.

- Temporary equipment (202.D.5) – temporary equipment that is not part of an existing stationary source and the projected aggregate emissions of all affected pollutants do not exceed 1 ton (5 tons for CO) and the use does not exceed 60 days in any consecutive 12-month period.
- Replacement equipment (202.D.9) – a permit is not required for the replacement in whole or in part for any piece of equipment with an existing PTO.
- Construction Equipment (202.D.16) – If the combined emissions from all construction equipment have a projected total over 25 tons of any pollutant (except CO) over a 12-month period, offsets are required under Rule 804, *Offsets*.

Table 1. OCS platforms and associated local air quality district and permitted emissions

Platform	Local Air Quality District	Current Operator	Federal and Local Permit Number	Permitted Facility Emissions (tons per year)						
				NO_x	ROC	CO	SO_x	PM	PM_{10}	GHG
A	SBCAPCD	DCOR	9110-R4	24.3	45.9	24.1	0.72	2.42	2.37	2,106
B	SBCAPCD	DCOR	9111-R4	23.2	46.3	22.1	1.33	2.70	2.65	1,775
C	SBCAPCD	DCOR	9112-R4	23.6	34.3	22.4	1.36	2.74	2.68	1,867
Edith	SCAQMD	DCOR	166073-R9	92.0	148.3	654.1	24.3	58.9	-	-
Ellen	SCAQMD	BETA	166073-R9	92.0	148.3	654.1	24.3	58.9	-	-
Elly	SCAQMD	BETA	166073-R9	92.0	148.3	654.1	24.3	58.9	-	-
Eureka	SCAQMD	BETA	166073-R9	92.0	148.3	654.1	24.3	58.9	-	-
Gail	VCAPCD	Venoco	01494	60.9	24.2	203	3.50	8.13	-	-
Gilda	VCAPCD	DCOR	01492	82.3	26.4	24.7	2.91	5.13	-	-
Gina	VCAPCD	DCOR	01491	26.4	5.23	7.88	4.75	1.61	-	-
Grace	VCAPCD	Venoco	01493	46.7	17.4	122	2.77	4.02	-	-
Habitat	SBCAPCD	DCOR	9107-R4	21.5	42.9	18.9	1.70	4.32	4.24	-
Harmony	SBCAPCD	ExxonMobil	9101-R5	220	73.9	122	74.3	19.9	19.6	34,133
Harvest	SBCAPCD	FMOG	9103-R5	366	122	199	43.2	26.0	25.6	227,888
Henry	SBCAPCD	DCOR	9113-R4	23.4	20.9	23.6	1.34	3.17	3.12	2,056
Heritage	SBCAPCD	ExxonMobil	9102-R5	223	75.8	121	73.5	20.0	19.7	34,222
Hermosa	SBCAPCD	FMOG	9104-R5	195	88.0	107	36.9	17.1	16.6	129,667
Hidalgo	SBCAPCD	FMOG	9105-R5	197	74.4	86.7	26.5	17.2	16.8	-
Hillhouse	SBCAPCD	DCOR	9114-R4	30.1	53.1	23.5	1.36	3.19	3.13	2,544
Hogan	SBCAPCD	POOI	9108-R4	67.9	16.3	23.0	0.33	7.19	6.99	5,260
Hondo	SBCAPCD	ExxonMobil	9100-R5	153	84.9	75.1	60.1	14.1	13.9	17,830
Houchin	SBCAPCD	POOI	9109-R4	87.0	18.5	34.6	0.34	8.36	8.46	9,650
Irene	SBCAPCD	FMOG	9106-R7	51.5	32.3	20.0	9.06	5.51	5.35	3,305

Notes: SCAQMD permits are for all platforms combined; therefore, emissions are divided by the four platforms. GHG Emissions are qualified in short tons, as per SBCAPCD permits.

- PERP Equipment (202.F.2) – A permit for equipment under the PERP is not required; however, Rule 202.D16 for construction equipment does apply. To operate PERP equipment in State territorial waters and the OCS requires a 14-day notice and the information outline in Form APCD-38P.
- Marine Vessels (202.F.7) – a permit is not required for marine vessels if the potential to emit per stationary source is less than 25 tons per year of any affected pollutant over a consecutive 12-month period. It is possible each platform could be considered a separate stationary source for this exemption. This exemption requires Form APCD-38M, Marine Vessel Exemption Request.
- New Source Review for Marine Vessel Engines (202.F.8) – Marine vessels operating for less than 12 consecutive months and that do not exceed 10 tons of NO_x, oxides of sulfur, reactive organic compounds or PM are not subject to New Source Review (SBCAPCD Regulation VIII). The exemption applies to construction, maintenance, repair, and/or demolition activities and includes propulsion engines, auxiliary engines, and permanently affixed support engines.

2.3.1.4 The Application of SBCAPCD Air Regulations to OCS Decommissioning

The application of the regulations is dependent upon the interpretation of a number of issues, including the extent to which the decommissioning activities are considered “OCS sources”, and therefore subject to 40 CFR part 55, which allows for the corresponding onshore area (COA) to implement their respective rules and regulations and permitting requirements. The application of the COA permitting requirements also depends on the extent to which the decommissioning equipment is considered to be a stationary source, and therefore subject to the COA District rules and regulations.

Discussions with the SBCAPCD, which maintains current jurisdiction over the majority of the Pacific OCS platforms (15 of the 23 platforms), indicate that the decommissioning activities would be required to obtain an ATC or a PTO, as would any activity associated with the current operations of the platforms. The platforms would retain their stationary source designation throughout the entire decommissioning and dismantling process, including platform and pipeline removal. District permits would be required pursuant to Rule 201 (Permits Required) for decommissioning. This includes the need to comply with all State and District rules incorporated into the OCS Air Regulation in Appendix A of 40 CFR Part 55. Note that the 4H decommissioning activities in 1996 (in State waters), which were performed 4 years after the wells had been P&A’d, were issued a PTO.

Generally, P&A and equipment clean-out activities could be conducted under the existing platform PTOs. These activities may require modification to the existing PTOs to cover new equipment sources, increases in allowed boat trips, etc.

Decommissioning activities like removal of topsides, jacket, pipelines, power cables, etc. would need a new ATC or PTO and would be subject to New Source Review (NSR), which would likely trigger Best Available Control Technology (BACT) requirements on non-propulsion related equipment. BACT is required for projects where emissions exceed specified thresholds for various air pollutants as detailed in Rule 802.D. Non-propulsion equipment would include items such as derrick barge generators, cranes, dive generators, etc. In addition, as PERP is not applicable to the OCS, all PERP-type equipment would also be required to come under the respective permit.

It is possible that sources of emissions from decommissioning operations such as topside and jacket removal would not be platform-specific, in the sense that emissions generated from a derrick barge used to abandon multiple platforms would be considered a single source subject to permits.

The implementation of offsets as a tool to obtain a net air quality benefit is generally prohibited for the demolition or removal of a stationary source by California Health and Safety Code (H&SC) section 42301.13 as well as through the inclusion of 42301.13 in Appendix A of 40 CFR part 55. In August 2016, the SBCAPCD updated their new source review rule 802, part B - exemptions, to include the H&SC section 42301.13 (rule 802.B.3). Therefore, for the SBCAPCD, offsets would not be allowed for the decommissioning projects as part of the permitting process.

Toxic emissions and corresponding health risk assessments would not be required as they are not required for emissions from OCS sources.

The District requirements and thresholds for conducting an Air Quality Impact Analysis (AQIA) to examine for potential exceedances of air quality standards, would likely be applicable to the decommissioning activities since the activities would exceed the AQIA thresholds specified in Rule 802. F. As the decommissioning sources would be located substantially offshore, receptor selection in the AQIA would be critical. Generally, areas near the offshore activities would be only subject to short term (1-hour or 3-hour) pollutant standards, if any, as listed in Rule 805.F table 1, as recreational vessels, which are considered receptors, would not be present for extended periods of time. Onshore receptors, however, would be potentially subjected to longer exposure times, and, even though they are located at a considerable distance from the source location, demonstration of compliance most likely would be required. In addition, as per Rule 805.G, pre-construction ambient air monitoring may be required.

2.3.2 Ventura County Air Pollution Control District (VCAPCD)

The VCAPCD has local jurisdiction over four platforms in the OCS. The platforms along with the associated permit numbers are listed in **Table 1** above.

2.3.2.1 Rules and Regulations

VCAPCD issues and enforces the applicable local, State, and Federal air quality regulations. Potentially applicable VCAPCD rules (March 2018) for decommissioning activities are summarized in Appendix A**.** These District rules are also contained in Appendix A of 40 CFR part 55.

2.3.2.2 General Permit Approach

The VCAPCD also employs a similar two permit program as the SBCAPCD. Operators of stationary sources are required to obtain an Authority to Construct (ATC) before construction or modification begins. The ATC provides the District staff time to review the project plans and determine if the project will comply with all applicable District rules. The District integrates State and Federal requirements for new source review into its ATC process. After construction is completed, but before operation begins, operators are required to obtain a PTO. For platform abandonment work, the District would issue an ATC. Section 2.3.2.4 provides more detailed information on the likely permitting process for decommissioning activities.

2.3.2.3 Potential Permit Exemption Options

Certain activities and operations may be exempt from VCAPCD rules and regulations and therefore permitting requirements. Rule 23 provides the following potential rules exemptions.

- Rule 23.D.2 exempts marine vessels that transport freight, equipment mounted in the marine vessel may not be exempt if required by any other rule.

- Rule 23.DS.6 exempts internal combustion engines with a maximum continuous design power rating of less than 50 bhp and gas turbines with a rated full load output of less than 0.30 megawatts (300 kilowatts) at ISO Standard Day Conditions.
- Rule 23.F.10 exempts cleaning operations and materials as follows for cleaning agents certified by the SCAQMD as Clean Air Solvents.

2.3.2.4 The Application of VCAPCD Air Regulations to OCS Decommissioning

Based upon discussion with VCAPCD, if they determine that decommissioning activities are OCS sources, then they would have similar permitting authority as the SBCAPCD. District permits would be required pursuant to Rule 10 (Permits Required) for decommissioning. This includes the need to comply with all State and District rules incorporated into the OCS Air Regulation in Appendix A of 40 CFR Part 55.

Generally, P&A and equipment clean-out activities could be conducted under the existing platform PTOs. These activities may require modification to the existing PTOs to cover new equipment sources, increases in allowed boat trips, etc.

Decommissioning activities like removal of topsides, jacket, pipelines, power cables, etc. would need a new ATC or PTO and would be subject NSR and BACT requirements on non-propulsion related equipment. BACT is required for projects where projects emit pollutants listed in Rule 26.2.A. Non-propulsion equipment would include items such as derrick barge generators, cranes, dive generators, etc. In addition, as PERP is not applicable to the OCS, all PERP-type equipment would also be required to come under the respective permit. In addition, the decommissioning project would need to demonstrate that it would not cause the violation of any ambient air quality standard or the violation of any ambient air increment (as per Rule 26.2.C).

Although the VCAPCD has not incorporated H&SC section 42301.13 into their rules, section 42301.13 is included in Appendix A of 40CFR part 55 and the VCAPCD would therefore be prohibited from requiring offsets under the permit process.

Toxic emissions and corresponding health risk assessments would not be required as they are not required for emissions from OCS sources.

2.3.3 South Coast Air Quality Management District (SCAQMD)

The SCAQMD has local jurisdiction over four platforms in the OCS. The platforms along with the associated permit numbers are listed in **Table 1** above.

2.3.3.1 Rules and Regulations

SCAQMD issues and enforces the applicable local, State, and Federal air quality regulations. Potentially applicable SCAQMD rules (March 2018) for decommissioning activities are summarized in Appendix A. These District rules are also contained in Appendix A of 40 CFR part 55.

2.3.3.2 General Permit Approach

The SCAQMD permit process involves the same two permit process as the SBCAPCD and VCAPCD. The initial permit is the Permit to Construct (PC) applied for and issued prior to installation of new or relocated equipment, or prior to modification of an existing equipment. The follow-up permit is a PO.

2.3.3.3 Potential Permit Exemption Options

SCAQMD Rule 1304 lists exemptions to regulations, potential exemptions for decommissioning activities may include:

- Rule 1304(a)(7) allows for exemption from modeling and offset requirements for portable equipment if the source is periodically relocated and is not located more than twelve consecutive months at any one facility in the District. The exemption does not apply to portable internal combustion engines.
- Rule 1304(a)(8) allows for exemption from modeling and offset requirements for portable equipment if the source is periodically relocated and is not located more than twelve consecutive months at any one facility in the District. The source must not cause an air quality standard exceedance and the emissions from the engine do not exceed the following limits:
    - Volatile Organic Compounds (VOC) 55 pounds per day;
    - Nitrogen Oxides (NO_x) 55 pounds per day;
    - Sulfur Oxides (SO_x) 150 pounds per day;
    - Particulate Matter (PM_{10}) 150 pounds per day; and
    - Carbon Monoxide (CO) 550 pounds per day.

2.3.3.4 The Application of SCAQMD Regulations to OCS Decommissioning

If the determination is made by the SCAQMD that the decommissioning activities are OCS sources, then the SCAQMD would have similar permitting authority as SBCAPCD and VCAPCD. SCAQMD maintains current jurisdiction over 4 of the 23 Pacific OCS platforms. District permits will be required pursuant to Regulation II-Permits for decommissioning. This includes the need to comply with all State and District rules incorporated into the OCS Air Regulation in Appendix A of 40 CFR Part 55.

It is likely that P&A and equipment clean-out activities could be conducted under the existing platform POs. These activities may require modification to the existing PO's to cover new equipment sources, increases in allowed boat trips, etc.

It is likely that the District would issue a permit to construct (PC) for decommissioning activities such as topside, jacket, pipeline and power cable removal. These decommissioning activities would be subject to NSR and require the implementation of BACT on non-exempt equipment (as per rule 1303.A) In addition, the decommissioning project would need to demonstrate that it would not cause the violation of any ambient air quality standard or the violation of any ambient air increment (as per Rule 1303.B.1).

Although the SCAQMD has not incorporated H&SC section 42301.13 into their rules, section 42301.13 is included in Appendix A of 40 CFR part 55, and therefore the SCAQMD would not be allowed to require offsets as part of the permitting process.

Toxic emissions and corresponding health risk assessments would not be required as they are not required for emissions from OCS sources. The use of PERP equipment would be included in the permit.

Generally, all P&A activities could be conducted under the existing permits, with some modifications as needed to ensure emissions limits are adhered to or modified. Additional activities associated with decommissioning would require new construction-related permits.

2.4 Net Air Quality Benefit

Federal guidance on the requirement for a positive net air quality benefit is present in Appendix S of 40 CFR 51, condition 4 for sources that would locate in a designated nonattainment area. In California, new source review associated with air district rules are designed with the implicit assumption that if the emission offset requirements of a new source review rule are met by a new or modified source, the requirement to demonstrate a positive net air quality benefit is fulfilled. However, California has adopted rules that do not allow for offsets for decommissioning activities, consistent with H&SC section 42301.13, and section 42301.13, which is included in 40 CFR part 55 Appendix A. Therefore, for all OCS decommissioning activities, other measures may be required to achieve a net air quality benefit such as:

- Credit for the elimination of operational emissions;
  - As the emissions associated with the operations of the platforms would be eliminated when the platform is decommissioned, this may be a source of emission reductions that could be credited towards the decommissioning emissions to achieve a net air quality benefit. Operational emissions would be removed permanently, year-after-year, whereas decommissioning emissions would last for 1-2 years for each platform.
- Permanent surrendering of offsets used for platform PTO/POs;
  - Existing offsets used as part of existing platform permits, if applicable, may also be surrendered as a means of offsetting the decommissioning emissions.
- Offsets applied through environmental review (NEPA/CEQA);
  - As part of the environmental review of the project, under CEQA or NEPA, mitigation could be required which could include, amongst other items, the application of emission reduction credits. This would apply to all of the Districts, or whoever is the Lead Agency for NEPA or CEQA.
- Control technology options;
  - Control technology options could provide substantial reduction in emissions from a number of large sources associated with the decommissioning projects. These could include the use of higher tier marine engines, such as Tier 4 clean engines. Implementation of technologies on large sources, such as selective catalytic reduction on the derrick barge large generator engines to reduce NO_x emissions by over 80 percent, could also be implemented. Ensuring degassing of equipment and utilizing the existing platform flares is a method to ensure hydrocarbon fugitive emissions are minimized. District guidance documents for air quality contain a number of mitigation measures, such as those listed above, which could be implemented to reduce emissions, and could be either proposed by applicants or required as part of the permitting process.
- Emission reduction programs.
  - Emission reduction programs are programs located in the community to which a project can contribute to reduce emissions as a means of obtaining the equivalent of offsets. A program recommended by the SBCAPCD and VCAPCD is the CARB vessel speed reduction program, where funds are applied to reduce the speed of ocean-going vessels passing through the Santa Barbara Channel. A reduction in speed corresponds to a substantial reduction in emissions from ocean-going vessels, providing an economical means of reducing emissions. Other emission reduction programs as sponsored by individual districts and could also allow for equivalent “offset” measures which would allow for achieving a net air quality benefit.

3 Decommissioning Operations and Timing

This section details the operations and timing requirements related to the decommission of the Pacific OCS facilities, including the six decommissioning phases. Durations of activities, estimated vessel trips and mobilization requirements are discussed below for each of the six phases. Duration and trips are included for each platform, as well as a per unit for some activities, which will allow for the quantification of emissions for each platform system (platforms, pipelines, power cables, etc.) based on the characteristics of each individual platform system. Equipment requirements and equipment specifics are discussed in Section 4.

The information compiled here is incorporated into the platforms database in the DEEP spreadsheet, which includes information on the platform specifics (such as depth, associated pipelines, jacket and deck weights, etc.).

Information on the timing of the individual phases and sub-phases was developed from previous reports, including Smith 2016, MMS 2000, Twomey 2000, studies related to the 4H platform decommissioning (Basavalinganadoddi and Mount 2004, Poulter 2003, CSLC 1997, SBCAPCD 1996) and British Petroleum United Kingdom decommissioning reports. In addition, the timing assumptions were shared with current operators of the Pacific OCS platforms and feedback was obtained on the assumptions for many of the platforms.

The six phases of the decommissioning process used in this report include the following:

- **Pre-abandonment**
- **Topside Removal**
- **Jacket Removal**
- **Debris Removal**
- **Pipelines and Power Cable Removals**
- **Processing/Disposal.**

The operations and timing requirements for each of these is discussed below. Note that many of the assumptions associated with this emissions estimate may change as detailed decommissioning plans are submitted. The discussion below assumes certain processes and equipment usage are needed in order to develop an accurate emission estimate for the individual phases. The process and corresponding emissions estimates in this study are hypothetical and will be revised based on the actual processes developed as part of the future decommissioning efforts.

3.1 Pre-Abandonment

Pre-abandonment activities would include the following activities:

- **Well-plugging & abandonment**
- **Topside platform preparation**
- **Marine growth removal**
- **Removal of conductors**

Pre-abandonment activities would involve plugging and abandoning wells utilizing either a rigless system or a drilling rig. Topside platform preparation involves preparing the platform for the removal of the topside modules, including equipment abandonment, removal of interconnections between the modules, preparation of transport connections and cleaning of components. Marine growth can be substantial on platform legs and conductors, and this marine growth would be removed prior to equipment removal. It is assumed that marine growth would be allowed to fall to the ocean floor. Conductors would then be removed which would utilize the platform cranes and cargo barges. At this point, the platform would be ready to have the topside modules removed.

Well plugging and abandonment timing would be a function of the complexity of the wells. As per Smith 2016, wells are categorized for rig-less well abandonments based on four levels of complexity; low, medium-low, medium-high and high. The definitions of well complexity are listed below.

- A low complexity well would be a straightforward well without deviation problems or sustained annular pressures, and without pumps.
- A medium-low complexity well would be more complex with mid-range horizontal displacements with deviations less than 50° at the surface casing shoe. A medium-low complexity well could have minor complications such as stuck pipe or short-term milling or fishing operations.
- A medium-high complexity well could have high deviations between 50° and 60° at the surface casing shoe or extended reach wells. They may contain electric submersible pumps or sucker rod pumps. A medium-high complexity well would have greater operational difficulties and time delays due to hydrogen sulfide concerns, longer fishing or milling operations.
- A high complexity well would have high deviations with greater than 60° maximum angles, severe dog legs or extended reach. A high complexity well may have operational difficulties including sustained annular pressures, parted casing, long term fishing or milling work, repeated trips in and out of the hole, etc.

In addition, discussions with platforms operators indicate that a number of wells may require the use of a drilling rig due to well complexity. Therefore, a fifth category is included that addresses the use of a drilling rig and associated activities. Generally, the use of a drilling rig would require additional timing and level of effort. The timing for the rigged well P&A is estimated based on the current timing levels associated with the CSLC efforts on Platform Holly and discussions with operators. The timing to plug and abandon each type of well is listed in **Table 2** for both a drilling rig and a rigless well P&A.

Table 2. Well complexity level and abandonment workdays

Well complexity level	Work days
Rig-less Low	3
Rig-less Medium-low	4
Rig-less Medium-high	5
Rig-less High	8
Rig	21

In addition to the P&A activities, there is an additional 7 days added on to the timing estimate at each platform to account for setup and breakdown of the P&A systems. As per Smith 2016, the P&A method that is likely to be used for most wells is the rig-less well P&A system. More complex well P&A operations may require the use of a rig. Additional information on the well complexity was not available on a per-well and per-platform basis; therefore, it was assumed that 50 percent of rig-less high complexity wells would require the use of a drilling rig system.

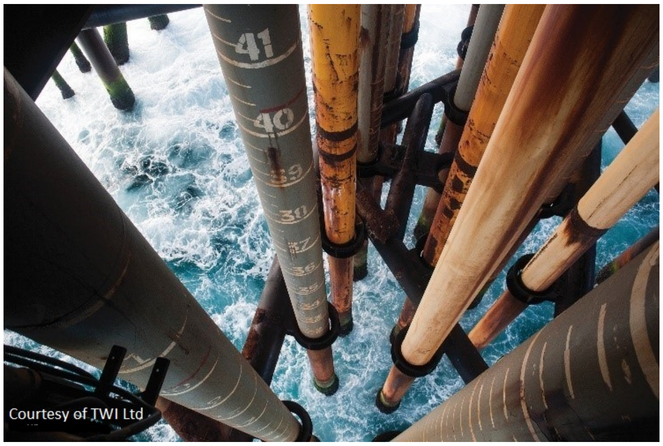
The estimates on a per well basis as applied to the database of wells and types of wells for each platform produces time estimates for P&A activities at each platform and are shown in **Table 3** at the end of this subsection.

Topside platform preparations involve the procedures associated with shutting down and preparing the facility for removal. Topside inspections and underwater inspections are conducted to determine the condition of the structure and to identify any problems for removal. Divers would perform the underwater inspection in water depths ranging from 0 feet to 200 feet and remotely operated vehicles (ROVs) would perform the underwater inspections from water depths ranging from 201 feet to 1,200 feet.

Topside preparation includes the flushing/cleaning and degassing/purging of tanks, processing equipment and piping; disposal of residual hydrocarbons; removal of platform equipment; cutting of piping and cables between deck modules; separation of modules into individual units; installation of connections for deck module lifting; removal of obstructions to lifting; and structural reinforcement. Below the water surface, the jacket would be prepared to aid in jacket facilities removal, including the removal of marine growth from the structure. Estimates of topside preparation timing are listed in Smith 2016 and included in **Table 3**, as confirmed and adjusted through discussions with some operators. Some of the activities, such as the flushing/cleaning and degassing/purging, would be conducted while the platform is still operational, when fluids can be disposed of through the existing pipelines, and vapors can be burned in the platform flare systems and these emissions are assumed to be incorporated into the existing operator permits and are not a part of this emissions estimate.

The marine growth would be removed from the structure, including the conductors and boat landings by divers down to approximately 100 feet below the ocean surface. This would remove most of the heavy and hard marine growth. The remaining balance of the marine growth below 100 feet would be removed at the offloading facility/scrap yard or by topside crews using high-pressure water blasters once the jacket or jacket section is on the deck of the barge. The in-water cleaning operations would be completed with the dive equipment set up on the platform. Removal of marine growth timing is included in the estimates of topside preparation timing.

Estimates of marine growth to be removed have been included in previous studies (Continental Shelf Associates, Inc. 2005). Sampling of marine growth on Platform Harvest indicated a growth levels from 2.5 to 415 kg/square meter with growth thickness as high as 30 cm. A value of 1,000 tons of marine growth per 8-leg platform is used as an assumed value (MMS 1997).



Conductors

Conductor removal combines three distinct procedures: severing, pulling/sectioning, and offloading. Severing of the conductor casings would be performed using abrasive cutting methods to sever the conductor and mechanical cutting methods for sectioning the conductor during recovery. Pulling the conductors would be done with the casing jack removal method. Casing jacks are utilized to lift the casings as well as make the initial lift to confirm that conductors have been completely severed prior to pulling. Pulling the conductor and casings entails using the casing jacks to raise the conductors on a platform deck which are then cut into 40-foot long segments. Offloading involves utilization of a crane to lay down each conductor casing segment in a platform staging area, offloading sections to a cargo barge, which are then transported to a shore-based port for offloading and disposal. The timing for the removal of the conductors and casings would be a function of the number and length of the conductors and casing at each platform, which is both a function of the number of casings and the platform water depth. The platform database includes information for each platform on the length and size of each conductor and casing, including the total weight. Information on conductor removal timing is shown in **Table 3**.

Conductors are assumed to be coated with some remaining marine growth which would be removed as they are pulled. Most of the marine growth would have been removed as a part of the platform preparation that occurs immediately prior to the conductor removal operations. The remaining marine growth would be removed during conductor recovery.

Conductor weights are included in the platform database and include the weights of the conductor, the casings and the cement in the annuli. Conductor length are based on water depth, 65 feet of clearance above the water and 15 feet below the mudline removal requirements. Conductors and casing would be raised simultaneously and cut at the same time in one complete segment. A cargo barge would be used to move cut conductors/casings to the Ports of Los Angeles or Long Beach (POLA/POLB). Distance to the ports are listed in **Table 3** depending on the platform. Barge speed would determine the timing of barge trips and the number of active barge/tug combination to allow for cut conductor/casing removal. Barge capacity is discussed in later sections and would determine the frequency of barge trips along with the weight of conductors.

Table 3. Pre-abandonment timing

Component	Value
Number of wells, per platform	0 – 63 wells to P&A
P&A Activities, per platform	0 – 457 days
Topside preparations, per platform	60 – 90 days
Conductor segment length	40 feet
Conductor time per segment	4 hours
Conductor length	Water depth + 15 feet below mudline + 65-foot height above water line
Conductor removal time, per platform	0 – 290 days
Barge speed	4 mph
Distance to POLA	11 – 168 miles

3.2 Topside Removal

Removal of the topsides would include the following activities:

- **Mobilization of equipment and crews**
- **Cutting and removal of equipment and deck modules**
- **Demobilization materials, equipment and crews**

A derrick barge (DB) would be mobilized to the platform location, along with cargo barges. The individual platform topside modules would then be removed by the DB and placed on the cargo barge for transport to a disposal location. The cargo barges are assumed to be transported and maneuvered by tugboats. Once all of the topside modules have been removed and loaded onto cargo barges, the removal of the topside would be complete.

Another method of removal is removing the topside in a single piece utilizing a large derrick barge, such as the Pioneering Spirit by Allseas, which is designed for a single-lift removal of topsides weighting up to 48,000 tons. The analysis in this study assumes a smaller DB removing the topside in modules. The use of the Pioneering Spirit is an example of the range of different decommissioning options that are available. Some DB also are self-propelled instead of utilizing tugboats. The emissions calculations are similar as the DB propulsion engines characteristics are entered as opposed to the tugboat engine characteristics.

Derrick Barge (DB)

Mobilization of the equipment would involve bringing the equipment from its source location to the work site. This would involve mobilizing the DB as well as the cargo barges, the cutting crew/equipment and the dive crew/equipment.

Mobilization of the DB would most likely require mobilization from outside the United States (Smith 2016), depending on the current location of the DB. Mobilization could take as long as 100 days. Offshore Magazine publishes a periodic inventory of heavy lift DBs (Moon 2016). The 2016 inventory included 80 heavy lift vessels that are classified as capable of platform abandonment. Of those, 21 have a lift capacity of greater than 2,000 tons with an additional 32 that have capabilities greater than 500 tons. The operating areas for these barges are shown in **Table 4** along with the total number of companies that have provided these types of barges. Companies include China National Offshore Oil Corporation, Emas Chiyoda Subsea, Heerema Marine, McDemott, Seaway and ZPMC-OTL Marine. Currently no such vessels are available on the U.S. West Coast and would have to be brought from other locations.

Table 4. Heavy lift barges, 2016 inventory

Operating region	Barges greater than 2,000-ton capacity	Barges between 500 – 2,000-ton capacity
Asia	4	2
Europe	1	4
Gulf of Mexico (GOM)	6	8
Middle East	1	6
Mexico	1	0
World General	8	12
Total	21	32
Number of different companies	12	11

Source: Moon 2016

Some cargo barges (300- and 400-foot long barges used for transport of the deck modules, jacket sections, conductors and pipeline sections) may be available at the west coast POLA/POLB. However, as the number of barges required can be quite high, up to 14 barges for the largest platforms, and as some platforms may be abandoned as a group, the number of cargo barges required would most likely exceed the number available in the Southern California area. Cargo barges would then need to be brought from the GOM or Seattle. Discussions with vendors indicate that cargo barges are available from Seattle and the GOM for the projects.

Dive crews and cutting crews and equipment are assumed to be available from area ports. The time to mobilize this equipment from the ports to the platform site is a function of the distance and the barge/tug speed. Mobilization times are included in the platform database and summarized in **Table 5**.

The use of the cargo barges could range from a single use to multiple uses. As dismantling the materials onshore might involve some dismantling on the cargo barge as well, in order to allow for small sections to be more easily removed from the barge with land-based cranes, a substantial amount of time could be required for cargo barge unloading. Therefore, this analysis assumes only a single trip for each cargo barge (as per Smith 2016), requiring multiple cargo barges for each platform removal. The number of cargo barges required are based on the weight of the platform and the barge capacity.

Removal of the deck modules would be performed with the DB and cargo barges. Timing of deck module removal would be a function of the size of the deck components and the complexity. Smith 2016 included information on the platform deck modules and timing. The number of deck modules per platform and the time to remove each deck module are included in the platform database. These assumptions by Smith 2016 were confirmed through discussions with operators and examining other historical decommissioning project timings and reports (MMS 2000, BP 2005/2011, SBCAPCD 1996).

Table 5. Topside removal timing inputs

Component	Value
Mobilization of Equipment	10 – 38 hours
Deck modules, separate and remove	12 – 30 hours per module
Number of deck modules per platform	2 – 13 modules
Deck removal, days	4 – 11 days

3.3 Jacket Removal

Removal of the jacket would include the following activities:

- **Mobilization of equipment and crews**
- **Removal of mud plug**
- **Severing of piles**
- **Removal of jacket sections**
- **Demobilize materials, equipment and crews**

Removal of the jacket would also utilize the DB. The jacket would be cut into sections and each section lifted by the DB onto an awaiting cargo barge for transport to a disposal location. The number of jacket sections would be defined by the capability of the DB to lift the jacket sections onto the cargo barge. For deeper platforms, a lifting barge may also be used to lift the jacket sections up to the point where the DB can complete the remainder of the lifting effort. A lifting barge is essentially a barge with less crane reach but with extra cabling to allow for lifting from a deeper position. As with the topside removal, a large DB, such as the Pioneering Spirit, could potentially lift an entire jacket from one of the large platforms in one section. This analysis assumes multiple jacket sections with a DB sized in the 2,000 – 3,000 ton range.

Mobilization of the equipment and crew would involve the use of the DB and the cargo barges as well as the diving and cutting crews and equipment, as per the removal of the topsides. Mobilization of the equipment and crews would be a function of the location of the platform and the distance the equipment is originally located from the area (DB location may be in Asia, for example). Mobilization of cargo barges and crews most likely would take place out of the POLA/POLB area, west coast or GOM. Equipment mobilization would be coordinated as part of the topside removal phase. However, additional cargo barges most likely would be required to move the jacket sections to port for disposal. Sectionalizing and cutting apart the deck modules and jacket sections at port would take a considerable amount of time, and each cargo barge may be used as a storage location for the removed parts; therefore, each cargo barge is assumed to be used only once (Smith 2016).

Severing of the piles to allow for removal of the jacket is also a function of the platform size and the extent of shell mounds that would have to be displaced to allow for severing of the piles the required 15 feet below the mudline. Information on pile severing times is included in the platform database and summarized in **Table 6**.

The jacket would be cut into sections, with the number of sections being a function of the jacket size and water depth. The timing per cut are included in the platform database. Each jacket section would be cut and then removed using the DB or a combination of the DB and a lifting barge for those jacket sections located below a 300-foot depth. Jacket section numbers per platform are shown in **Table 6**. Timing to remove each section as well as the number of sections is also included in the platform database and summarized in **Table 6**.

Table 6. Jacket removal timing inputs

Component	Value
Mud plug removal, per platform	16 – 46 hours
Severing the piles, per platform	24 – 285 hours
Jacket number of sections per platform	1 – 43 sections
Jacket cuts	16 – 48 hours per section
Jacket section removal	68 – 288 hours per section
Deck and Jacket removal per platform	13 – 136 days

Partial Removal Option: The number of sections of the platform jacket that would be removed as part of the partial removal option are also included in the platform database. Under the partial removal option, the jacket would be removed to 85 feet below the ocean surface. This generally assumes the removal of the first section of the jacket only. Some platform jackets, such as Platform A, B and C and Gina, Henry and Hillhouse, are only assumed to have a single section and a single lift for full jacket removal with no cutting of the jacket into smaller sections. Given the structure of these platforms, the partial removal option would involve the removal of the entire jacket, similar to the full jacket removal, except that the piles would not be removed.

Demobilization would include the transport of the loaded cargo barges back to the POLA/POLB or other port and the transportation of equipment and crews back to the ports.

Total time to remove jacket and topsides per platform are shown in **Table 7**.

Table 7. Platform removal timing estimates, topside and deck removal only

Platform	Full Removal, days	Partial removal, days
A	29	21
B	29	21
C	29	21
Edith	34	13
Ellen	22	11
Elly	25	10
Eureka	102	10
Gail	116	9
Gilda	34	12
Gina	18	13
Grace	27	8
Habitat	19	9
Harmony	182	11
Harvest	113	10
Henry	22	16
Heritage	167	11
Hermosa	100	9
Hidalgo	80	11
Hillhouse	27	20
Hogan	36	14
Hondo	98	13
Houchin	34	14
Irene	35	19

3.4 Debris Removal

Debris removal would include the following activities:

- **Mobilization of equipment and crews**
- **Removal of shell mounds**
- **Removal of miscellaneous debris**
- **Surveys of platform and pipeline areas**
- **Site clearance**
- **Demobilize equipment and crews**

Shell mounds accumulate under a platform due to the marine growth on the platform that falls to the ocean floor over time, as well as muds and cuttings that may have historically been discharged to the marine environment. As some of these materials may be contaminated, the shell mounds might be removed as part of the abandonment activities. The quantity of shell mounds to be removed, if removed, would affect the duration of the removal activities. Estimates of shell mound volumes were made by surveys on most platforms conducted in 2001 (MEC Analytical Systems, Inc. and Sea Surveyor, Inc. 2003). These surveys were used to estimate the volume of the shell mounds below the jackets at a future date assuming that shells are deposited at a linear rate since the year 2001. Some platforms were not surveyed in 2001 and these platforms shell mound volumes were estimated based on other platforms within similar depth, bottom slope and age.

In addition to the shell mounds that have accumulated over time, the marine growth on the jacket sections that would be removed as part of the platform pre-abandonment activities may be allowed to fall to the ocean floor and contribute to the size of the shell mounds. It is assumed that this marine growth would not be removed to the surface at the time of the platform pre-abandonment activities. This volume of marine growth has been added to the volume of the shell mounds to total the amount of debris under the platforms that would be removed as part of the debris removal activity. Shell mounds and deposited marine growth removal activity are assumed to utilize a clamshell bucket dredge. A clamshell bucket dredge, operated by a derrick from a stationary barge, would “bite” into the sediments, leaving a cratered surface. The removal rate is a function of the bucket size, fraction liquids, depth and lowering/raising speed.

Also, a portion of the volume below the mudline would also be removed approximately equal to the area of the shell mound. Shell mounds removal activities are based on an assessment of the removal requirements for the 4H shell mounds done for the CSLC as part of the draft Environmental Impact Report (EIR) for the shell mounds removal in 2010. Those removal estimates are included in **Table 8**.

Demobilization would include the transport of the cargo barges back to the POLA/POLB and the transportation of equipment and crews back to the ports. Timing for the demobilization would be the reverse of the mobilization timing, which is included in the platform database.

Site clearance operations are performed after all materials have been removed. Site clearance is conducted to ensure that OCS leases and the operational area surrounding platforms are free of obstructions that would interfere with other uses of the OCS, such as commercial fishing and trawling operations. Site clearance procedures for decommissioning a platform and associated pipelines and power cables in the OCS would typically involve the following four step process: (1) pre-decommissioning survey; (2) post decommissioning survey; (3) ROV/diver target identification and recovery; and (4) test trawling. A survey vessel equipped with high-resolution side-scan sonar is used to conduct the pre- and post-decommissioning surveys. The pre-decommissioning survey documents the location and quantity of suspected debris targets. The survey is also used to map the location of pipelines, power cables, and sensitive environmental habitats (hard bottom areas and kelp beds) to ensure that the deployment and retrieval of anchors is done in a safe and environmentally sound manner. The post-decommissioning survey identifies debris lost during the project and documents any impacts from the operations such as anchor scars. An ROV and divers are deployed to further identify and remove any debris that could interfere with other uses of the area. Test trawling is conducted to verify that the area is free of any potential obstructions. Timing of site clearance activities is included in Smith 2016 and is included in the platform database.

Table 8. Debris removal timing inputs

Component	Value
Shell Mounds volume (year 2022)	1,156 – 20,221 yds^3
Shell mound accumulation rate	31 – 409 yds^3/year
Platform bottom slope range	0.2 – 7.3%
Site Clearance	15 days
Volume of marine growth removed	1,000 yds^3 per 8-leg platform
Shell mounds removal bucket size	24 yds^3
Shell mounds removal, depth below mudline	2 feet
Shell mounds removal rate	17,000 bucket-feet/day (6 minutes/bucket for a 100-foot depth, 17 hours per day)
Shell mounds removed fraction of water	1.54 total volume/shell mounds volume per bucket
Shell mounds removal days, per platform	3.5 – 17.2
Shell mounds removal, barge trips	1.3 – 11.6

3.5 Pipelines and Power Cable Removal

Pipelines and power cable removal would include the following activities:

- **Mobilization of equipment and crews**
- **Flushing of pipelines**
- **Cutting and capping and burying pipeline ends**
- **Removing pipelines as applicable**
- **Demobilize equipment and crews**

Removal of the pipelines would involve preparing the pipelines and utilizing a pipeline lay barge to reverse-install the pipelines by cutting and lifting pipeline sections to the surface. The pipelines would be cut into sections and placed on a cargo barge located next to the lay barge, and then transported to shore for disposal. Removal of the power cables would involve the use of supply boats and lifting mechanisms to lift the power cables and then cut them into sections. Sections would then be transported to shore for disposal

Federal regulations allow an operator to decommission a pipeline or power cable in place if BSEE determines that the pipeline or power cable "does not constitute a hazard (obstruction) to navigation and commercial fishing operations, unduly interfere with other uses of the OCS, or have adverse environmental effects." If BSEE determines that the pipeline or power cable is an obstruction, it must be removed per the regulations at 30 CFR 250.1754. The decision on the final disposition of a specific pipeline or power cable would not be made until a thorough technical and environmental review is conducted during the decommissioning permitting process.

All pipelines must first be cleaned by flushing water through the pipeline with pipeline cleaning devices (pigs). The pipeline is then disconnected from the OCS platform. For pipelines decommissioned in place, the cut end is plugged and buried at least 3 feet below the seafloor or covered with protective concrete mats. In addition to cutting and burying the ends, all pipeline valves, fittings, pipeline crossings and spanned areas that could unduly interfere with other uses of the OCS must be removed from the pipeline.

As exact pipeline removal requirements are not known at this time, for this study, timing estimates are developed based on the following assumptions: pipelines routed to shore would be removed from areas shallower than the 200-foot water depth level to the State Tidelands boundary; pipeline segments between platforms on the OCS would be decommissioned in place; OCS pipeline segments in greater than 200 feet of water depth would be decommissioned in place. An alternative scenario is also included which involves removing all the pipelines at depths greater than 200 feet and between platforms, or removing none of the pipelines. A further additional option is included which would allow for the removal of the pipelines in State waters (from the State Tidelands to the shoreline) as well. The 200 foot limit was assumed in other studies (Smith 2016) and is the approximate limit for divers. In addition, 30CFR 250.1003.a.1 requires burial of pipelines shallower than 200’, so the 200 foot removal requirements reflect the CFR requirements.

Pipeline Removal

For sections of pipeline that are removed, the pipeline would be surveyed first and then a dive crew and pipeline lay barge would be used to lift the pipeline and cut sections which would be laid on a cargo barge for transport to a land-based port such as POLA/POLB.

Timing assumptions associated with pipeline removal are listed in **Table 9**. Timing for the removal of OCS pipelines in less than 200 feet of water are based on the Smith 2016 study, which quantified the timing for pipeline removal to estimate costing. For pipelines more than 200 feet deep, timing estimates are based on the timing per mile from the Smith 2016 report along with a 50 percent additional factor due to the additional depth issues. For State water pipelines, the same removal rate as pipelines in less than 200 feet of water has been applied.

Power cables on the OCS would be completely removed to the State Tidelands boundary. The cables would be cut using an ROV and then pulled onto a supply boat before being transported to port. In addition, an option is included in DEEP to remove power cables located in the State waters as well. Timing for this removal is based on the rate of cable removal in the OCS (Smith 2016) applied to the length of power cables estimated to be in the State waters. Note that not all platforms utilize a power cable.

3.6 Processing/Disposal

Processing and disposal of materials would include the following activities:

- **Transportation of components to a shore-based port on cargo barges**
- **Offloading of materials at the ports, including cutting and sectionalizing**
- **Transportation of materials to recycle or disposal facilities**

Table 9. Pipeline and power cable removal timing inputs

Component	Value
Length of pipeline to be removed, per platform	0 – 33.7 miles
Length of pipeline deeper than 200 feet	0 – 18.5 miles
Length of pipeline between platforms	0 - 6.3 miles
Total length of pipeline in State waters	0 – 22.4 miles
Rate of pipeline removal, average	1.8 days/mile
OCS Shallow Pipeline removal, days per platform	0 – 61 days
Total length of power cable in OCS	0 – 27.2 miles
Total length of power cable in State Waters	0 – 19.2 miles
Power cable removal timing, per platform	0 – 94 days
Power cable removal rate, average	5.6 days/mile
Power cable unit weight	45.5 tons/mile

Transportation of components to shore would involve primarily movement of components with cargo barges, ranging in size from 180 to 400 feet in length. The larger barges would be required to transport the jacket sections and deck modules while the 180-foot barges would be used for pipeline and power cable transportation. For transport of shell mounds material, hopper barges or deck cargo barges configured with bins would be utilized and transported to ports for use as fill material at the ports or other disposal options. Cargo barges do not have their own propulsion mechanisms and would be maneuvered by tugboats. Timing to transport the cargo barges to and from the ports is based on the distance from port and the average speed.

Offloading of the components at the ports are estimated to take an extensive amount of time (multiple years) due to the need to disassemble and cut apart the structures into smaller sizes. The Smith 2016 report estimated the timing for cutting and transfer and assumed that cutting apart the structures would be conducted on the barges and then the smaller sections would be moved onshore with an onshore crane. Disassembled materials would then be transported from the ports by truck, rail or loaded onto barges or ships for transport to other locations.

Transportation of the materials by truck would take place from the port locations to the respective disposal or recycling location. It is assumed, as per the Smith 2016 study, that the jacket and deck modules would primarily be recycled as scrap at Los Angeles area scrap/recycling yards such as SA Recycling or transported to foreign locations via barges. The conductors, power cables and pipelines might be transported from the offloading site to disposal sites near Bakersfield, California or also transported to foreign locations via barges. POLA studies (POLA 2012) indicate that 1-2 millions tons per year of scrap metal are exported through the ports annually, with an annual increase in exports of over 3 percent annually.

Due to the uncertainties associated with hauling of materials onshore, the truck trips or barge trips to foreign locations necessary for this phase and their associated emissions have not been estimated in this study.

Table 10. Processing and disposal timing inputs

Component	Value
Material transport to port time, hours, per platform	10 – 38 hours
Deck modules and Jackets offload at port time, days, per platform	78 – 1,191 days
Pipeline offload at port time, days	0 – 84 days
Barge Loads for topside, jacket, pipelines and power cables	4 - 17
Deck modules and Jackets offload at port time, days, per platform	78 – 1,191 days
Pipeline offload at port time, days	0 – 84 days

3.7 Partial Removal Option

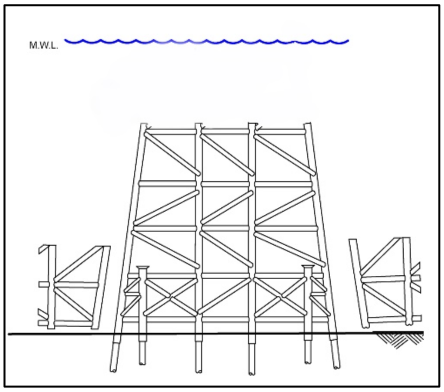
Under the partial removal option, only the top portion of the jacket would be removed. This would affect the timing of the jacket removal and corresponding jacket section transport, debris removal and processing and disposal. Other phases would remain the same as the full abandonment option, including pre-abandonment, topside removal, pipelines and power cable removal, and site clearance for areas around the platform. Partial removal could involve the following options:

- **Partial Laydown, where the jacket is cut at 85 feet and then pulled with tugs/derrick barge to be dropped to the ocean floor at the platform site**
- **Partial Disposal Offshore, where the topmost 85-foot portion of the jacket is removed and then transported to an offshore disposal site**
- **Partial Disposal Onshore, where the topmost portion of the jacket is removed and then transported to the POLA/LB for dismantling**

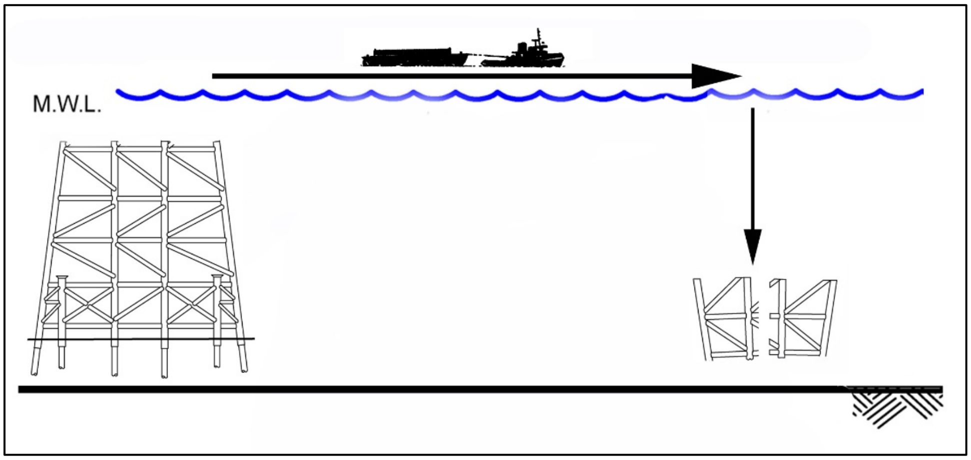
An offshore disposal site would be a location offshore where the jacket could be laid down and used as an artificial reef in that area as opposed to the current platform location as the artificial reef location or disposing of the material onshore. Use of one of these locations, or other designated artificial reef areas, could be used for the disposal of platform jackets. It is assumed that the derrick barge would still be needed for removal of the topmost portion of the jacket under the partial removal options but for substantially less time for all platforms except the shallowest platforms. **Figure 3** shows the three options for partial jacket removal options.

3.7.1 Partial Removal Option - Jacket Removal

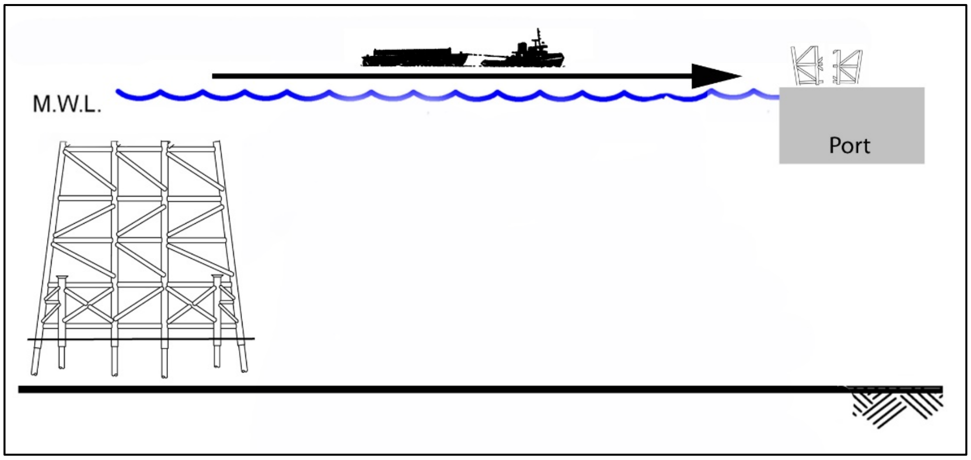
Removal of the top 85 feet of the jacket would be performed as part of the partial removal option. The top 85 feet of the jacket could be removed with a single lift from a derrick barge for most of the platforms except possibly the largest platforms (Eureka, Harmony, Heritage, Hermosa) and an associated single cargo barge trip (if the partial jacket is transported and not laid down at the platform site). The topmost 85 feet of the jacket could be laid to rest immediately adjacent to the platform, which may not require the use of the derrick barge (although the derrick barge would still be used for topside removal); it could be transported and disposed of in another offshore location; or it could be transported to a port for onshore disposal. Each of these options are included in DEEP.



Partial Laydown



Partial Disposal Offshore



Partial Disposal Onshore

Figure 3. Partial jacket disposal options

The partial removal option would not require severing of the piles and would require fewer jacket cuts for most platforms, because only a single jacket section would be removed. The timing of the tasks is shown in **Table 11**.

Table 11. Partial removal timing inputs

Component	Value
Top 85-foot portion of rig weight*	230 – 2,887 tons
Deck and Jacket removal timing, partial jacket removal, per platform	8 – 21 days
Barge Loads for topside, partial jacket, pipelines and power cables**	3 - 8

Notes: * estimated based on average jacket weight per foot. May include multiple sections. ** Includes transport of the top portion of the jacket to port with a single cargo barge trip.

3.7.2 Partial Removal Option - Debris Removal

Debris removal would only involve the removal of miscellaneous debris, conducting surveys and site clearance. Removal of the shell mounds and piles would not be conducted as the shell mounds and piles are assumed to be left in place under the remaining jacket portion as part of the partial removal option.

3.7.3 Partial Removal Option - Processing and Disposal

Processing and disposal of materials would involve the processing and disposal of the pipelines and power cables, the topsides, the top portion of the jacket and any miscellaneous debris associated with transportation of the materials for disposal. Depending on the method of disposal of the top portion of the jacket, the top portion of the jacket may require transport to another offshore disposal location or to a port.

4 Vessel and Equipment Requirements

This section details the type and number of vessels and equipment related to the decommissioning of the Pacific OCS facilities that may be needed during the six decommissioning phases. The number of some equipment, such as cargo barges and associated tugboats, is based on the estimated platform topside, jacket and pipeline weights estimated in Section 3, which are based on the characteristics of each individual platform system. Emission estimates are made based on past studies as well as discussions with current operators and equipment suppliers. These estimates most likely would change once decommissioning projects specifics are arranged with respective bidders. These differences could be the result of different equipment specifications or the use of different approaches to the decommissioning that might be utilized, such as single-lift barges for a one-piece topside removal verses a multi-piece topside removal.

The information compiled here is incorporated into the equipment and the platforms database in DEEP in order to estimate emissions, which includes information on the platform specifics (such as depth, associated pipelines, jacket and deck weights, etc.) as well as the estimated number of equipment for each platform. The number of equipment is also based on the decommissioning scenarios selected, which include a partial or a full abandonment of the platform jacket, as well as the extent of pipeline removal, power cable removal and the need to remove shell mounds. Each of these options would change the number of cargo barges and other equipment, such as pipeline barges, that may be required. In addition, as per Smith 2016, the deeper platforms would require the use of a lifting barge, and these are included in the platform database to be used to estimate the emissions associated with each decommissioning activity.

Vessel and equipment requirements and specifics are based on previous studies and contacts, including the following:

- Decommissioning Cost Update, (Smith 2016);
- SBCAPCD Permitting Documents for the 4H Project;
- SBCAPCD 4H Project Fuel Use Logs;
- Proposed Negative Declaration for 4H Project (Willis et. al. 1994);
- Abandonment Analysis of Chevron 4H platforms (Basavalinganadoddi and Mount 2004);
- Case History: Overview of 4H platform Decommissioning (Poulter 2003);
- Hogan & Houchin Abandonment Cost Estimate (Twomey 2000);
- EPA Current Methodologies in Preparing Mobile Source Port Related Emission Inventories (EPA 2009);
- BOEM Gulfwide Emissions Inventory Study (BOEM 2017);
- State of the Art of Removing Large Platforms in Deep Water (MMS 2000);
- Discussion with current platform operators; and
- Equipment vendor discussions.

The scope of the vessel and equipment requirements is based on activities associated with mobilization, site-based activities and demobilization. Mobilization assumes the use of vessels and equipment from primarily the POLA/POLB except for the larger derrick barges and cargo barges, which could be mobilized from Asia, Europe, the GOM, or Seattle, depending on the equipment type. Mobilization requirements are therefore substantial for the larger distance mobilization locations. Demobilization is generally assumed to be to the POLA/POLB, except for demobilization of the topsides and jackets, which could be demobilized to Asia, the GOM, POLA/LB, Seattle or a number of other locations including Mexico, Latin America, the East Coast Region of the U.S., Florida, the Great Lakes region or other locations with large ports and substantial recycling capabilities.

Site activities include the use of derrick barge equipment and generators on the barges as well as dive compressors and other equipment that would be located at the platforms or on one of the adjacent vessels. For topside preparation, the use of some of the platform equipment, such as the platform crane, is assumed to be utilized prior to the dismantling of the topsides.

Equipment associated with disposal is discussed below. Emission estimates do not include onshore activities at the ports or inland, such as truck transportation/disposal onshore as the area ports are assumed to maintain programs and emissions controls and caps on these activities, such as the POLB/LA Clean Air Action Plans.

Supply boats are assumed to be associated with every phase and would be used to supply the site with equipment. Supply boats could use a number of different ports to obtain supplies, including the POLA/LB, Port Hueneme or the Casitas Pier area in Carpinteria. However, as a worst case for emissions estimates, supply boats are assumed to mobilize each day from the POLA/POLB area or Port Hueneme. The supply boats were assumed to have the same characteristics as the supply boats as specified in the local jurisdiction platform air permits, which included the M/V Santa Cruz, Ryan, and the Adel Elise vessels. The most commonly used supply boat for current platform operations is the Santa Cruz. Supply boats are assumed to bring supplies to the platform site and then return to the respective port. Supply boat trips are assumed to be once per day.

Crew boats are assumed to travel to the site twice each day from the nearest pier, with an option to increase this number in DEEP as needed, with the nearest piers being Ellwood, Casitas, Port Hueneme or the POLA/POLB, which are the piers discussed in the platforms respective air district permits. Crew boat characteristics were assumed to be the same as those specified in the local jurisdiction air permits, i.e. the M/V Alan, M/V Callie Jean and the Prince Tide. The most commonly used crew boat for current platform activities is the Alan.

The vessels and equipment requirements for each phase is discussed below.

4.1 Pre-Abandonment

Well plugging and abandonment timing would be a function of the complexity of the wells. As per Section 3, many of the wells may be abandoned using rig-less arrangements involving a crane and a cement pumping unit, as assumed in Smith 2016. The crane is assumed to be the platform crane as defined by the platform air quality permits.

Some wells may require the use of a drilling rig depending on the well complexity. As detailed information on the wells was not available, it was assumed that 50 percent of the highly complex wells as defined by Smith 2016 would require the use of a drilling rig instead of a rig-less approach.

Crew and supply boats were assumed to be used to supply additional equipment and materials as well as personnel.

Topside preparation would require the use of a compressor, crane, generator and welding machines, as well as crew and supply boats. A dive boat would also be utilized, which would travel to and from the platform as well as maintain maneuvering positioning near the platform.

Marine growth removal would require the use of dive compressors, generators and a dive boat.

Conductor removal would require the use of the platform crane along with generators, mechanical cutters and cargo barges. The number of cargo barges would be based on the total weight of the conductors.

Cargo barges are assumed to utilize a large tugboat. For large tugboats, a tugboat similar to the Lauren Foss is assumed, as the Lauren Foss is currently operating in southern coastal waters.

Table 12. Pre-Abandonment vessel and equipment requirements

Equipment/Vessel	Horsepower	Number	Basis
Platform Crane	160-545	1	Platform air permits
Well kill pumps	318	1	Platform Heritage air permits
Cement pumping skid	500	1	Platform Heritage air permits
Drilling rig	2000	1	Estimated rig size
Compressor	200	2	4H emissions estimates
Generator	400	2	MMS 2000 compilation
Welding machine	80	8	4H emissions estimates
Mechanical cutter	100	2	4H emissions estimates
Vessel- Crew boat	1,701/218	1	Similar to M/V Alan vessel
Vessel- Supply boat	2,000/1,005	1	Similar to M/V Santa Cruz
Vessel- Dive boat	1,701/218	1	Similar to M/V Alan vessel
Vessel- Cargo Barge set	8,200/563	1	Large tugboat: Similar to Lauren Foss

Notes: multiple horsepower's for vessels are for main and auxiliary engines.

4.2 Topside Removal

Equipment for topside removal would be utilized both for topside removal and for jacket removal and are critical in determining the emissions levels associated with the decommissioning projects. The derrick barge capacity is defined by the lifting capabilities of the derrick barge cranes. A derrick barge is classified by the tonnage, such as a 2,500 ton or a 4,500 ton derrick barge. For example, the McDermott DB30 is a 2,500 ton derrick barge with a 2500 ton crane capacity that would require a tugboat for propulsion. Total generator horsepower on the DB30 is close to 5,500 hp. In contract, the McDermott DB50 is rated at 4,200 tons with propulsion systems and dynamic positioning with over 18,000 hp of generator horsepower. Due to the reach required for the cranes to remove the topsides and jackets, the actual, effective capacity of the cranes is closer to 50 percent of their rated capacities.

Derrick Barge McDermott DB30

The platforms in the Pacific OCS potentially have a wide range of derrick barge needs. The average topside weight per module of the Pacific OCS platforms is 550 tons, ranging from an average of 188 tons to 1,099 tons, meaning that a 2,500 ton rated derrick barge should be capable of handling all of the topside removal requirements in the Pacific OCS, with many of the platforms capable of being decommissioned with even smaller derrick barges (12 of the platforms have topside modules that weight less than 500 tons average per module). Note that these are averages and that there could be substantial variation amongst topside module weights. For the removal of the 4H platforms, for example, the derrick barge Wotan was rated at 500 tons. For the installation of the Point Arguello platforms, a 3,000 ton rated derrick barge was used.

The average weight per jacket section of the Pacific OCS platforms is 1,054 tons, with average weights per section ranging from 253 to 1,600 tons with 10 Pacific OCS platforms having average jacket section weights less than 1,000 tons. Most likely, a 2,500 ton derrick barge would be capable of servicing most if not all of the Pacific OCS platforms for jacket removal, depending on the exact configurations and jacket lift requirements. The MMS 2004 analysis assumed the need for a 4,000 ton rated derrick barge, as was assumed in the COST report (COST 2008) whereas the Smith 2016 report, the second update to the MMS 2004 study, projected the need for a 500 to 2,000 ton rated derrick barge. The advantages to the use of a derrick barge that is sized efficiently to the needs required are reduced horsepower and associated emissions. This analysis assumes the use of a 2,500 ton derrick barge; however, a larger barge may be needed based on the specific platform characteristics and the availability and costing. Conversely, smaller derrick barges for many of the platforms could be utilized as many of the platforms have lifting needs under 500 to 1,000 tons. Jackets could also be separated into additional sections, thereby reducing the weight per section, to allow a smaller derrick barge to be utilized. This approach has the disadvantage of requiring additional timing and may not necessarily reduce total emissions, but would reduce peak day emissions levels.

Use of a derrick barge would include mobilization of the derrick barge and cargo barges from their current locations. The derrick barge is assumed to be similar to a McDermott DB30, which is a 2,500-ton capable derrick barge equipped with a total of 5,485 horsepower generators currently located in the Asia pacific region (as of 2016). The DB30 derrick barge would require the use of a large tugboat for mobilization and demobilization. The exact derrick barge possibly would be different, as, for example, according to McDermott, the DB30 is currently occupied on long-term projects in the Asia area.

Cutting and removal of deck sections would require compressors, cranes (both the platform crane and the derrick barge crane), generators and welding machines.

Table 13. Topside removal vessel and equipment requirements

Equipment/Vessel	Horsepower	Number	Basis
Crane	160-545	1	Platform air permits
Compressor	200	2	4H emissions estimates
Generator	400	2	MMS 2000 compilation
Welding machine	80	8	4H emissions estimates
Vessel- Crew boat	1,701/218	1	Similar to M/V Alan vessel
Vessel- Supply boat	2,000/1,005	1	Similar to M/V Santa Cruz
Vessel- Dive boat	1,701/218	1	Similar to M/V Alan vessel
Vessel- Cargo Barge set	8,200/563	1	Large tugboat: Similar to Lauren Foss
Vessel- Derrick barge	5,485	1	Barge: Similar to McDermott DB30

Notes: multiple horsepower's for vessels are for main and auxiliary engines.

4.3 Jacket Removal

The equipment for each of the jacket removal activities would require the derrick barge (same as for the topside removal), a lifting barge, if needed, welding machines, dive vessels, cargo barges and crew and supply boats. The lifting barge would only be required for those platforms that have jackets located in deep water (greater than 300 feet), which would include Eureka, Gail, Grace, Harmony, Harvest, Heritage, Hermosa, Hidalgo, Hondo and Irene. The lifting barge would require a tugboat, similar to the Justin Foss, which is a tugboat currently utilized in the south coast area.

This study assumes the use of a lift barge for deeper jackets, as most derrick barge cranes do not have sufficient cabling to lift heavy weights from substantial depths; therefore, a lifting barge is brought in and then the derrick barge is used to lift the jacket sections onto the cargo barges once they are lifted to shallower depth. There are different approaches that could be used for lifting the lower-most jacket sections of the platforms, including buoyancy devices, etc., and use of a different approach would change the emissions estimates. This analysis assumes the use of a lifting barge.

The cutting of the jacket would require a mechanical cutter, which would be powered by generators.

Table 14. Jacket removal vessel and equipment requirements

Equipment/Vessel	Horsepower	Number	Basis
Generators	400	2	MMS 2000 compilation
Welding machine	80	2	4H emissions estimates
Vessel- Crew boat	1,701/218	1	Similar to M/V Alan vessel
Vessel- Supply boat	2,000/1,005	1	Similar to M/V Santa Cruz
Vessel- Dive boat	1,701/218	1	Similar to M/V Alan vessel
Vessel- Cargo Barge set	8,200/563	1	Large tugboat: Similar to Lauren Foss
Vessel- Derrick barge	5,485	1	Barge: Similar to McDermott DB30
Vessel- Lifting barge	4,300	1	Small tug: Similar to Justine Foss

Notes: multiple horsepower's for vessels are for main and auxiliary engines.

4.4 Debris Removal

The equipment requirements for each of the debris removal activities includes a crane barge, cargo barges, dive vessel, crew and supply boats. The crane barge assumes the use of a tug for movement and maneuvering, with the crane barge assumed to be mobilized from the POLA/POLB. The crane barge would be used for removal of the shell mounds, if that option is selected.

The extent of equipment and vessel use would depend on whether the shell mounds are removed. Removal of the shell mounds assumes a 3,000 yds^3 cargo barge, with the number of cargo barge trips based on the volume of shell mounds estimated at each platform.

Table 15. Debris removal vessel and equipment requirements

Equipment/Vessel	Horsepower	Number	Basis
Welding machine	80	2	4H emissions estimates
Vessel- Crew boat	1,701/218	1	Similar to M/V Alan vessel
Vessel- Supply boat	2,000/1,005	1	Similar to M/V Santa Cruz
Vessel- Dive boat	1,701/218	1	Similar to M/V Alan vessel
Vessel- Cargo Barge set	8,200/563	1 - 12	Large tugboat: Similar to Lauren Foss and 3,000 yds3 per cargo barge.
Vessel- Crane barge	4,300 500	1 1	Small tug: Similar to Justine Foss Crane size

Notes: multiple horsepower's for vessels are for main and auxiliary engines.

4.5 Pipelines and Power Cable Removal

The vessel and equipment requirements for pipeline and power cable removal would depend on the extent of pipeline and power cable removal activities. Pipeline removal options include leaving all or a part of the pipelines in place based on pipeline depth and pipelines between platforms. For the power cables, the options are removing all of the power cables in the OCS or leaving the power cables in place. Pipelines and power cables located in State waters may also be removed at the same time as the OCS pipelines and power cables as the equipment for removal will already be mobilized. Vessel and equipment requirements would include a derrick lay barge for pipeline removal, compressors, dive vessels, and supply boats. Transportation of the removed pipeline segments would require cargo barges. Removal of the power cable segments is assumed to be performed by supply boats. All demobilization activities are assumed to terminate at the POLA/LB.

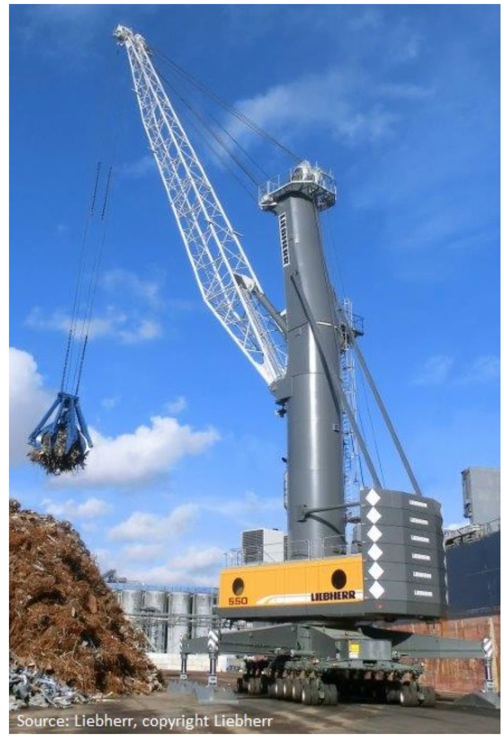
Table 16. Pipelines and power cable removal vessel and equipment requirements

Equipment/Vessel	Horsepower	Number	Basis
Compressors	200	2	4H emissions estimates
Vessel- Supply boat	2,000/1,005	1	Similar to M/V Santa Cruz
Vessel- Dive boat	1,701/218	1	Similar to M/V Alan vessel
Vessel- Cargo Barge sets	8,200/563	1 - 12	Large tugboat: Similar to Lauren Foss and 3,000 yds3 per cargo barge.
Vessel- Derrick lay barge	4,300	1	Barge: Similar to McDermott D27

Notes: multiple horsepower's for vessels are for main and auxiliary engines.

4.6 Processing/Disposal

Once removed material (such as the topside modules or jacket sections) is delivered to the port location, it would be dismantled and either processed for recycling or transported for disposal. For materials that can be recycled, primarily steel structural components, these would either be placed into containers or into bulk systems and shipped to other recycling locations at other ports or loaded into trucks for transport to onshore recycling locations. The SA Recycling facility located at the POLA/LB has metal processing capabilities exceeding 2.5 million tons per year (POLA 2012) with a new Liebherr 550 electric 144 ton crane for offloading of materials (POLA 2016). The SA Recylcing warf has plans to convert completely to electricity as per POLA documents (POLA 2016) and this would enable all work to be completed related to onshore dismantling and containerizing/preparation of materials to be completed without the use of internal combustion diesel engines and assocaited emissions.



Liebherr 550 Crane

For dismantling at the ports, equipment requirements may include translift mobile cranes, crawler transporters, rough terrain cranes and fork lifts as well as welding and cutting equipment in addition to the crane already located at the site. Extensive trucking requirements would also be needed if materials are to be hauled offsite to inland recycling centers as discussed in Section 3. Loading into barges at the ports would also occur if materials are to be transported offshore to foreign or other destinations.

The translift crawler cranes can have lifting capacities over 1,000 tons and are powered by 400-500 hp engines. These cranes would need to be mobilized to the site from other locations, most likely via barges or other long distance transportation methods.

4.7 Equipment Availability and Emissions Levels

Equipment used for decommissioning would be either available along the southern west coast, primarily the POLA/LB, or need to be brought to the area from other locations. Equipment meeting the air emissions requirements for new permits or California requirements may be difficult to acquire and some equipment might need to be modified in order to operate in California waters.

The availability of equipment and the anticipated emission levels are discussed below.

4.7.1 Derrick Barges

Derrick barges would be the largest and the most expensive piece of equipment needed for the decommissioning activities. As discussed above in Section 3 and listed in **Table 4**, derrick barges are located primarily in the GOM and Asia. Derrick barges are equipped with large diesel-powered generators that supply electricity to a range of equipment on the derrick barge, including cranes, welders, etc. Derrick barges can be equipped with propulsion engines for movement or rely on tugboats for movement. As many derrick barges are not operating in U.S. waters, it is assumed that most engines would have minimal emission control equipment.

4.7.2 Crew, Supply and Dive Boats

Crew, supply and dive boats would generally be available on the west coast as they are currently used for platform servicing. The most heavily used boats are equipped with emissions controls, as per area district requirements.

The most used supply boats for current platform operations include the Santa Cruz, Ryan and the Adel Elise, which are equipped with the equivalent of Tier 2 and Tier 3 engines, utilizing various methods of emission controls including advanced diesel engine management systems, electronically controlled fuel injectors, timing retard, turbochargers and aftercooling. Other supply boats are also used on a spot-charter basis that are uncontrolled and currently limited to no more than 10 percent of vessel trips. Dive boats are assumed to be equivalent to supply boats.

The most used crew boats for current operations are the Alan, the Callie Jean and Prince Tide. These are equipped with the equivalent to Tier 2 main engines and Tier 3 auxiliary engines, utilizing various emission control technologies including timing retard, turbochargers and aftercooling. Other crew boats are also used on a spot-charter basis that are uncontrolled and currently limited to no more than 10 percent of vessel trips.

As crew and supply boats are currently used extensively by the platform operations, they would be available for decommissioning from area ports with emission levels currently complying with permit conditions associated with area onshore air districts. As crew and supply boats may be used more extensively with a decommissioning project, engine upgrades to some crew and supply boats might be required in order to ensure net air quality benefits and to meet area district BACT requirements as applicable.

4.7.3 Tugboats

Tugboats account for a large part of the emissions associated with decommissioning as they would be responsible for the transportation of equipment and materials to and from the sites. Therefore, the availability of lower-emitting equipment is important. Generally, all cargo barges and some derrick barges (such as the DB30) would require the use of tugboats for transport and maneuvering. The inventory within California of tugboats totaled 128 vessels in 2015, as per an inventory compiled by CARB (SCAQMD 2015). Recent inventories by the POLA/LB (POLA-LB 2017), indicate there are 22 ocean-capable tugs in the POLA/LB area, with 6 operators.

Harley Marine Services and Foss Maritime Company both have the largest ocean tug capabilities in the west coast area (Tugboats 2018). Harley Marine has over 60 tugs in its fleet, with 30 tugs having Tier 2 and above emission levels, including 14 Tier 3s and 7 Tier 4s. Most of these vessels are based out of Portland, OR.

Foss Marine has over 70 tugs in its fleet, with 16 tugs having Tier 2 and above emissions ratings, including 2 Tier 3s and 5 Tier 4s. Four of the Tier 4 tugs are based in Hawaii, with the remainder of the Tier 2 and above tugs located in Seattle, Long Beach and San Francisco.

In addition, Sause Brothers has a fleet of 24 tugs, with 5 tugs having a Tier 2 and above rating, with one of these being a Tier 3 and the rest being Tier 2. All of these are based in Portland, OR.

Crowley Marine has a tug fleet of over 70 tugs, with 6 Tier 2 level tugs based out of Louisiana. There are a number of tugboat companies with a few tier level tugboats, including Bay and Delta, Brusco, Pacific Tugboat and Western.

In total, there are a number of higher tier emission level tugboats that might be available along the west coast, with an estimated 28 Tier 2s, 22 Tier 3s and 13 Tier 4s ranging in size from 2,000 hp to 10,880 hp. Appendix B lists the tugs, their size, tier level and location.

As cargo barges and some derrick barges require the use of tugs, a number of tugs may be required for equipment delivery from areas such as the GOM or Asia. In addition, some tugs, such as the 5 tug group used for the Chevron Refinery El Segundo Marine Terminal in Los Angeles, or the Foss Marine Tier 4 fleet located in Hawaii, are currently committed to ongoing projects. Therefore, it is likely that ocean tugs from other areas would be required and these are generally equipped with lower emissions ratings. In addition, as tugs are required to comply with Tier 4 requirements when they are rebuilt or are new, over time, the number of Tier 4 tugs will increase. Tier 4 tugs could also be commissioned for the decommissioning projects, as the Tier 4 tugs used in Hawaii were commissioning from Foss Marine.

4.7.4 Other Equipment

Other barges would be required, including potentially a lay barge for pipeline removal, a crane barge for shell mounds removal and a lift barge for the removal of jacket sections located in more than 200 feet of water depth. Generally, these barges may be available on the west coast, such as the crane barge, but others most likely would need to be mobilized from the GOM.

Other equipment, such as compressors, welders, and generators, would most likely be available from area ports and would therefore be capable of complying with California portable equipment requirements.

4.8 Timeline of Decommissioning Phases

Some of the phases of the project could be completed in parallel while other phases are dependent on the previous phase to be completed. For example, the removal of the pipelines and power cables could be completed at the same time as the topside or jacket removal activities. Removal of the marine growth could be completed at the same time as the topside preparation. Equipment for some phases may be required in other phases as well. **Table 17** shows the timing of the different phases and **Figure 4** shows the equipment requirements by phase.

Table 17. Decommissioning timing requirements, average platform

<table>
<tr><th colspan="2">Phase/Sub-Phase</th><th>Duration, days</th></tr>
<tr><td rowspan="4">Pre-Abandon-ment</td><td>Topside Platform Preparation</td><td>89</td></tr>
<tr><td>Well P&A Work</td><td>165</td></tr>
<tr><td>Marine Growth Removal*</td><td>44</td></tr>
<tr><td>Conductor Removal</td><td>76</td></tr>
<tr><td colspan="2">Topside Removal</td><td>9</td></tr>
<tr><td colspan="2">Jacket Removal</td><td>51</td></tr>
<tr><td rowspan="2">Debris Removal</td><td>Shell Mounds Removal</td><td>11</td></tr>
<tr><td>Post Removal Site Clearance</td><td>15</td></tr>
<tr><td colspan="2">Pipelines and Power Cable Removal*</td><td>26</td></tr>
<tr><td colspan="2">Cumulative Total*</td><td>415</td></tr>
</table>

Notes: These subphases (*) could be conducted in parallel with other subphases, thereby reducing the cumulative total decommissioning timeframe.

Equipment use will depend on the phase. For example, as in **Figure 4**, some equipment is used for multiple phases, such as generators, crew and supply boats, whereas other equipment is used for only one or two phases, such as lifting barges and crane barges.

The timing of the decommission project will depend on a number of different factors and varies considerably for each platform. Water depth, for example, defines not only the size of the jacket, but also the extent of conductor removal efforts as the deeper the water, the more length of conductors are required to be removed. **Figure 5** shows the decommissioning timing by subphase for the average of all 23 platforms. As indicated, well P&A requires the largest amount of time, followed by conductor removal and topside platform preparation and then jacket removal.

Due to the different characteristics of the platforms, there is a substantial variation in the amount of time it would take to decommission the different platforms. **Figure 6** shows the timing estimated to be required for each platform by subphase. Note that for Heritage and Harmony, for example, as they rest in more than 1,000 feet of water, a substantial amount of the decommissioning time is spent removing the conductors and the jackets.

Well P&A also requires a substantial amount of time as well and is a function of the number of wells and the well complexity. Platforms such as Heritage, with a number of more complex wells, or Ellen and Gilda, with more than 60 wells, would require more time to P&A than platforms such as Hermosa, with fewer, less complex wells.

Equipment	Pre-Abandon	Topside Removal	Jacket Removal	Debris Removal	Pipe and Power Cables	Disposal
Cargo Barge Sets	X	X	X	X	X	
Cement Pumping Skid	X					
Compressor	X	X			X	X
Crane	X					X
Crane Barge				X		
Crew Boats	X	X	X	X		
Derrick Barge		X	X			
Derrick Lay Barge					X	
Dive Boats	X		X	X	X	
Drilling rig	X					
Generator	X	X	X			
Lifting Barge Set			X			
Mechanical Cutter	X					
Supply Boats	X	X	X	X	X	
Welding Machine	X	X	X			X
Well Kill Pump	X					
Onshore Equipment						X

Figure 4. Decommissioning equipment requirements

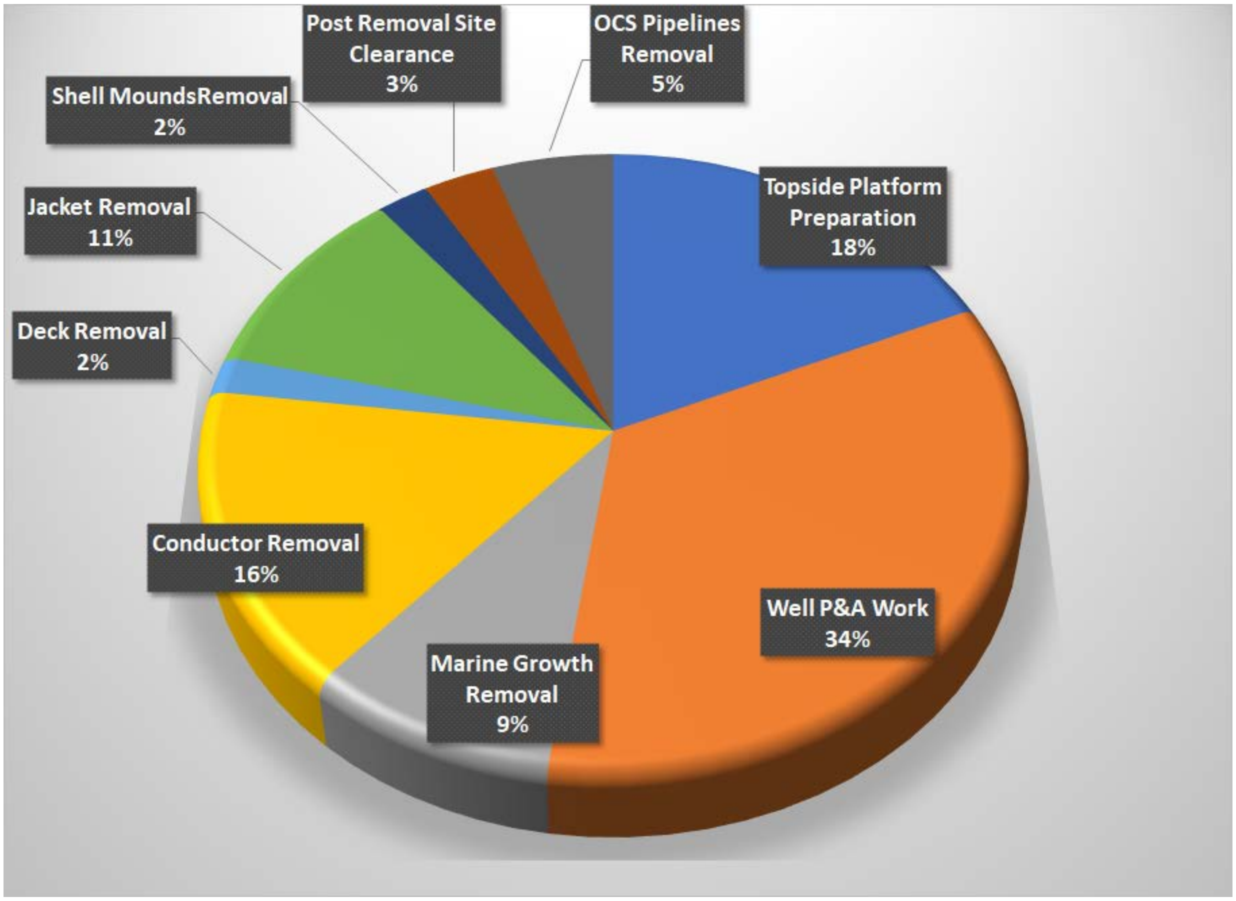


Figure 5. Average platform decommissioning timing by subphase

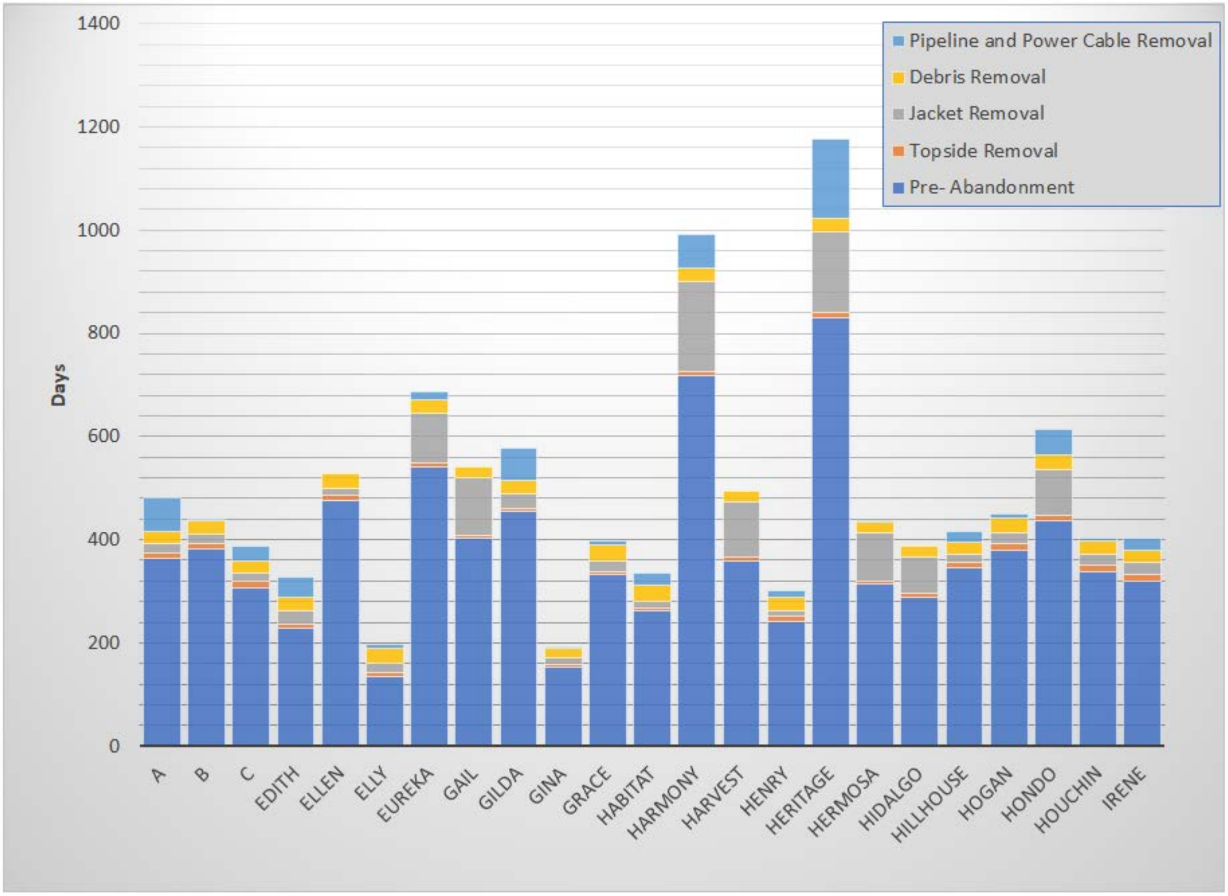


Figure 6. Decommissioning timing by platform and phase

5 Emission Estimates

This section summarizes the emissions estimates related to the decommissioning of the Pacific OCS facilities. Assumptions related to the estimate of emissions are discussed in Appendix B. Emissions estimates are based on the characteristics of each individual platform system as well as a range of input parameters used for quantifying emissions. Input parameters include the following items:

- Platform specific characteristics;
- Year of decommissioning (to estimate shell mounds volumes);
- Jacket removal options (full, partial with laydown in place or transport);
- Pipeline and power cable removal options (all, only shallow water and State waters);
- Emission factors (uncontrolled, Tier 3 or Tier 4);
- Equipment sources (Asia, Europe, GOM, Seattle, POLA/LB);
- Shell mounds removal options (remove or not, removal characteristics);
- Transportation options (crew and supply boat speeds, cargo barge/tug speeds, cargo barge capacities, mobilization timing, numbers of crew/supply boat trips/day);
- Selection of “area” to limit emissions to a subarea of the project, including the total emissions within all three air districts (Santa Barbara, Ventura and South Coast) or specific air districts/Counties; and
- Other items (demobilization port for topsides/jackets, contingency factors).

The information utilized to develop the emissions estimates are emission factors for the vessels and equipment described in Section 4; load factors; usage factors, and specific details and assumptions for the equipment and decommissioning activities. Each of these is discussed in Appendix B.

Most equipment is assumed to operate during the entire sub-phases. Some equipment, however, such as the well kill pump and the cement pump, are assumed to only operate for a fraction of the subphase. The lifting barge is only included for those platforms located in deeper water.

5.1 Emissions Estimates by Platform

Table 18 shows the estimated total emissions for the full removal of the platforms. Total emissions include only those that occur within the Santa Barbara, Ventura or South Coast air districts. The emissions summaries listed in **Table 18** assumes removal of only pipelines in the OCS that are shallower than 200 feet and not between platforms (as per the Smith Report assumption, Smith 2016), includes the removal of the shell mounds and assumes the use of uncontrolled emission factors on all equipment except engines controlled at their current levels under permits such as platform cranes, crew and supply boats,.

Table 18. Total emissions estimates, full abandonment, uncontrolled, total tons, by platform

Platform	NOx	ROC	CO	SOx	PM	PM10	PM2.5	GHG MT
A	363	29	90	0	28	27	27	13,589
B	301	24	76	0	23	23	23	11,491
C	259	21	66	0	20	20	20	9,948
Edith	242	19	70	0	20	20	20	10,285
Ellen	331	26	100	0	28	27	27	14,566
Elly	188	15	51	0	15	15	15	7,568
Eureka	591	46	168	0	48	48	48	24,784
Gail	530	43	126	0	40	40	40	19,158
Gilda	358	29	90	0	28	27	27	13,484
Gina	155	12	35	0	11	11	11	5,381
Grace	330	27	82	0	25	25	25	12,398
Habitat	320	26	85	0	26	25	25	12,698
Harmony	1,211	97	316	0	95	95	95	47,379
Harvest	737	59	201	0	59	59	59	29,864
Henry	246	20	60	0	19	19	19	9,093
Heritage	1,259	102	350	1	102	102	102	51,829
Hermosa	673	54	181	0	54	53	53	27,005
Hidalgo	549	44	151	0	44	44	44	22,431
Hillhouse	270	22	69	0	21	21	21	10,327
Hogan	345	27	83	0	26	26	26	12,616
Hondo	622	49	164	0	49	48	48	24,498
Houchin	308	24	74	0	23	23	23	11,286
Irene	482	38	138	0	40	39	39	20,341

Figure 7 shows the total emissions for the average of all of the Pacific OCS platform by phase. Conductor removal and well P&A produce a high percentage of the emissions during the pre-abandonment phase due to the long timing requirement to remove the conductors and P&A the wells. Jacket removal also produces high emissions both due to the extensive use of tugboats and the large derrick barge.

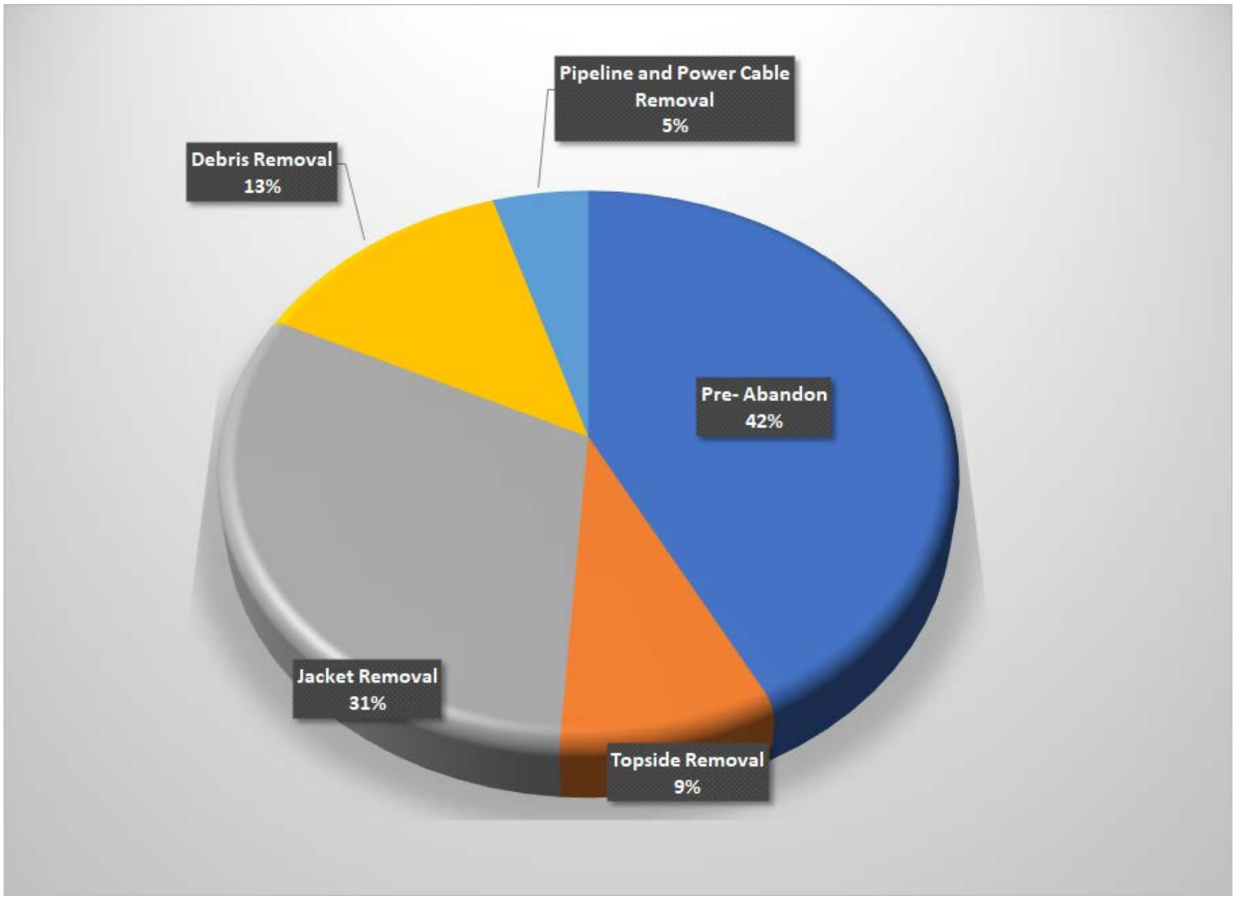


Figure 7. Total NOx emissions percentage by phase, uncontrolled, average platform

Emissions also vary considerably by platform due to the size of platforms and the water depths. **Figure 8** shows the emissions by platform and phase.

As expected, the largest and deepest platforms produce the most emissions. This is due to the increased amount of time and effort required to remove the larger jackets and longer conductors, and therefore equipment use and emissions levels. For example, Platforms Harmony and Heritage generate the largest total emissions because they require a substantial amount of time for conductor removal, due to the longer lengths of conductors in deep water, and the jacket removal generates greater than average emissions as the jacket is larger as a result of being in deeper water. Note that all platforms in deeper water generate more emissions from the jacket removal phase due to their larger jackets and more time required (Eureka, Gail, Harmony, Harvest, Heritage, Hermosa, Hondo). It is these platforms where partial abandonment produces the greatest benefit as fewer emissions are generated from jacket removal.

Note also, that although Harmony and Harvest are both located in deep water requiring longer durations for jacket removal, Harvest has substantially fewer conductors, thereby requiring less time and fewer emissions associated with the Pre-Abandonment phase.

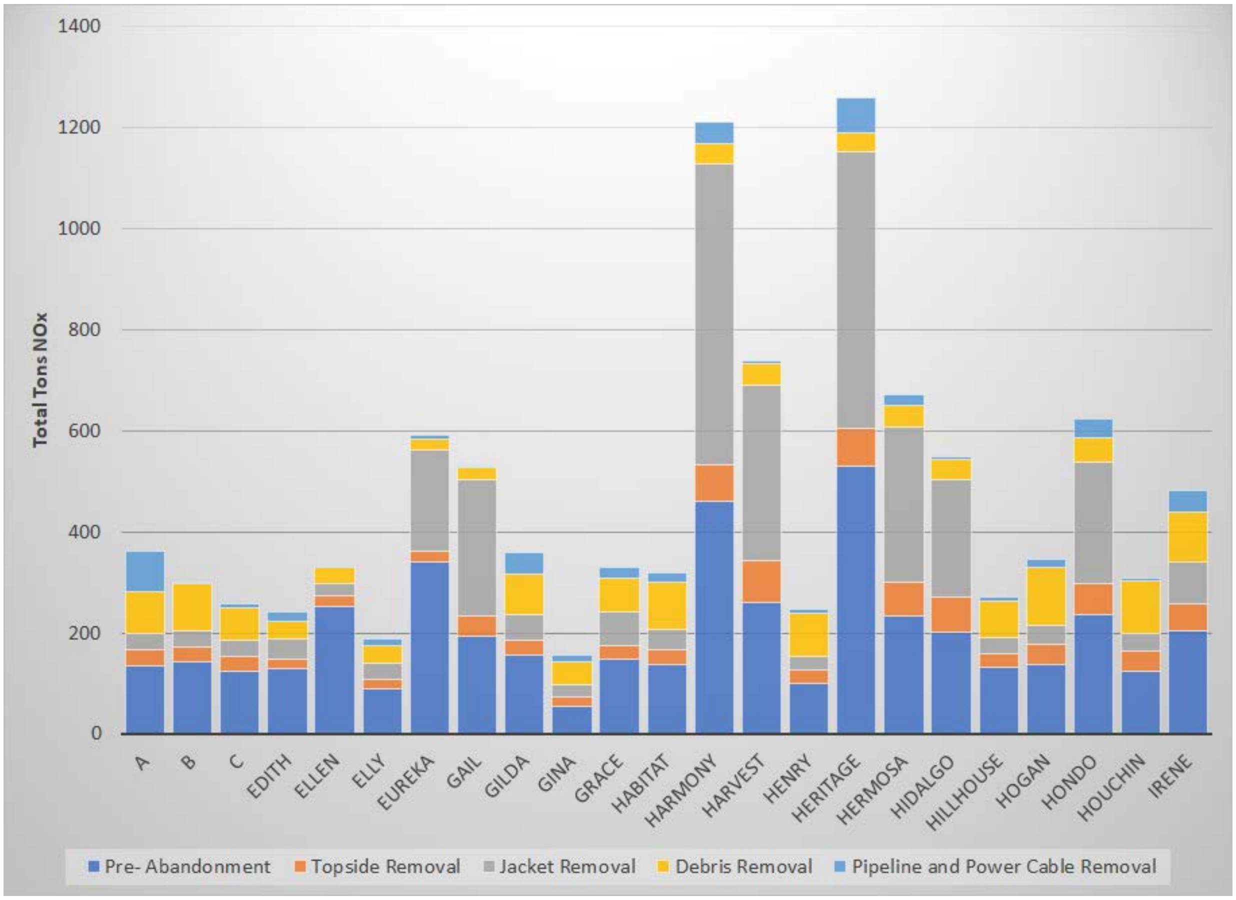


Figure 8. Total NOx emissions by platform and phase within California, uncontrolled

Some platforms also have minimal pipeline removal requirements as some platform pipelines are associated with nearby platforms that then subsequently connect to shore.

Smaller platforms in shallower water, such as Gina or Elly, generate the fewest emissions due to their smaller infrastructure.

5.2 Emissions Estimates By Equipment

For emissions estimates by equipment, the total emissions are dominated by cargo barges (including the tugs) and crew and supply boats, which generate almost 50 percent of total NOx emissions, depending on the platform. As an example, **Table 19** shows the NOx emissions associated with Platform Harmony by phase and equipment type.

Table 19. Total NOx emissions estimates by phase and equipment type, Platform Harmony, uncontrolled, full abandonment, total tons

Equipment	Decommissioning Phase				
	Pre-Abandon	Topside Removal	Jacket Removal	Debris Removal	Pipeline and Power Cable Removal
Cargo Barges & Tugs	94.5	55.6	328.0	25.2	11.1
Cement Pumping Skid	5.4	0.0	0.0	0.0	0.0
Compressors	9.6	0.7	0.0	0.0	4.7
Crane	19.5	0.3	0.0	0.0	0.0
Crane Barge	0.0	0.0	0.0	4.6	0.0
Crew Boats	48.4	0.7	12.4	0.9	0.0
Derrick Barge	0.0	10.8	91.9	0.0	0.0
Derrick Lay Barge	0.0	0.0	0.0	0.0	8.0
Dive Boats	15.3	0.0	19.5	3.2	0.2
Drilling Rig	39.1	0.0	0.0	0.0	0.0
Generators	93.6	2.2	37.9	0.0	0.0
Lifting Barge	0.0	0.0	74.0	0.0	0.0
Mechanical Cutter	16.0	0.0	0.0	0.0	0.0
Supply Boats	108.1	1.6	27.7	4.5	20.7
Welding Machine	9.6	1.1	4.6	0.0	0.0
Well Kill Pump	0.2	0.0	0.0	0.0	0.0

Figure 9 shows the average emissions level for all of the platforms by equipment and percentage of NOx emissions. The cargo barges and tug combinations produce the most emissions, followed by derrick barge and generators, which are used for multiple phases of the decommissioning process. Crew boats, dive boats and supply boats also generate a substantial amount of emissions as they are used daily throughout the entire decommissioning process to transport construction personnel and equipment. The equipment that generates the most emissions provides information for the implementation of targeted emission reduction strategies to reduce the air quality impacts in the most effective manner. For example, cleaner engines utilized for cargo barge tugs and generators would contribute substantially more to reducing air emissions than clean engines on welding machines. Clean engines applied to tugboats would be more effective than retrofitting the lifting barge engines, for example, as the tugboat contributes more emissions.

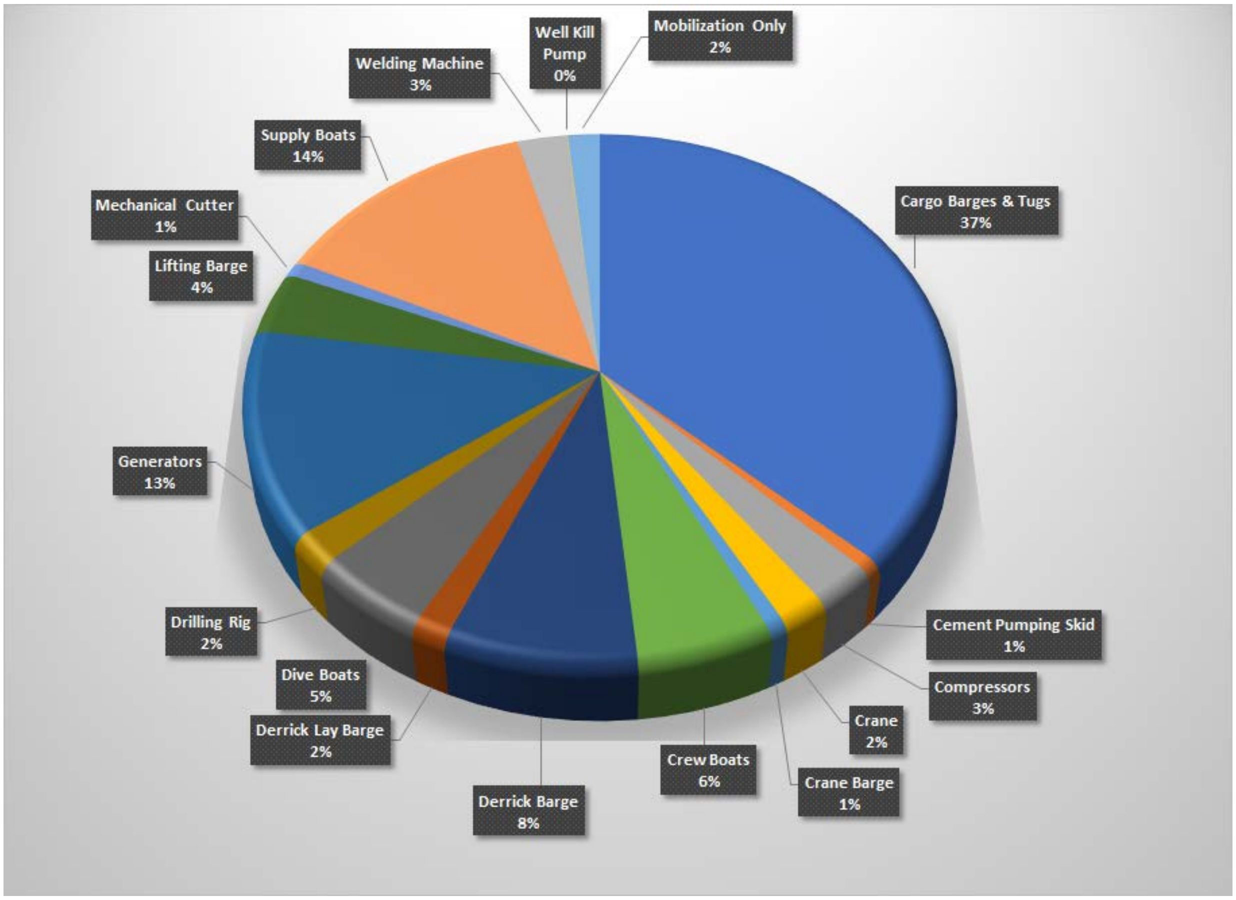


Figure 9. Average platform total NOx emissions percentage by equipment

Mobilization of equipment also can produce a substantial amount of emissions depending on the locations from which the equipment is mobilized. The emissions levels discussed above only include the emissions from activities within the three air districts combined (total emissions). However, movement of equipment from as far away as the GOM or Asia, requiring up to 50 days one-way to mobilize, can produce emissions levels of up to 2,000 tons of NOx to mobilize equipment from distant ports. Note that most of these emissions would not occur in U.S. waters.

Figure 10 shows the emissions by equipment type. Equipment types include either stationary sources, such as generators, or mobile sources, such as tugboats or crew and supply boats. The majority of the emissions are associated with mobile sources.

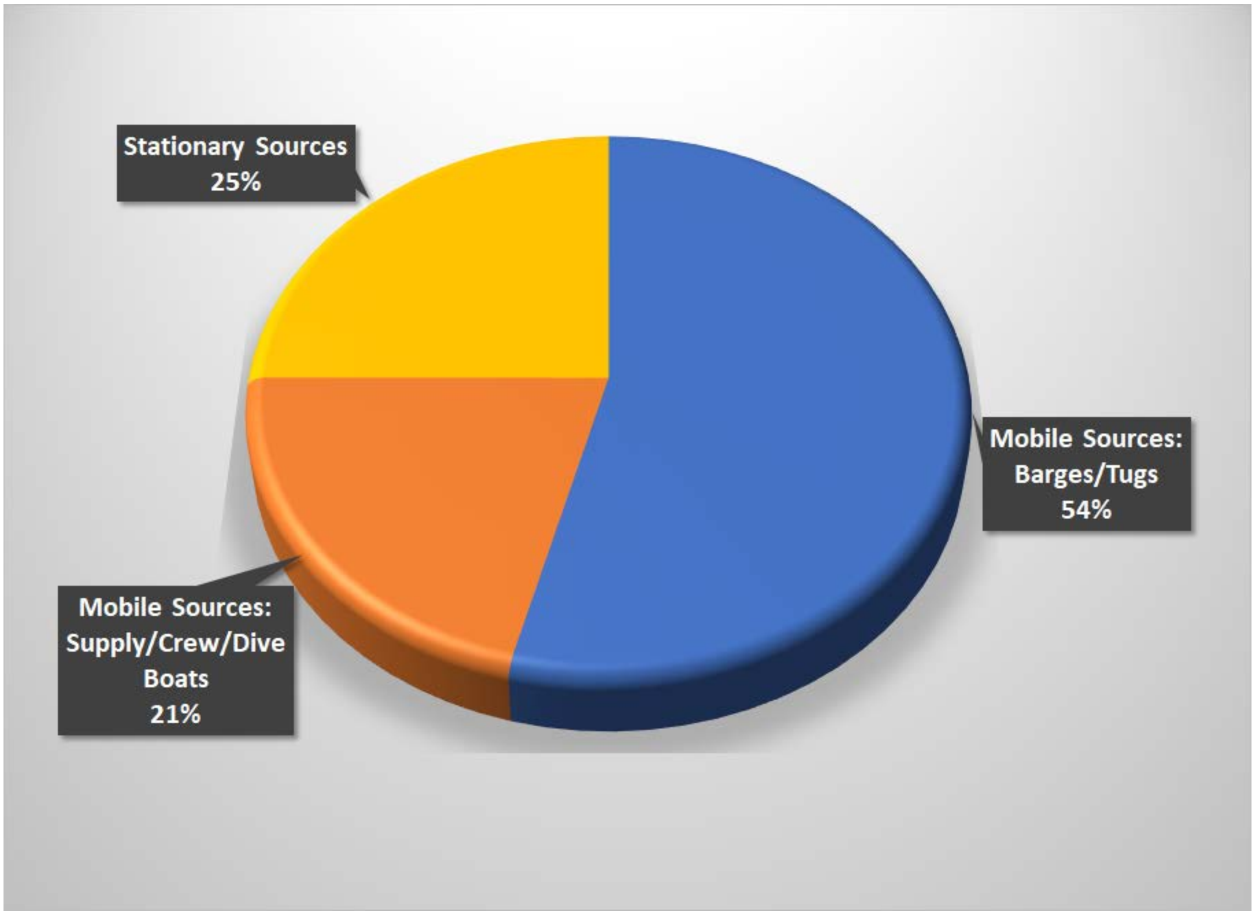


Figure 10. Average platform total NOx emissions percentage by equipment type

5.3 Emissions Estimates for Partial Jacket Abandonment by Platform

In addition to full abandonment of the facilities, emissions are also estimated for partial abandonment of the platform jackets. Partial jacket abandonment assumes removal of the top 85 feet of the jacket. For some platforms located in shallow water, the partial abandonment would be similar to the full jacket abandonment as most of the jacket would be removed under the partial abandonment option.

Partial removal of the jacket would still require removal of the conductors, which is a substantial amount of effort as described above.

Under the partial removal scenario, the emissions from the cargo barges and the derrick barges are substantially reduced for most platforms because of the reduced level of activity associated with limited jacket removal requirements. Platforms in shallower water, however, have only a minimal emissions reduction as most of the platform would be removed under the partial jacket removal option with only the piles not removed. For Platform Harmony, for example, emissions are reduced by close to 50 percent for partial removal of the jacket. **Table 20** shows the emissions associated with partial abandonment for each platform along with the percent reduction in NOx compared with the full jacket abandonment option.

Under the partial jacket abandonment, the substantial reductions in platform decommissioning emissions occurring for the deepest platforms. The reductions in NOx for the entire decommissioning effort per platform range up to a 49% reduction, with the shallowest platforms producing minimal gain from the partial jacket abandonment scenario. Note that this reduction is for the entire decommissioning project, including all phases.

Table 20. Total emissions estimates, partial abandonment, uncontrolled, total tons

Platform	NOx	ROC	CO	SOx	PM	PM10	PM2.5	GHG MT	% NOx Reduction from Full Abandonment
A	339	27	85	0	26	26	26	12,795	6%
B	277	22	71	0	22	21	21	10,695	8%
C	236	19	61	0	18	18	18	9,153	9%
Edith	206	16	61	0	17	17	17	8,928	15%
Ellen	310	24	95	0	26	26	26	13,792	6%
Elly	159	12	44	0	13	12	12	6,464	16%
Eureka	396	31	120	0	33	33	33	17,438	33%
Gail	269	22	67	0	21	21	21	10,050	49%
Gilda	313	25	79	0	24	24	24	11,907	13%
Gina	140	11	32	0	10	10	10	4,864	10%
Grace	272	22	69	0	21	21	21	10,385	17%
Habitat	287	24	77	0	23	23	23	11,512	10%
Harmony	625	51	179	0	52	51	51	26,405	48%
Harvest	404	33	119	0	34	34	34	17,447	45%
Henry	227	18	56	0	17	17	17	8,447	8%
Heritage	725	59	222	0	63	62	62	32,426	42%
Hermosa	378	31	109	0	31	31	31	16,046	44%
Hidalgo	332	27	98	0	28	28	28	14,321	39%
Hillhouse	249	20	64	0	19	19	19	9,580	8%
Hogan	307	25	74	0	23	23	23	11,318	11%
Hondo	395	31	110	0	32	32	32	16,299	37%
Houchin	272	22	66	0	21	20	20	10,061	11%
Irene	412	33	122	0	34	34	34	17,828	14%

Note: Assumes only partial removal of the jacket with laydown and no shell mounds removal.

5.4 Emissions by Area and Unit

As some equipment is mobilized from a substantial distance, mobilization emissions can be large. Therefore, the emissions are also calculated as follows:

- Emissions only within the three air districts combined; or
- Emissions only within SBCAPCD; or
- Emissions only within VCAPCD; or

- Emissions only within SCAQMD.

Emissions are calculated within each “defined” area based on the equipment that is located at the platform site, such as derrick barges, cranes, generators, etc., and from vessels. As vessels move from the site to the ports/piers, such as crew boats, supply boats, mobilization of derrick and cargo barges, only the emissions generated during the period when those vessels are located within the respective “defined” area are included. Total emissions within each defined area are listed in **Table 21**. The majority of emissions would occur within Santa Barbara County because Santa Barbara has the largest number of platforms.

Table 21. Total emissions estimates by platform district, uncontrolled, total tons NOx

Defined Area	Total NOx Emissions, Full Abandonment	Total NOx Emissions, Partial Jacket Abandonment
Santa Barbara APCD	7,945	5,466
Ventura APCD	1,373	995
SCAQMD	1,353	1,070
All California	10,671	7,531

Emissions are also grouped by Unit and Field, which are definitions associated with management and production of the resources. Emissions by Unit/Field are shown in **Table 22**. The Santa Ynez Unit produces the greatest emissions levels due primarily to the larger and deeper platforms.

Table 22. Total emissions estimates within Units/Fields, uncontrolled, total tons NOx

Unit/Field	Platforms within Unit/Field	Total NOx Emissions, Full Abandonment	Total NOx Emissions, Partial Jacket Abandonment	Partial Percent Reduction
Beta	Edith, Ellen, Elly, Eureka	1,353	1,070	21%
Carpinteria Offshore Field	Henry, Hogan, Houchin	899	807	10%
Dos Cuadras Field	A, B, C, Hillhouse	1,193	1,101	8%
Pitas Point	Habitat	320	287	10%
Pt Arguello	Harvest, Hermosa, Hidalgo	1,959	1,114	43%
Pt Hueneme	Gina	155	140	10%
Pt Pedernales	Irene	482	412	14%
Santa Clara	Gilda	358	313	13%
Santa Clara Field	Gail, Grace	860	541	37%
Santa Ynez	Harmony, Heritage, Hondo	3,093	1,744	44%

5.5 Emissions by Depth

Emissions by platform water depth are shown in **Table 23**. As expected, deeper platforms, with larger jackets and longer conductors, generate the greatest levels of emissions associated with decommissioning.

For the partial jacket removal option, this difference is not as great, although water depth still affects the emissions associated with conductor removal.

Table 23. Total emissions estimates by platform water depth, uncontrolled, total tons NOx

Water Depth	Number of Platforms	Total/Average NOx Emissions, Full Abandonment	Total/Average NOx Emissions, Partial Jacket Abandonment
Less than 250 feet	11	3,328/303	2,980/271
Between 250 – 750 feet	9	4,249/472	2,807/312
Greater than 750 feet	3	3,093/1031	1,744/581

5.6 Emissions Comparison to Other Studies and Projects

While this study significantly updates assumptions from previous studies and provides a more detailed analysis related to air quality and therefore a better indication of the emission potentials from decommission operations, a comparison to past emissions estimates conducted in the other studies provides a check on the results developed herein. Other studies, such as the California Ocean Science Trust Study on Evaluating Alternatives for Decommissioning California's Offshore Oil and Gas Platforms (COST 2008) provided estimates of the emissions to remove the jacket and topside for Platform Harmony. The COST study estimated emissions based on updated timing and equipment requirements as detailed in the previous MMS 2004 study. The MMS 2004 study, like the Smith 2016 study, were focused on the costs of decommissioning. While the COST study estimated emissions as a general, rough estimate and utilized equipment assumptions available at that time, this study updates those estimates and adds a number of substantial refinements. The COST study also only estimated emissions associated with topside and jacket removal and did not address additional activities such as well P&A, conductor removal, pipeline and power cable removal, etc. **Table 24** compares the assumptions between this report and other reports for equipment assumptions related to Platform Harmony.

Note that the COST was based on the MMS 2004 study, which assumed a substantially larger derrick barge of over 4,000-ton capacity for Platform Harmony, whereas the Smith 2016 report assumed a derrick barge capacity of 2,000 tons. As seen in **Table 24**, this smaller derrick barge results in substantially less total horsepower. The total emissions for the jacket and topside removal in this study are therefore less by than that estimated in the COST study. In addition, load factors for the derrick barge are lower in this study as they are based on the derrick barge fuel use for the 4H platform removals as well as lay barge activities in the Pacific area. This also contributes to the lower emissions estimates.

Note that by changing the horsepower and load factors in this study to equate to those in the COST study, the emissions estimate for jacket removal and topside removal are very similar to the COST study.

Table 24. Decommissioning equipment assumptions comparison, Platform Harmony

Assumptions	MMS 2000 Study	MMS 2004 Study	Smith 2016 Study	COST Study	DEEP Analysis
Derrick Barge	2,000 ton capacity	4,400 ton capacity max	DB30, 2,500 ton capacity	DB50, 4,400 ton capacity	DB30, 2,500 ton capacity
Derrick Barge Generator Engines, total hp	-	-	5,485	18,105	5,485
Derrick Barge Thruster Engines, total hp	-	-	8,200	12,872	8,200
Tugs, number	-	-	-	5	3
Tugs, total hp, each	-	-	-	16,016	4,300 – 8,200
Cargo Barges, number	10	-	14	8	15
Support Vessels, number	-	-	-	1	3
Support Vessel, total hp each	-	-	-	3,036	2,348 – 1,919
Full jacket plus topside removal, days	96	104	135	135	135
Partial jacket plus topside removal, days	21	-	-	20	12
Emission factors	-	-	-	Uncontrolled	Uncontrolled
Load factors	-	-	-	25-40%	10 – 85%

Note: The MMS and Smith studies were cost only studies and did not include air emissions information, such as emission and load factors.

For the partial removal scenario, the timing is less in this study than that assumed for the COST study, with the partial removal of the jacket estimated to take less than a week to cut and lay down the top-most jacket section, which is based on the time to cut and remove a single jacket section as described on the Smith report (Smith 2016). Because the derrick barge would already be located at the platform to remove the topside modules, additional set up time to remove the top-most section of the jacket would be minimal. Partial laydown of the top-most jacket section is estimated to produce emissions levels that are less than the COST study due primarily to the shorter timeframe, the lower load factors and the lower horsepower requirements.

By equating the derrick barge and tug horsepower and load factors to the COST study, the emissions estimate for topside removal and partial removal jacket removal are still less than the COST study. This is primarily due to the longer durations assumed in the COST study. If the durations are equated, the emissions estimates are similar.

Regarding the timing of specific decommissioning tasks, another study, the MMS 2000 study titled "The State of the Art of Removing Large Platforms Located in Deep Water", provided some estimates of platform topside removal for Platforms Hidalgo, Gail and Harmony. Removal of the topsides was estimated to take between 3.3 and 4.8 days, which is a somewhat lower estimate than this study and the Smith study, which estimated up to 9 days for Platform Harmony including a 25 percent contingency factor.

Decommissioning projects in the North Sea, including the British Petroleum (BP) Miller project (2011) and the BP Hutton project (2005), were upwards of 40-50,000 tons for the jacket and topsides combined, with 22-40 wells, comparable to the largest and deepest platforms in the Pacific OCS. These decommissioning programs estimated removal of the platform to take 1.5 years, with well abandonment taking an additional 2 years. Platform removal estimates for this study assumed up to 2.7 years for the largest platforms, with well P&A ranging up to 1.3 years.

For GHG emissions, total emissions of CO_2 for the BP platforms were estimated in the BP studies at close to 90,000 tonnes (metric) for Miller and 7,470 tonnes (metric) for Hutton; a substantial range although the specifics of the calculations, such as whether mobilization and demobilization were included, may explain the large range of values. GHG emissions ranged up to 51,000 tonnes (metric) in this study without the inclusion of mobilization and demobilization emissions. A partial scenario was also examined in the BP studies, which produced about a 40 percent reduction in the emissions associated with partial removal relative to full removal, for the entire project. The 40 percent number compares similarly to the 40-50 percent reduction associated with the large platforms in this study.

The 4H project, associated with the removal of four pacific coast platforms in the 1990s, estimated total NOx emissions from the removal of the three, shallow-water platforms at 78 tons. The estimates for the smallest, shallow water platform in this study average about 70 tons of NOx per platform, without well P&A, shell mounds removal and using the uncontrolled emission factors, which is about four times the emissions levels of the 4H estimates. However, the derrick barge used for the 4H project was substantially smaller by more than 50% than the derrick barge assumed in this study, which accounts for some of the difference in emissions. Some NOx reduction efforts were also employed with the 4H removal process, which provided additional reductions over the uncontrolled emission levels in this study.

Emissions are also substantially affected by timing of the subtasks. Subtask timing in this study are based on the estimates provided in the Smith 2016 report along with supplemental research, including discussions with current operators. Current operators are beginning to conduct analysis and generate emissions estimates for the decommissioning of their platforms. Some operators were willing to share confidential information in order to confirm some of the assumptions in this analysis. The timing estimates from this study were shared with industry and some feedback was received and incorporated into the analysis. The emissions levels in this study were found to be similar to those currently being estimated by industry for Pacific OCS platform decommissioning efforts. In general, well P&A, conductor removal, deck and jacket removal were within 10 percent of the timing estimates provided by industry. Some timing estimates were modified in this study due to the discussions with industry, including topside platform preparation, which was increased substantially, to between 60-90 days from an average of 27 days and post removal site clearance was increased to two weeks instead of one. Some timing estimates were lower for industry, including pipeline and power cable removal. Overall, total timing for platform decommissioning after adjustments for the platforms of which industry estimates were obtained compared favorably, with the difference in timing being less than 5 percent.

5.7 Emissions Uncertainty

There is uncertainty associated with the exact equipment that might be utilized for a decommissioning project. The estimates provided in this study are based on previous studies related to costs of decommissioning and include the MMS 2004 and the Smith 2016 studies, as well as discussions with equipment operators such as Foss Marine Services and the platform operators. However, due to the variability on availability of equipment, different sized derrick barges or tugboats may be selected for use, which would change the emissions estimates. For example, the emissions estimate for the full removal of Platform Harmony is based on the use of a DB30 or equivalent sized derrick barge. However, if a larger barge, such as the DB50 is required, emission levels would increase due to the larger engines on these larger derrick barges. Under this case, emissions could increase by more than 30 percent with the larger derrick barge.

6 Conclusions and Analysis

Decommissioning of offshore platforms in the Pacific OCS would require a substantial amount of effort and time. The in-depth air emission quantification produced in this study allows for an up-to-date and complete understanding of the estimated emissions by phase, subphase and equipment type for the Pacific OCS decommissioning operations, better enabling the directed application of effective mitigation strategies to reduce air quality impacts. The analysis presented in this report documents the estimated emissions that may be generated from the decommissioning activities based on the information available at this time. As more project specific information becomes available and as the parties responsible for decommissioning begin to submit applications and develop specific scenarios with contractors, a more detailed and accurate estimate can be produced. The analysis conducted in this report produces conclusions related to timing, emissions by phase and equipment, decommissioning emissions as they relate to existing operational permit levels and insight into mitigation strategies that could reduce the impacts of air emissions. These are discussed below.

6.1 Emission Sources and Mitigation Effectiveness

The majority of the emissions are generated during the jacket and conductor removal subphases, followed by well P&A and topside preparation. The largest emitting types of equipment are the mobile sources (tugs and supply/crew boats) and generators.

The total emission levels shown in Section 5 assume the use of uncontrolled engines for most equipment except engines controlled at their current levels under permits (platform cranes, crew and supply boats). There is an increased availability of cleaner engine tugboats on the west coast that could be used that would allow for a substantial reduction in emissions levels from the uncontrolled case. Mitigation effectiveness is dependent on the clean engines technology both being available and being feasible. The use of clean engine technology that is currently being used on existing boats in operation ensures both the availability and feasibility of these mitigation strategies. The large scale of the decommissioning efforts could justify the commissioning of project-specific clean diesel equipment, that could then provide air quality benefits to the area associated with the decommissioning projects as well as long after the decommissioning projects are completed.

In addition, similar technology could be utilized on derrick barges, including diesel particulate filters or SCR technologies, to reduce particulate emissions and NOx emissions which would also allow for substantial emission reductions. These technologies may be required by local air districts as part of the decommissioning permitting process. With the addition of these mitigation strategies, emissions levels may be able to be reduced to below applicable district thresholds and/or current platform operational permit levels.

Figure 11 shows the emission levels for all of the platforms grouped by Unit/Field associated with full removal of the jacket and partial removal of the jacket for both the uncontrolled case and assuming clean diesel engines for all equipment, thereby demonstrating the effectiveness of the mitigation with clean diesel engines. The figure also shows the permitted and 2014 actual platform operational emissions. Note that the actual emissions data for the BETA unit were not available.

Figure 12 shows the NOx emissions for the average of all the platforms for full removal of the jacket and partial removal of the jacket for both the uncontrolled case and assuming clean diesel engines for all equipment. The figure also shows the average platform permitted and actual 2014 operational emissions. This substantial reduction in emissions associated with the use of clean diesel demonstrates the high level of mitigation effectiveness associated with the use of clean diesel engines.

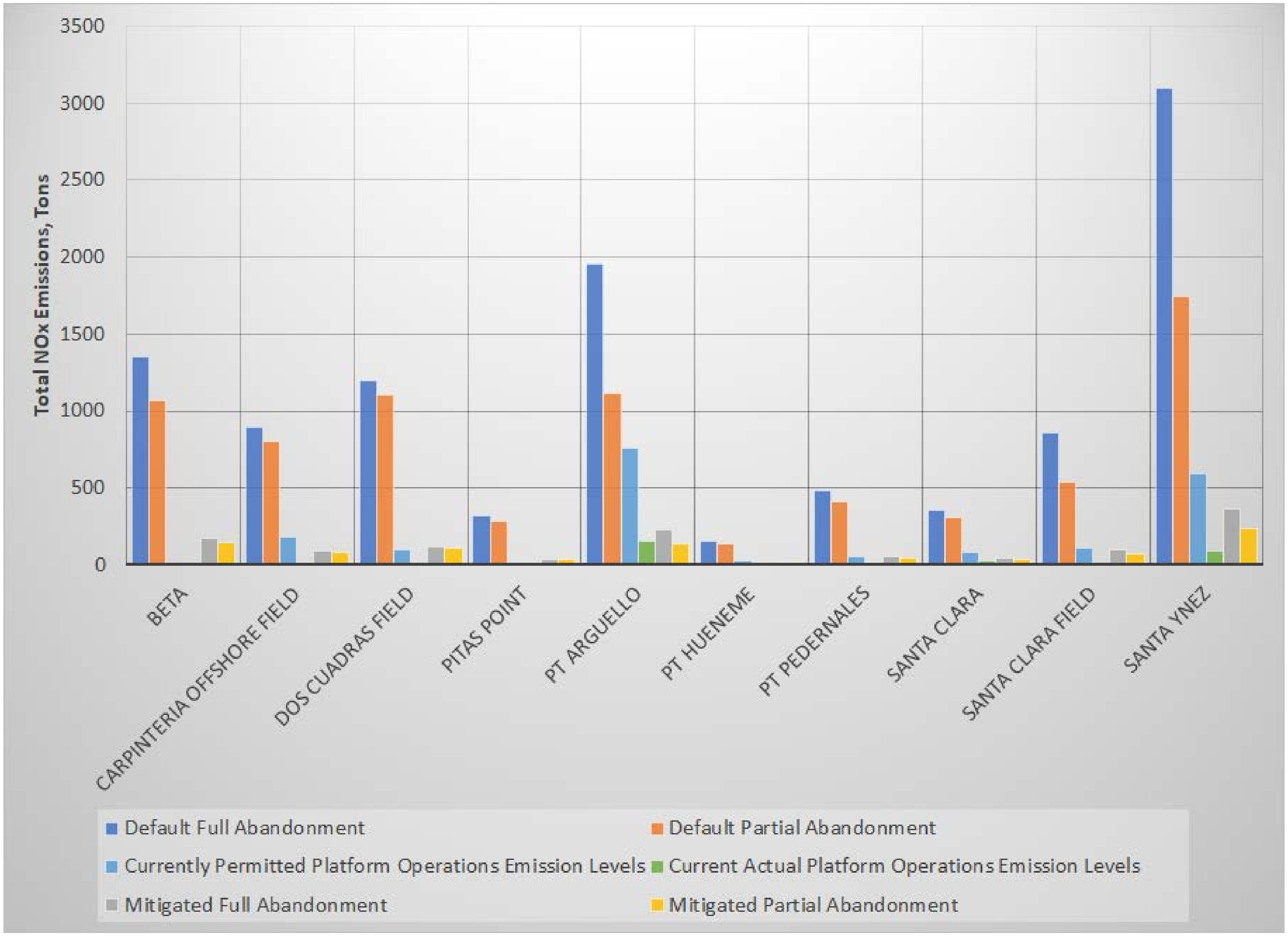


Figure 11. Total NOx emissions by unit/field, full and partial options with and without mitigation compared with permitted and actual operational emissions

In many cases, the estimated emissions from the decommissioning projects may be below the emission levels associated with the existing platforms operating permits as well as the current platforms operating emission levels (year 2014) with the use of clean diesel engines. For example, many the platforms decommissioning emissions levels would be reduced to below their respective current operational annual permit levels with the application of clean diesel engines on all equipment under both the full and partial jacket removal scenarios. Three platforms (Harvest, Hermosa and Hidalgo) decommissioning emissions would be reduced to below their actual annual operating emissions for the partial jacket removal. This indicates the substantial level of emission reduction and the level of mitigation effectiveness associated with the use of clean diesel engines and gives rise to the potential for a net air quality benefit from the elimination of the operational platform emissions under the fully mitigated (i.e., clean diesel engine) scenario.

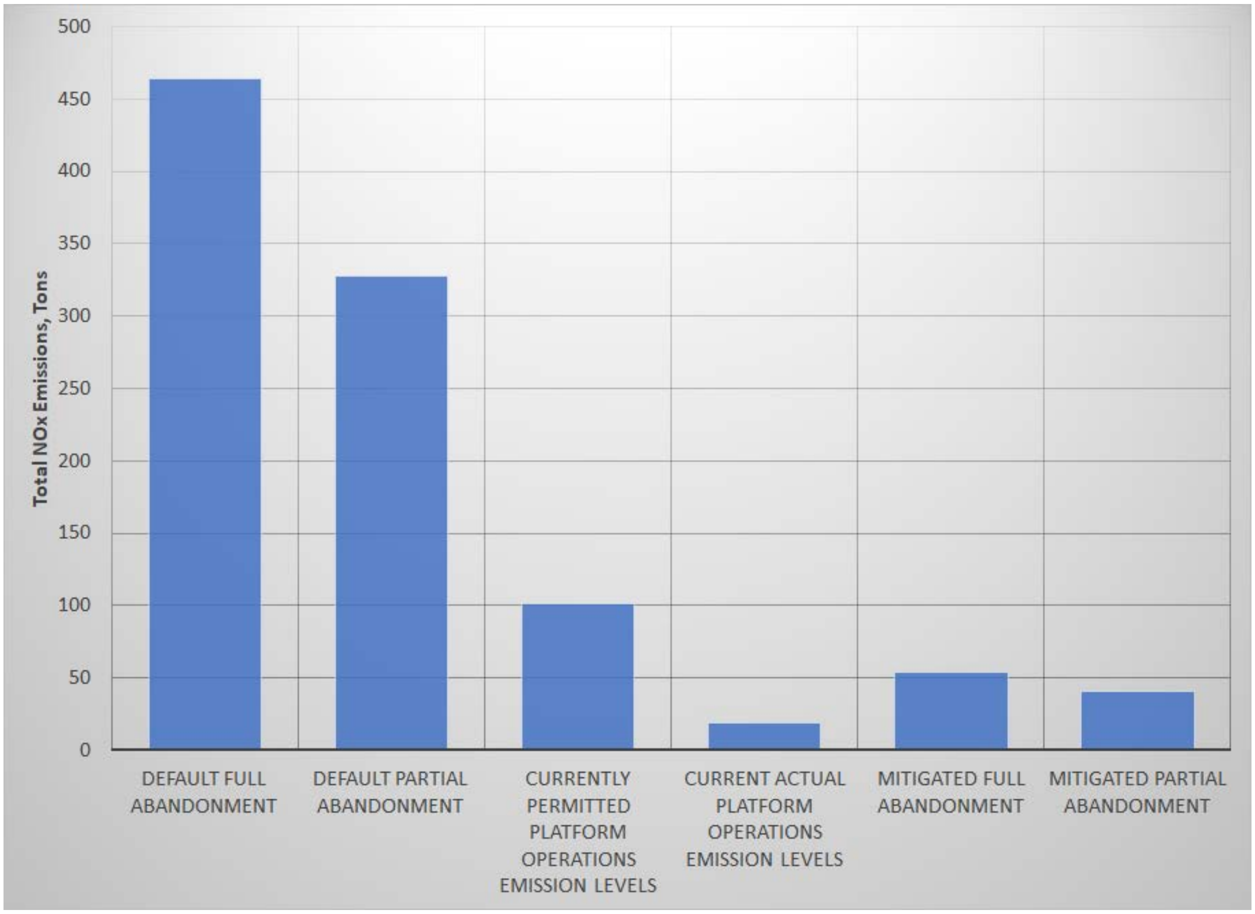


Figure 12. Total NOx emissions for the average platform, full and partial abandonment options with and without mitigation, compared to permitted and actual operational emission

For the decommissioning projects, even under the mitigated cases, emissions levels from platform decommissioning would exceed those related to best available control technology (BACT) and air quality impact assessment (AQIA) thresholds, triggering those requirements. Emissions would also exceed the thresholds associated with determining significance under CEQA.

6.2 Equipment Selection and Timing

The use of derrick barges sized according to the activity ensures that emissions are minimized. Although the relationship is not linear as the same amount of work is conducted, inefficiencies arise when oversized equipment is utilized to conduct a task that could be performed more efficiently with correctly sized equipment. These inefficiencies result in increased emissions. As discussed in Section 3.3, many platforms in the Pacific OCS have average weights per topside module or jacket section that would allow for a smaller derrick barge to be used. The use of the most efficient equipment to conduct the task would help to ensure air quality impacts are minimized. There are several uncertainties, including costs, equipment availability, platform decommissioning timing, and weather/sea state conditions that could affect the selection of the derrick barges.

On a regional perspective, there needs to be regional coordination between the decommissioning responsible parties. If multiple decommissioning projects were to commence at the same time in the same air basin, as a series of cumulative projects, this could substantially increase the probability of emissions causing exceedances of ambient air quality standards at onshore areas. The extent to which permitting agencies, regulatory authorities and coordinated operator efforts could ensure that simultaneous regional activities are minimized is critical to ensuring air quality impacts are reduced.

6.3 Decommissioning Issues by Phase

Each of the different phases of decommissioning will present its own set of challenges and issues.

Pre-Abandonment

During pre-abandonment, the ***P&A*** work may be able to be conducted under the current operating permits associated with the individual platforms. P&A work is estimated to take a large proportion of the time associated with the decommissioning projects but will also need to utilize the existing platform and onshore equipment and processing capabilities in order to process fluids and gas associated with well P&A.

Conductor removal is also an extensive task that is likely to take place as part of the current operating permits.

Activities associated with ***marine growth removal*** may be an issue because marine growth left on the structures taken to the ports can result in subsequent odor issues associated with marine growth decay, as was the case with the 4H project. Removal of all marine growth offshore could minimize odor issues, but this would increase the timing and emissions as it would have to be performed in the offshore environment.

If ***shell mounds*** are removed, available locations for the disposal of the shell mounds is a potential issue. Discussions with the POLB staff indicate that use of fill locations within the port used for historical projects may be limited, and the requirements related to fill material (such as grain sizing, etc.) may make disposal of the shell mounds an issue within the ports. Removal of the shell mounds requires a substantial level of effort yet leaving the shell mounds in place may result in obstructions in the OCS seafloor that could be in conflict with existing lease or permit requirements.

Topside Removal

Topside removal, while not a large fraction of the timing, could produce substantially different emissions levels depending on the use of a single-lift or multiple lift derrick barge. While a single lift barge could perform the removal quickly, it would also require substantially larger engines, thereby producing greater peak day emissions levels.

Disposal of the large quantity of materials associated with the topside (and the jackets) could also present disposal challenges, including the timing to cut up the modules and jacket sections at the port. Clean engine tugs are available and the clean engine technologies are feasible and applied in practice; however clean engine tugs may still need to be specifically commissioned for the level-of-effort needed for these large decommissioning projects. Derrick barges, which generally operate in foreign waters, are most likely not clean engine equipped and would most likely need to be specifically retrofitted and commissioned for the decommissioning projects in order to comply with area BACT requirements.

Jacket Removal

Removal of the jackets can generate a substantial amount of emissions for the larger platforms and the use of the partial removal option would substantially reduce the emissions for the larger platforms. However, the partial removal option introduces the issue of "rigs-to-reef" and the use of artificial reefs along the coast, which is still an outstanding issue in California.

The smaller platforms do not have a substantial air quality advantage with the partial removal scenario due to the shallower water depth. The disposal challenges of the large amount of materials associated with the jackets from all platforms could be a significant issue and would be minimized through the use of the partial jacket removal scenario.

Debris Removal

Debris removal issues for the full jacket removal option would be related to removing or leaving in place the shell mounds, as disposal of the shell mounds may be challenging in terms of finding a disposal location, and because removing the shell mounds would generate emissions. Partial removal of the jacket would most likely leave the shell mounds in place but would require that some "debris" is left onsite, thereby producing potential obstructions for fisherman. Some issues associated with the cutting of the 4H platforms piles occurred, which could extend the timing, and therefore emissions, associated with the removal of the piles and seafloor infrastructure below the mudline.

Pipelines and Power Cable Removal

Pipelines and power cables could be completely removed, partially removed or left in place. Leaving these items on the ocean floor could also allow for "debris" and obstructions for fisherman to remain after decommissioning. These issues would need to be balanced with the additional level of effort and emissions associated with removing all the subsea components.

Processing and Disposal

Processing and disposal of over 450,000 tons of materials associated with all of the platforms could produce substantial strains on the area recycling capabilities. Much of the materials may need to be shipped overseas for disposal, yet overseas markets for recycling materials are becoming more restricted. Due to uncertainties of disposal locations, emissions associated with truck trips have not been estimated for this study.

6.4 Net Air Quality Benefit

The estimated decommissioning emissions are substantial and range into the hundreds of tons of pollutants associated with a single platform decommissioning effort if uncontrolled equipment is used. Cleaner engines and technologies, such as tugboats currently located along the west coast, are available or could be commissioned that could result in substantial emission reductions. Implementation of available clean technologies for decommissioning could produce less than the annual permitted emissions levels of the operating platforms, which would represent a net air quality benefit due to the elimination of the operating platform emissions.

Additional measures could be implemented (see Section 2.3.4) to achieve a net air quality benefit, such as permanent surrendering of offsets used for platform PTOs; offsets applied through environmental review (NEPA/CEQA); control technology options; and emission reduction programs such as the vessel speed reduction program.

6.5 Conclusions

The process of decommissioning the Pacific OCS platforms is approaching for several facilities, and planning for the detailed air quality impacts, including equipment, equipment availability and permitting issues, associated with the level of effort is important for the process to proceed smoothly. This study provides detailed air quality emissions estimates and equipment assessments in line with current permit levels of detail as well as incorporating discussions with air districts, operators and equipment providers on the current state of the air permitting and level of effort needed to decommission the large number of platforms located in the Pacific OCS. Timing of subtasks has been confirmed with a comparison to other studies and projects as well as discussions with platform operators, some of which are currently in the decommissioning planning stages.

The estimates included in this analysis include many assumptions based on the current platform arrangements and potential decommissioning equipment characteristics. As more detailed decommissioning estimates and quotes are developed by the operators, more accurate estimates can be developed.

The emissions levels as estimated in this assessment are substantial and range into the hundreds of tons of pollutants associated with a single Platform decommissioning effort if higher-polluting equipment is used. These emissions are summarized below:

- Total emissions from all platforms are over 10,000 tons of NOx for full abandonment for the uncontrolled case, reduced to about 7,500 tons of NOx under the partial jacket abandonment scenario.
- Use of clean diesel engines reduces emissions to about 1,200 tons and 900 tons, for the full and partial jacket abandonment scenarios for all platforms combined, respectively.
- The Santa Ynez Unit (Platforms Harmony, Heritage and Hondo) produces about 30 percent of the total emissions from all platform decommissioning activities.
- Shallow water platforms (less than 250 feet deep) produce on average about 300 tons of NOx per decommissioning project, whereas deep water platforms produce on average more than 1,000 tons of NOx.

Conclusions associated with the study include the following:

- Cleaner engines and technologies, such as the clean tug boats currently located along the west coast, are available or could be commissioned that could result in substantial emission reductions.

- Partial removal of the jackets provides for substantial reductions in emissions for deep water platforms.
- Partial removal of the jackets for facilities located in shallower depth (less than 190 feet) provided minimal reductions from the complete removal of the facilities.
- With the implementation of available clean technologies, emissions levels of pollutants associated with the average platform decommissioning construction project would generally be below the current emissions levels associated with the permitted operations of the average platform,
- For some platforms, the average platform decommissioning project emissions could be below the actual historical operational emissions for those facilities under the partial removal scenario.
- Thus, a net air quality benefit to the region could be realized through the removal of these ongoing emissions sources through a decommissioning process that could produce less than the annual operational permitted emissions levels of the operating platform.
- Additional mitigation strategies primarily associated with vessels supporting and conducting decommissioning operations could further reduce the emission potentials associated with the combustion intensive decommissioning operations.
- There are substantive challenges and issues associated with these decommissioning activities, such as locations for disposal of materials, marine growth odor, effective use and selection of large equipment, coordination of decommissioning efforts between operators and whether federal facilities use of the California regulations for partial decommissioning ("rigs-to-reef") are feasible.

The use of uncontrolled diesel engines may present substantial air quality impacts to onshore areas. Mitigation measures associated with the use of clean diesel engines are available and feasible which would help to ensure that decommissioning of Pacific OCS platforms do not produce substantial impacts and would help to ensure that the decommissioning of the Pacific OCS platforms may present a net air quality benefit to the region.

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Appendix A: Regulatory Standards

The tables on the following pages summarizes data related to engine standards for the EPA and the State of California.

Appendix A Table of Contents

Federal Standards

Clean Air Act

The Federal Clean Air Act of 1970 and 1990 Clean Air Act Amendments provide provisions for the attainment and maintenance of the National Ambient Air Quality Standards (NAAQS) and to address emissions that have the potential to affect local, regional, and global air quality. The 1990 Clean Air Act Amendments are listed below:

- Title 1 Attainment and maintenance of the NAAQS;
- Title II Motor vehicle and fuel reformulation;
- Title III Hazardous Air Pollutants;
- Title IV Acid deposition;
- Title V Federal operation permits;
- Title VI Stratospheric ozone protection; and
- Title VII Enforcement.

Title 42 – Air Pollution Prevention and Control

The Clean Air Act is defined by the US Code Title 42 section 7601 – 7627 (CAA Section 301-328). Chapter 85, Air Pollution Prevention and Control, of Title 42 of the Clean Air Act provides the definition (Subchapter III, Section 7602) for a major stationary source and major emitting facility as any stationary facility or source of air pollutants which directly emit or has the potential to emit 100 tons or more per year of any pollutant (including any major emitting facility or source of fugitive emissions of any such air pollutant). Section 7602 also provides the definition for small source as a source that emits less than 100 tons of regulated pollutants per year. Stationary source is defined as any source of air pollutant except those emissions resulting directly from an internal combustion engine for transportation purposes or from a non-road engine or non-road vehicle.

Subchapter III, Section 7627, Air Pollution from Outer Continental Activities, defines an OCS source as any equipment, facility or activity that:

- emits or has the potential to emit any air pollutant;
- is regulated or authorized under the Outer Continental Shelf Lands Act; and
- is located on the OCS or in or on waters above the OCS.

The definition further delineates "activities" to include, but not be limited to, platform and drill ship exploration, construction, development, production, processing, and transportation. OCS vessel emissions under Section 7627 are defined as emissions from any vessel servicing or associated with an OCS source, including while at the OCS source or en route to or from the OCS source within 25 miles of the OCS source, and are considered direct emissions from the OCS source.

Ambient Air Quality Standards

The Clean Air Act set NAAQS (40 CFR part 50) for pollutants considered harmful to public health and the environment. The Clean Air Act identifies two types of NAAQS. Primary standards provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. The EPA has set NAAQS for six principal pollutants, which are called "criteria" air pollutants. The State of California has also set standards for sulfates, hydrogen sulfide, vinyl chloride, and visibility reducing particles in addition to the six principal pollutants (see below). The Federal and State Air Quality Standards, along with the companion California Ambient Air Quality Standards (CAAQS) are presented below in **Table 2-1**, Federal and State Air Quality Standards.

NEPA Thresholds

The National Environmental Policy Act (NEPA), signed in to law in 1970, as it applies to the OCS platforms, requires analyzing and addressing impacts associated with Federal decisions relating to oil and gas planning, leasing, or field development, including exploration. development, and production (40 CFR Parts 1500-1508). An air quality assessment to include modeling is required to assess impacts to air quality and/or Air Quality Related Values (AQRV) if a proposed project meets the at least one of the criteria in each of the groups of criteria below:

- Emissions/Impacts - the proposed action:
    - Is anticipated to cause a substantial increase in Emissions based on the emissions inventory; or
    - Will materially contribute to potential adverse cumulative air quality impacts as determined under NEPA.
- The geographic location of the proposed action is in:
    - Proximity to a Class I or sensitive Class II Area; or
    - A non-attainment or maintenance Area; or
    - An area expected to exceed the NAAQS or PSD increment based on monitored or previously modeled values for the area, proximity to designated non-attainment or maintenance areas, or emissions for the proposed action based on the emissions inventory.

An AQRV is defined as a resource, as identified by the Federal Land Manager for one or more Federal areas that may be adversely affected by a change in air quality. The resource may include visibility or a specific scenic, cultural, physical, biological, ecological, or recreational resource identified by the Federal Land Manager for a particular area.

Air quality modeling may not be required:

- If the Lead Agency demonstrates and the EPA, and the Agencies whose lands are affected concur (in writing or by electronic transmission) that, due to mitigation or control measures or design features that will be implemented, the proposed action will not cause a Substantial Increase in Emissions. The demonstration will describe the proposed features or measures, the anticipated means of implementation, and the basis for the conclusion that the proposed action will not cause a Substantial Increase in Emissions.
- If the EPA and the Agencies whose lands are affected concur (in writing or by electronic transmission) that an existing modeling analysis addresses and describes the impacts to air quality and AQRVs for an area under consideration, and the analysis can be used to assess the impacts of the proposed action.

Federal Rules and Regulations

Air permits are required by Title V, Part 70, of the Clean Air Act. The EPA has delegated authority to the local air districts for the processing and enforcement of Federal Part 70 air quality permits. This section details Federal air quality regulations applicable to the operation of oil platforms on the OCS. Associated State and local air quality regulations are discussed in Section 2.2 and 2.3 below.

New Source Review/Prevention of Significant Deterioration (40 CFR 51/52)

The New Source Review (NSR) and Prevention of Significant Deterioration (PSD) regulations apply to new major sources or major modifications at existing sources for pollutants where the area the source is located is in attainment, non-attainment, or unclassifiable with the NAAQS. Part 52.1 (40CFR52.1(b)(43) defines the PSD program as the EPA implemented major source pre-construction permit program or an approved major source pre-construction permit program that has been incorporated into a State Implementation Plan; any permit approved under these programs is a major NSR permit. The California Air Resources Board (CARB) refers to the Federal Nonattainment Area permitting program as Federal New Source Review and refers to the attainment permitting program as Prevention of Significant Deterioration. A major source is defined (40CFR52.21(b)(1)(i) as any stationary source which emits, or has the potential to emit, 250 tons per year or more of a regulated pollutant for which a national ambient air quality standard has been promulgated and any pollutant identified as a constituent or precursor for such pollutant (NSR pollutant) or any physical change that would occur at a stationary source if the changes would constitute a major stationary source by itself. A major modification (40CFR52.21(b)(2)(i) means any physical change in or change in the method of operation of a major stationary source that would result in a significant increase in emissions of a regulated NSR pollutant and a significant net increase in emissions of that pollutant from the major stationary source.

Part 52.1 provides additional definitions that may apply to decommissioning activities. A stationary source means any building, structure, facility, or installation that emits or may emit a NSR pollutant (40CFR52.1(b)(5). A building, structure, facility, or installation means all the pollutant emitting activities which belong to the same industrial grouping, are located on one or more contiguous properties, and are under control of the same person expect activities of any vessel (40CFR52.1(b)(6). Pollutant emitting activities are considered part of the same industrial grouping if they belong to the same major group; major group as defined by the same first two-digit SIC (Standard Industrial Classification Code) code (40CFR52.1(b)(6). Construction is defined (40CFR52.1(b)(8) as any physical change or change in method of operation that would result in a change of emissions.

Part 55 (40CFR55.13) notes that PSD shall apply to OCS sources. The regulations require the following:

- installation of the "Best Available Control Technology" (BACT);
- an air quality analysis;
- an additional impacts analysis; and
- public involvement.

The local air districts have regulations for new source review which comply with the Federal regulations. See Section 2.3.

OCS Air Regulations (40 CFR 55)

The OCS air regulations establish the requirements to control air pollution from OCS sources to attain and meet the Federal NAAQS and State CAAQS. These requirements are delegated to, and enforced by, the local air pollution control districts through equivalent permits as discussed in Section 2.5.

Part 55 (40CFR55.2) defines an OCS source as any equipment, activity, or facility which:

- emits or has the potential to emit any air pollutant;
- is regulated or authorized under the Outer Continental Shelf Lands Act; and
- is located on the OCS or in or on waters above the OCS.

The definition includes vessels in two cases:

- only when they are permanently or temporarily attached to the sea bed and used to explore, develop, or produce resources; and

- physically attached to an OCS facility, in which case only the stationary source aspects of the vessels will be regulated.

Potential emissions are defined (40CFR55.2) as the maximum emissions of any pollutant from an OCS source at its design capacity. The definition further notes emissions from vessels servicing or associated with an OCS source shall be considered direct emissions from such a source while at the source. Emissions from vessels en route to or from the source within 25 miles of the source are to be included in the potential to emit calculation for the OCS source.

The Part 55 regulations (40CFR55.4) include the requirements for an operator to obtain a permit and to file an NOI prior to any physical change or method in operation that results in an increase of emissions. The NOI is required no more than 18 months prior to submitting a permit application. The NOI requirements include; general company information, a description of the facility, an estimate of the project emissions, a list of emissions points, air pollution control equipment, any additional information that can affect emissions, and information necessary to determine any impact to onshore areas. Emissions points include those associated with vessels and an estimate of the quantity and type of fuels and raw materials to be used.

Part 55 Appendix A lists the titles of the State and local requirements that are contained within the documents incorporated by reference into 40 CFR part 55. For the State, these include some Title 17 subchapter 6 references (visible emission standards, nuisance prohibitions, etc.) and reference to the Health and Safety Code section 42301.13, the prohibition on requiring offsets for demolition projects. For local air districts, numerous rules are listed as applicable to the OCS.

New Source Performance Standards (40 CFR 60)

The use of tier-certified engines demonstrates compliance with the emissions limits of the New Source Performance Standards. Local air quality districts enforce this requirement using analogous rules and regulations.

Emission Standards for Hazardous Air Pollutants (40 CFR 61 and 63)

The National Emission Standards for Hazardous Air Pollutants (NESHAP) are stationary source standards for hazardous air pollutants. Standards in Part 61 are based on the activity and hazardous air pollutants that may be emitted. The standards in Part 63 are based on the industrial classification of a facility. The NESHAP standards for Reciprocating Internal Combustion Engines (RICE) are outlined under 40 CFR 63 Subpart ZZZZ. The standards for major sources including industrial, commercial, and institutional boilers and process heaters are outlined in Subpart DDDDD. Subpart EEEE includes the standards for non-gasoline organic liquids distribution.

Compliance Assurance Monitoring (40 CFR 64)

Part 64 requires monitoring to provide a "*reasonable assurance of compliance with emission limitations or standards*" for permitted emissions units.

Operating Permits (40 CFR 70)

All OCS platforms have Part 70 permits as required under Title V of Clean Air Act. Title V permits contain extensive information on equipment and operations. Local air quality district regulations contain rules to enforce the Federal permit requirements. It does not appear that operating permits will be required for most of the decommissioning activities. It is likely that the pre-abandonment activities will be conducted under the exiting platform permits to operate.

Fuel Sulfur Content (40 CFR 80)

Part 80 addresses diesel fuel sulfur requirements. Beginning in 2010-2012, diesel fuel sulfur for non-road, locomotive and marine (NRLM) engines was limited to 15 ppm sulfur

Emissions from Marine Engines (40 CFR 94 and 1094)

The diesel marine engine regulations address control of emissions from new and in-use marine compress-ignition (diesel) and vessels. The standards apply to marine diesel engines installed in a variety of marine vessels ranging in size and application from small recreational vessels to tugboats and large ocean-going vessels. Engines are grouped into one of three categories depending on engine cylinder displacement size and four different tier levels with unique timeline requirements for each tier level and engine size.

Parts 92 and 1094 address NO_x, HC, CO and PM emission requirements for marine engines. Additional emission control requirements were added to 40 CFR 94 in 2008 to further reduce NO_x and PM emissions engines and includes standards for both new and remanufactured engines. Remanufacture is defined as the removal and replacement of all cylinder liners, either during a single maintenance event or over a five-year period. A certified marine remanufacture system must achieve a 25 percent reduction in PM emissions compared to the engine's measured baseline emissions level. This requirement is not applicable to engines with output levels measuring below 600 kw. Requirements for marine diesel engines depend on engine size and are shown below.

Decommissioning Activities (30 CFR 250 Subsection Q)

Part 30 CFR 250, Oil and Gas and Sulphur Operations in the OCS, provides requirements for decommissioning of OCS platforms:

- Section 250.1710 – Permanently plug all wells on a lease timing;
- Section 250.1711 – BOEM permanent plug well orders;
- Section 250.1712 – Information submittal requirements;
- Section 250.1713 – Notification requirements;
- Section 250.1714 – Well plug requirements;
- Section 250.1715 – Well plug methods;
- Section 250.1716 – Wellheads and casings depth requirements;
- Section 250.1717 – Post plug information requirements;
- Section 250.1721 – Temporary abandonment requirements;
- Section 250.1722 – Subsea protective device requirements;
- Section 250.1723 – Well in temporary abandoned status process;
- Section 250.1725 – Removal of platforms and associated facility timing;
- Section 250.1726 – Initial platform removal application and submittal requirements;
- Section 250.1727 – Final application submittal requirements;
- Section 250.1728 – Removal depth requirements;
- Section 250.1729 – Post removal information requirements;
- Section 250.1730 – Approval of partial structure removal or toppling in place issues;
- Section 250.1731 – Facilities subject to an Alternate Use rights of use and easement (RUE);
- Section 250.1740 – Verification of a permanently plugged well or removed platform;
- Section 250.1741 – Trawl dragging site requirements;
- Section 250.1742 – Other site verification methods;
- Section 250.1743 – Site obstruction clearance verification requirements;
- Section 250.1750 – Decommission of a pipeline in place requirements;

- Section 250.1751 – Decommission of pipeline methods;
- Section 250.1752 – Pipeline removal methods;
- Section 250.1753 – Post pipeline decommission information requirements; and
- Section 250.1754 – Removal of a previously decommissioned in place pipeline.

Many aspects of these requirements could affect air emissions, such as removal or abandonment in place of pipelines, removal depth requirements and post-removal survey and trawling requirements.

Subsection Q, Section 1750 allows for a pipeline to be decommissioned in place, as approved by BSEE, if the pipeline does not constitute a hazard to navigation or commercial fishing operations, does not interfere with other uses of the OCS, or have adverse environmental effects. If these determinations cannot be made, then the pipelines might be removed.

Depending on the age and the associated permitted discharges from the platform, the shell mounds could consist of drill muds and drill cuttings with the shell material providing a cap like cover. Four platforms offshore California (Hazel, Heidi, Hilda, and Hope – 4H platforms) were removed in 1996 and the shell mounds were left in place. Options analyzed for these shell mounds included full removal of the shell mounds, leveling and spreading the mounds on the bottom, capping the mounds in place with sand, and enhancing the mounds as artificial reefs. For the 4H Platforms, the California State Lands Commission (CSLC) oil and gas lease and the California Coastal Commission coastal development permit required full removal of the shell mounds, and that the sites be free of debris and trawlable with standard trawling equipment. Currently no regulations require the removal of the shell mounds except for the Federal requirements in 30 CFR 250 that ensure that decommissioning is done in a manner that does not unreasonably interfere with other uses of the OCS and does not cause undue or serious harm or damage to the human, marine, or coastal environment.

Section 250.1728 requires the removal of all platforms and facilities to at least 15 feet below the mudline. Therefore, casings are required to be removed to 15 feet below the mudline as well as pilings, which would affect the amount of material removed and transported. Removal of some portion of the muds under a platform could be associated with removal of the shell mounds, but there are no regulatory requirements to do so.

State of California Rules and Regulations

The State of California has many regulations that may be applicable to decommissioning activities. These are summarized below and discussed in more detail below.

California Air Resources Board (CARB)

The CARB establishes the California Ambient Air Quality Standards (CAAQS), see **Table 2-1** above. Comparison of the criteria pollutant concentrations in ambient air to the CAAQS determines State attainment status for criteria pollutants in a given region. CARB has jurisdiction over all air pollutant sources in the State; it has delegated to local air districts the responsibility for stationary sources and has retained authority over emissions from mobile sources. CARB, in partnership with the local air quality management districts within California, has developed a pollutant monitoring network to aid attainment of CAAQS. The network consists of numerous monitoring stations located throughout California that monitor and report various pollutants' concentrations in ambient air.

California Health and Safety Code – Air Resources (Division 26)

Enacted on January 1, 1989, and amended in 1992, the Clean Air Act Amendments mandates achieving the health-based CAAQS at the earliest practical date. The CARB has established standards for diesel fuel, on-road diesel engines, off-road (non-highway) diesel engines, portable equipment, marine engines, and air toxics. These standards are applicable to many of the equipment types required for the decommissioning of the OCS platforms and are discussed in the following sections.

AB2588 (California Health & Safety Code, Division 26, Part 6)

The Air Toxics "Hot Spots" Information and Assessment Act of 1987 (AB2588) requires an inventory of air toxics emissions from individual stationary facilities, an assessment of health risk, and notification of potential significant health risk.

California Diesel Fuel Regulations

With the California Diesel Fuel Regulations, the CARB set sulfur limitations for diesel fuel sold in California for use in on-road and off-road motor vehicles. The rule initially excluded harbor craft and intrastate locomotives, but it later included them with a 2004 rule amendment. Under this rule, diesel fuel used in motor vehicles, except harbor craft and intrastate locomotives, has been limited to 500-ppm sulfur since 1993. This sulfur limit was later reduced to 15-ppm, effective September 1, 2006, for all source types.

Off-Road Diesel Fueled Fleets

Off road equipment would be used at the ports for breaking apart the materials and possibly on barges located offshore, such as cranes and generators. On July 26, 2007, the CARB adopted a regulation to reduce diesel PM and NO_x emissions from in-use (existing) off-road heavy-duty diesel vehicles in California. Applicable vehicles include those used in construction, mining, industrial operations, and include work over rigs and have a number of requirements including reporting, labeling and fleet average emissions levels. Implementation of the requirements are a function of the fleet sizes and horsepower and are phased in over a period of years, with prohibitions on the addition of any Tier 0 or Tier 1 equipment after 2014, prohibitions on the addition of Tier 2 equipment after 2018 for large fleets and 2023 for small fleets. Fleet average emission rates are specified in the rule for equipment based on horsepower with the allowed fleet average values decreasing until 2023 for large and medium fleets and until 2028 for small fleets. Therefore, as a fleet could have a mix of engine emissions levels from Tier 1 to Tier 4 (as long as their fleet average meets the requirements), emission standards and Tier levels 1-4 are presented below.

California Statewide Portable Equipment Registration Program (PERP)

Various portable equipment, such as generators and compressors, may be used offshore during the decommissioning projects. The California Portable Equipment Registration Program (PERP) allows for owners or operators of portable engines and certain other types of equipment to register their units with CARB to operate their equipment throughout California without having to obtain individual permits from local air districts. Certain engines registered in the PERP program are also subject to the Airborne Toxic Control Measures (ATCM) for diesel particulate matter (DPM). The ATCM fleet standards became effective in January 2013, became more stringent in January 2017 and will become most stringent in January 2020. This regulation is part of the State's Diesel Risk Reduction Plan to reduce DPM. The use of PERP equipment for decommissioning activities can be coordinated through the local air districts. The ATCM has emission standards for each fleet depending on engine size range. Appendix A shows the standards effective January 1, 2013, and the weighted PM emission fleet averages by the 2020 compliance date. PERP is not applicable to use of equipment in the OCS, but the local air directs utilize the requirements when developing permits for OCS activities.

California Code Diesel Engine Requirements Marine Craft

Extensive use of marine diesel engines would be a part of the decommissioning process, including tugboats, crew boats, dive boats and barges. Title 13, Section 2299.5 provides a low sulfur fuel requirement, emission limits and other requirements for commercial harbor craft. Title 17, Section 93118.5 provides emission limits for marine engines by size and Tier level as shown below. All owners/operators of commercial harbor craft that operate in California Regulated Waters are required to comply with this regulation. Category 1 engines are defined as any marine engine with a displacement of less than 5.0 liters per cylinder and with a maximum rating of 50 hp or greater, Category 2 engines are marine engines with a displacement of 5.0 to less than 30 liters per cylinder, which would generally address most tugboats and vessels associated with the decommissioning efforts. Vessels with greater than 30 liters per cylinder are generally larger, ocean going vessels and not applicable to decommissioning.

The rule requirements are applicable to both new and in-use vessels. New vessels currently have requirements of a Tier 4 engine. The regulation requires that in-use Tier 1 and earlier propulsion and auxiliary diesel engines on a vessel meet emission limits equal to or cleaner than Tier 2 or Tier 3 U.S. EPA standards in effect at the time the engine is brought into compliance. Once an engine meets either the Tier 2 or Tier 3 standards, the engine is considered to be compliant. Compliance dates for in-use engines are based on the engine model year and the annual operating hours with the oldest, highest-use engines required to comply first. In-use vessels are required to be compliant by 2020-2022 depending on the port location, with SCAQMD port-based vessels being required to comply earliest.

Therefore, as marine diesel equipment could present a range of engine tiers from Tier 2 to Tier 4 depending on the model year of the equipment. Tier 2 to Tier 4 requirements are listed below.

Title 17 Airborne Toxic Control Measures (ATCM)

The ACTMs provide mobile and stationary source airborne toxic control promulgated by the CARB and codified in the California Code of Regulations (CCR). Control measures include fuel types, operating and testing requirements, and emissions standards. Section 93116 provides the requirements for diesel engines including engines used to provide motive power, and auxiliary engines used on marine vessels. Section 93118.5 applies to commercial harbor craft.

AB 2503 Rigs to Reef

In 2010, California enacted the California Marine Resources Legacy Act also known as "Rigs to Reef". Rigs to Reef established the California Artificial Reef Program and is administered by the Department of Fish & Wildlife Service. The Rigs to Reef program allows for consideration for partial removal oil & gas platforms if, compared to full removal, there is a net environmental benefit and substantial cost savings. Recent studies have included determinations that platforms may have higher densities of fish, can be more important as nurseries than natural reefs, and act as de facto marine refuges. A partial abandonment of the platform jacket could reduce the air quality emissions associated with jacket removal and disposal.

In February 2017, Senate Bill SB 588 determined that the 23 oil and gas platforms in Federal waters and the four platforms in State waters off the California coast are expected to reach the end of their useful production lifetimes and be decommissioned between 2017 and 2055. The legislation noted that existing Federal regulations provide for partial structure removal or toppling in place for conversion to an artificial reef or other use if the structure becomes part of a State artificial reef program. They also noted that for many years the GOM region has funded marine resource programs where oil and gas platforms are partially removed and converted to artificial reefs and the cost savings are shared between the State and the platform owner and operator, as appropriate. For platforms located in State waters, the law allows discretion to the State Lands Commission regarding decommissioning platforms. The legislation findings conclude that provided that partial removal of an oil platform and consideration of related alternatives would result in a net benefit to the marine environment compared to full removal, it is in the best interests of the State that a portion of the cost savings that result from partial removal and conversion to an artificial reef is shared with the citizens of this State to protect and enhance the State's marine resources.

The applicability of the California Rigs to Reef program to the Federal OCS platforms has yet to be finalized. The issue is part of the discussion by the BOEM Interagency Decommissioning Working Group. The group is composed of representatives from the Bureau, California State Lands Commission, California Coastal Commission, California Department of Fish and Wildlife, Department of Conservation Division of Oil, Gas and Geothermal Resources, National Marine Fisheries Service, Ventura County, Santa Barbara County, City of Goleta, City of Carpinteria, U.S. Coast Guard and U.S. Army Corps of Engineers. The Air Pollution Control Districts are not participating in this effort.

H&SC Section 42301 - Emission Offsets

Assembly Bill 3047 added to Section 42301.13 of the California Health and Safety Code pertaining to the demolition or removal of stationary sources. Section 42301.13 prohibits an air district from requiring, as part of its permit system or otherwise, that any form of emission offset or emission credit be provided to offset emissions resulting from any activity related to, or involved in, the demolition or removal of a stationary source.

California Environmental Quality Act (CEQA) Thresholds

The California Environmental Quality Act (CEQA) is a statute that requires State and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. Mitigation measures may include emissions offsets. CEQA applies to projects that are required to receive a discretionary approval from a regulatory agency for a permit. Every development project that requires a discretionary governmental approval will require at least some environmental review pursuant to CEQA, unless an exemption applies. Decommissioning activities that require a permit from a local municipality, a local air district or other California regulatory agency will be subject to CEQA.

The CEQA provides significance thresholds and specific criteria for determining whether a proposed project may have a significant adverse air quality impact. Appendix G, Environmental Checklist Form, of the State CEQA Guidelines includes the following list in the form of a questionnaire for air quality. Will the proposed project:

- Conflict with or obstruct implementation of the applicable air quality plan;
- Violate any air quality standard or contribute substantially to an existing or projected air quality violation;
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable Federal or State ambient air quality standard (including releasing emissions that exceed quantitative thresholds for ozone precursors);
- Expose the public (especially schools, day care centers, hospitals, retirement homes, convalescence facilities, and residences) to substantial pollutant concentrations; and
- Create objectionable odors affecting a substantial number of people.

Appendix G also provides the following questions for greenhouse gas emissions. Will the proposed project:

- Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment; and
- Conflict with an applicable plan, policy or regulation adopted to reduce the emissions of greenhouse gases.

Local air districts and some local planning agencies have additional thresholds for air quality and GHGs.

Table A-1. Federal and State air quality standards

Pollutant	Averaging time	California standards	National standards	
			Primary	Secondary
O_3	1-hour 8-hour	0.09 ppm 0.07 ppm	NS 0.070 ppm	NS 0.070 ppm
CO	1-hour 8-hour	20.0 ppm 9.0 ppm	35 ppm 9.0 ppm	NS NS
NO_2	1-hour Annual Average	0.18 ppm 0.030 ppm	0.10 ppm 0.053 ppm	NS 0.053 ppm (100 µg/m^3)
Sulfur Dioxide (SO_2)	1-hour 3-hour 24-hour Annual Average	0.25 ppm NS 0.04 ppm NS	0.075 ppm NS 0.14 ppm 0.03 ppm	NS 0.5 ppm NS NS
PM_{10}	24-hour Ann. Arith. Mean	50 µg/m^3 20 µg/m^3	150 µg/m^3 NS	150 µg/m^3 NS
$PM_{2.5}$	24-hour Ann. Arith. Mean	NS 12 µg/m^3	35 µg/m^3 12 µg/m^3	35 µg/m^3 15 µg/m^3
Pb	30-day Average Calendar Qtr. 3-month Average	1.5 µg/m^3 NS NS	NS 1.5 µg/m^3 0.15 µg/m^3	NS 1.5 µg/m^3 0.15 µg/m^3
Sulfates (SO_4[b])	24-hour	25 µg/m^3	NS	NS
H_2S	1-hour	0.03 ppm	NS	NS
Vinyl Chloride	24-hour	0.010 ppm	NS	NS
Visibility Reducing Particles	1 Observation	"extinction of 0.23 per kilometer" "extinction of 0.07 per kilometer" (California only).		

Notes: µg/m^3=microgram/cubic meter; Ann. Arith. Mean=Annual Arithmetic Mean; mm=millimeter; NS=No Standard; ppm=parts per million by volume (micromoles of pollutant per mole of gas)

Table A-2. CARB and U.S. EPA Tier 1, 2, and 3 off-road exhaust emission standards

New off-road diesel engines ≥ 25 hp (g/bhp-hr)						
Maximum rated power Hp (kW)	Tier	Model year[a]	NO_x	HC	NO_x+NMHC	PM
25≤hp<50 (19≤kW<37)	Tier 1	1999-2003[a]	-	-	7.1	0.60
	Tier 2	2004-2007	-	-	5.6	0.45
50≤hp<75 (37≤kW<56)	Tier 1	1998-2003[a]	6.9	-	-	-
	Tier 2	2004-2007	-	-	5.6	0.30
	Tier 3[b]	2008-2011	-	-	3.5	0.30
75≤hp<100 (56≤kW<75)	Tier 1	1998-2003[a]	6.9	-	-	-
	Tier 2	2004-2007	-	-	5.6	0.30
	Tier 3	2008-2011	-	-	3.5	0.30
100≤hp<175	Tier 1	1997-2002	6.9	-	-	-

Table A-2. CARB and U.S. EPA Tier 1, 2, and 3 off-road exhaust emission standards

New off-road diesel engines ≥ 25 hp (g/bhp-hr)						
Maximum rated power Hp (kW)	**Tier**	**Model year[a]**	**NO_x**	**HC**	**NO_x+NMHC**	**PM**
(75≤kW<130)	Tier 2	2003-2006	-	-	4.9	0.22
	Tier 3	2007-2011	-	-	3.0	0.22
175≤hp<300 (130≤kW<225)	Tier 1	1996-2002	6.9	1.0	-	0.40
	Tier 2	2003-2005	-	-	4.9	0.15
	Tier 3 [c]	2006-2010	-	-	3.0	0.15
300≤hp<600 (225≤kW<450)	Tier 1	1996-2000	6.9	1.0	-	0.40
	Tier 2	2001-2005	-	-	4.8	0.15
	Tier 3 [c]	2006-2010	-	-	3.0	0.15
600≤hp≤750 (450≤kW≤560)	Tier 1	1996-2001	6.9	1.0	-	0.40
	Tier 2	2002-2005	-	-	4.8	0.15
	Tier 3[c]	2006-2010	-	-	3.0	0.15
hp>750[b] (kW>560)	Tier 1	2000-2005	6.9	1.0	-	0.40
	Tier 2	2006-2010	-	-	4.8	0.15

(a) EPA model year. ARB model year for Tier 1 starts at 2000 for 25 hp ≤ to <175 hp.
(b) Engine families in this power category may meet the Tier 3 PM standard instead of the Tier 4 interim PM standard in exchange for introducing the final Tier 4 PM standard in 2012.
(c) Caterpillar, Cummins, Detroit Diesel Corporation, and Volvo Truck Corporation agreed to comply with these standards by 2005.

Table A-3. CARB and U.S. EPA Tier 4 off-road exhaust emission standards

New off-road diesel engines ≥ 25 hp (g/bhp-hr)						
Maximum rated power Hp (kW)	**Tier**	**Model year**	**NO_x**	**HC**	**NO_x+NMHC**	**PM**
25≤hp<50 (19≤kW<37)	Tier 4 Interim	2008-2012	-	-	5.6	0.22
	Tier 4 Final	2013 and later	-	-	3.5	0.02
50≤hp<75 (37≤kW<56)	Tier 4 Interim[a]	2008-2012	-	-	3.5	0.22
	Tier 4 Final	2013 and later	-	-	3.5	0.02
75≤hp<100 (56≤kW<75)	Tier 4 Phase In	2012-2014	0.30	0.14	-	0.01
	Tier 4 Phase Out		-	-	3.5	0.01
	Tier 4 Alternate NO_x[b]		2.5	0.14	-	0.01
	Tier 4 Final	2015 and later	0.30	0.14	-	0.01
100≤hp<175 (75≤kW<130)	Tier 4 Phase In	2012-2014	0.30	0.14	-	0.01
	Tier 4 Phase Out		-	-	3.0	0.01
	Tier 4 Alternate NO_x[b]		2.5	0.14	-	0.01
	Tier 4 Final	2015 and later	0.30	0.14	-	0.01
175≤hp<750	Tier 4 Phase In	2011-2013	0.30	0.14	-	0.01

Table A-3. CARB and U.S. EPA Tier 4 off-road exhaust emission standards

New off-road diesel engines ≥ 25 hp (g/bhp-hr)						
Maximum rated power Hp (kW)	**Tier**	**Model year**	**NO_x**	**HC**	**NO_x+NMHC**	**PM**
(130≤kW<560)	Tier 4 Phase Out		-	-	3.0	0.01
	Tier 4 Alternate NO_x^b		1.5	0.14	-	0.01
	Tier 4 Final	2014 and later	0.30	0.14	-	0.01
hp>750 (kW>560)	Tier 4 Interim	2011-2014	2.6	0.30	-	0.07
	Tier 4 Final	2015 and later	2.6	0.14	-	0.03

(a) Engine families in this power category may meet the Tier 3 PM standard instead of the Tier 4 interim PM standard
in exchange for introducing the final Tier 4 PM standard in 2012.
(b) The implementation schedule shown is the three-year alternate NO_x approach. Other schedules are available.

Table A-4. PERP off-road diesel engine tiers

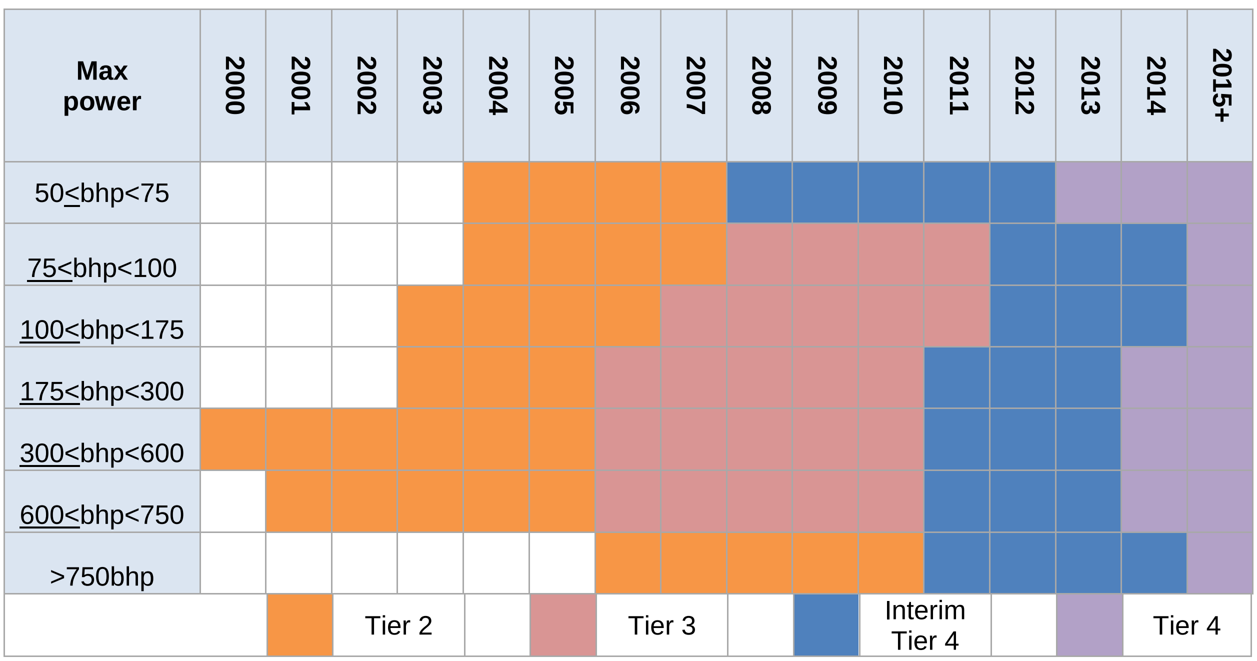

Table A-5. PERP fleet requirements for particulate matter

Fleet standard compliance date	Engines <175 hp (g/bhp-hr)	Engines 175 hp to 750 hp (g/bhp-hr)	Engines >175 hp (g/bhp-hr)
1/1/13	0.3	0.15	0.25

Table A-5. PERP fleet requirements for particulate matter

Fleet standard compliance date	Engines <175 hp (g/bhp-hr)	Engines 175 hp to 750 hp (g/bhp-hr)	Engines >175 hp (g/bhp-hr)
1/1/17	0.18	0.08	0.08
1/1/20	0.04	0.02	0.02

Table A-6. Emission standards Tier 2 marine diesel engines

Category	Displacement (Disp.) (liters/cylinder)	Date	NO_x & HC (g/bhp-hr)	PM g/bhp-hr)	CO g/bhp-hr)
1	Disp.<0.9 and power >50hp*	2005	5.6	0.30	3.7
	0.9 < Disp. < 1.2	2004	5.4	0.22	3.7
	1.2 < Disp. < 2.5	2004	5.4	0.15	3.7
	2.5 < Disp. < 5.0	2007	5.4	0.15	3.7
2	5.0 < Disp.	2007	5.8	0.20	3.7
	15 < Disp. < 20 (power < 4424 hp*)	2007	6.5	0.37	3.7
	20 < Disp. < 25	2007	7.3	0.37	3.7
	25 < Disp. < 30	2007	8.2	0.37	3.7

Note: for more information on exceptions and derivations, please see the original regulatory text.

Table A-7. Emission standards Tier 3 standard-power Category 1 marine diesel engines

Category 1 commercial standard-power density engines below 3700 kW				
Rated kW	**L/cylinder**	**PM g/bhp-hr**	**NO_x + HC g/bhp-hr**	**Model year**
19 to < 75 kW	<0.9a	0.22	5.6	2009
		0.22	3.5	2014
75 to <3700 kW	<0.9	0.10	4.0	2012
	0.9 - <1.2	0.09	4.0	2013
	1.2 - <2.5	0.08	4.2	2014
	2.5 - <3.5	0.08	4.2	2013

Table A-7. Emission standards Tier 3 standard-power Category 1 marine diesel engines

Category 1 commercial standard-power density engines below 3700 kW				
Rated kW	**L/cylinder**	**PM g/bhp-hr**	**NO_x + HC g/bhp-hr**	**Model year**
	3.5 - < 7.0	0.08	4.3	2012

Note: for more information on exceptions and derivations, please see the original regulatory text.
Standard-power engines are generally those with power density less than 47 hp/dm^3 of cylinder displacement.

Table A-8. Emission standards Tier 3 high-power Category 1 marine diesel engines

Category 1 recreational and high-power density engines below 3700 kW				
Rated kW	**L/cylinder**	**PM g/bhp-hr**	**NO_x + HC g/bhp-hr**	**Model year**
19 to < 75 kW	<0.9a	0.22	5.6	2009
		0.22	3.5	2014
75 to <3700 kW	<0.9	0.11	4.3	2012
	0.9 - <1.2	0.10	4.3	2013
	1.2 - <2.5	0.09	4.3	2014
	2.5 - <3.5	0.09	4.3	2013
	3.5 - < 7.0	0.08	4.3	2012

Notes: for more information on exceptions and derivations, please see the original regulatory text.
High-power engines are generally those with power density more than 47 hp/dm^3 of cylinder displacement and equipped with turbocharging or supercharging equipment.

Table A-9. Emission standards Tier 3 high-power Category 2 marine diesel engines

Category 2 engines below 3700 kW				
Rated kW	**L/Cylinder**	**PM g/bhp-hr**	**NO_x + HC[d] g/bhp-hr**	**Model year**
<2000	7 - <15	0.10	4.6	2013
$\geq$2000		0.10	5.8	2013
<2000	15 - <20[a]	0.25	5.2	2014
<2000	20 - <25[a]	0.20	7.3	2014
<2000	25 - <30[a]	0.20	8.2	2014

Note: for more information on exceptions and derivations, please see the original regulatory text.

Table A-10. Emission standards Tier 4 marine diesel engines

Category 1 and Category 2 engines above 600 kW					
Rated kW	**L/Cylinder**	**PM g/bhp-hr**	**NO_x g/bhp-hr**	**HC**	**Model year**
At or above 3700	<15.0	0.09	1.3	0.14	2014
	15.0 to 30	0.19	1.3	0.14	2014
	all	0.04	1.3	0.14	2016
2000 to <3700	all	0.03	1.3	0.14	2016
1400 to <2000	all	0.03	1.3	0.14	2014
600 to <1400	all	0.03	1.3	0.14	2017

Note: for more information on exceptions and derivations, please see the original regulatory text.

Table A-11. SBCAPCD rules potentially applicable to OCS platform decommissioning

SBCAPCD		
Rule	**Name**	**Requirement summary**
102	Definitions	Northern Zone Platforms; Irene Southern Zone Platforms; Harvest, Hidalgo, Hermosa, Heritage, Harmony, Hondo, Gina, Gilda, A, B, C, Hillhouse, Habitat, Hogan, Houchin, and Henry.
103	Severability	Severability of permits and rules.
201	Permits Required	This rule applies to any person who builds, erects, alters, replaces, operates or uses any article, machine, equipment, or other contrivance which may cause the issuance of air contaminants. Covers the issuance of Authority of Construct (ATC) and a Permit to Operate (PTO). District can also issue a consolidated ATC/PTO. For decommissioning the District would issue either an ATC or a PTO.
202	Exemptions from Rule 201	List of permit exemptions for certain equipment and activities.
204	Applications	Information required for a complete application.
205	Standards for Granting Permit	Equipment with emissions must meet standards for air pollution control and consistency with air quality plans.
206	Condition Permit Approval	Conditional approval of permit subject to specified written conditions.
207	Denial of Applications	Denial of an application will be in writing from the air pollution control officer.
210	Fees	Permit processing costs.

Table A-11. SBCAPCD rules potentially applicable to OCS platform decommissioning

SBCAPCD		
Rule	**Name**	**Requirement summary**
212	Emission Statements	All stationary sources with NO_x or ROC emissions of 10 tons or more must submit an actual emissions report.
301	Circumvention	Circumvention
302	Visible Emissions	Visible emissions standards.
303	Nuisance	Project air emissions cannot constitute a nuisance.
304	Particulate Matter	PM standards for Northern Zone (Platform Irene).
305	Particulate Matter	PM standards for Southern Zone.
309	Specific Contaminants	Limits on specific pollutants such as sulfur, NO_x and CO.
310	Odorous Organic Sulfides	Limits on hydrogen sulfide or organic sulfides emissions.
311	Sulfur Content of Fuels	Sulfur limits for the burning of fuel.
317	Organic Solvents	Emission limits on organic solvents.
321	Solvent Cleaning	Regulations for solvent cleaning.
324	Disposal and Evaporation of Solvents	Limit on daily solvent use.
331	Fugitive Emissions	Inspection and maintenance requirements.
333	Control of NO_x from IC Engines	Sets emissions limits for NO_x, ROC, and CO and requires an inspection and maintenance plan.
359	Flares	Emissions standards for flares and thermal oxidizers
802	New Source Review (NSR)	Provide for the review of new and modified stationary sources of air pollution and provides mechanisms by which Authorities to Construct for such sources may be granted without interfering with the attainment or maintenance of any ambient air quality standard, preventing reasonable further progress towards the attainment or maintenance of any ambient air quality standard and without interfering with the protection of areas designated attainment or unclassifiable. This rule also addresses Best Available Control Technology (BACT) requirements. It is likely that decommissioning activities will be subject to NSR.
805	AQIA, Modeling	Requires new or modified stationary sources to conduct an Air Quality Impact Analysis, Modeling, Monitoring, and Air Quality Increment analysis if emission exceed certain thresholds. It is likely that decommissioning activities would trigger this requirement.

Table A-12. VCAPCD rules potentially applicable to OCS platform decommissioning

VCAPCD		
Rule	**Name**	**Requirement summary**
2	Definitions	Provides definitions including one for OCS areas.

Table A-12. VCAPCD rules potentially applicable to OCS platform decommissioning

VCAPCD		
Rule	**Name**	**Requirement summary**
6	Severability	Severability of permits and rules.
7	Boundaries	OCS sources are located in the South VCAPCD zone.
10	Permits Required	ATC requirement.
11	Definitions Regulation II	Additional definitions.
12	Applications for Permits	Requirements for ATC and PTO permits.
13	Authority to Construct	Actions on applications for an authority to construct
16	BACT	BACT certifications
23	Exemptions of Permits	Permit exempt equipment and activities.
26.1	New Source Review Definitions	Provides definition for OCS.
26.2	New Source Review Requirements	This rule is applicable to new, replacement, modified or relocated emissions units in Ventura County. The rule is applied on a pollutant-by-pollutant and an emissions unit-by-emissions unit basis. The rule addresses BACT, offset, and other requirements.
26.13	New Source Review - Prevention of Significant Deterioration	Construction permitting program for new major facilities and major modifications to existing major facilities that emit either criteria or greenhouse gas pollutants.
29	Permit Conditions	Allows for any reasonable conditions to an ATC or a PTO.
33	Part 70 Permits	Requirements for major sources.
57.1	Particulate Matter - Fuel Burning	Emissions of PM shall not exceed 0.12 pounds per million BTU of fuel input.
62.7	Asbestos Demolition	Rules for any material containing Asbestos-Containing Materials (ACM).
64	Fuel Sulfur Content	Sulfur content limits for fuel.
71	Crude oil	Crude oil and reactive organic compound liquids
72.1	OCS Air Regulations	Incorporates by reference the Federal OCS Air Regulations (40 CFR 55).
73	NESHAPS	National standards for hazardous air pollutants.
74.7	Fugitive Emissions	Requirements to control volatile organic compound (VOC) leaks from components and releases from atmospheric process pressure relief devices.
74.9	Stationary ICE	NO_x, ROC and CO standards for ICE.
74.26	Storage Tank Degassing	Requirements for crude oil storage tank degassing operations.

Table A-13. SCAQMD rules potentially applicable to OCS platform decommissioning

SCAQMD		
Rule	**Name**	**Requirement summary**
102	Definitions	Definitions for application for requirements.
103	Geographical Areas	The OCS platforms are located in the Los Angeles Area; the area includes the boundary of Los Angeles in the Pacific Ocean.
201	Permit to Construct (PC)	Permit required for any action that may cause the issuance of air contaminants
201.1	Permit Conditions Federal Permit	Requirement to be consistent with any permit issued by Federal agency.
202	Temporary Permit to Operate	Temporary permit issued for a PC for use until PTO is issued.
203	Permit to Operate	Permit required for any equipment which may cause the issuance of air contaminants.
204	Permit Conditions	Allows for District to put condition requirements on a permit.
210	Applications	Outlines District process of applications.
219	Equipment Not Requiring a Permit	Provides a list of small equipment not subject to a District permit. Includes certain oil and gas equipment and cleaning operations.
221	Plans	Requires submittal of plans for all operations subject to District rules.
401	Visible Emissions	Visible emissions standards.
409	Combustion Contaminants	Limit on the amount of combustion contaminants in gas.
431.1	Sulfur Content Gas Fuels	Sulfur content requirements for stationary equipment.
442	Usage of Solvents	VOC limits for solvent use.
474	Fuel Burning Equipment – NO_x	Limits for NO_x for non-mobile fuel burning equipment.
1110.2	Emissions from Gas and Liquid Fueled Engines	Measures to reduce NO_x, VOCs, and CO from engines, applies to all stationary and portable engines over 50 bhp.
1149	Storage Tank Cleaning and Degassing	VOC reduction measures for cleaning, maintenance, testing, repair and removal of storage tanks and pipelines.
1171	Solvent Cleaning Operations	Requirements for the use, storage and disposal of solvent cleaning materials in solvent cleaning operations and activities.
1173	Fugitive Emissions	Requirements to control VOC leaks from components and releases from atmospheric process pressure relief devices.
1301	New Source Review	Pre-construction review requirements for new, modified, or relocated facilities.
1302	Definitions	Definition of a facility includes OCS sources and OCS waters.
1303	New Source Review Requirements	Requirements including BACT and offsets.
1304	Exemptions	Exemptions including portable equipment and offset options.

Table A-13. SCAQMD rules potentially applicable to OCS platform decommissioning

SCAQMD		
Rule	**Name**	**Requirement summary**
1313	Permit to Operate	Federal PTO regulations.
1403	Asbestos Emissions from Demolition Activities	Requirements to limit asbestos emissions from building demolition and renovation activities, including the removal and associated disturbance of ACMs.
1470	Stationary Diesel ICE Engines	Requirement operating a stationary ICE engine with a bhp rating greater than 50 (>50 bhp).
1701	Prevention of Significant Deterioration	Pre-construction review requirements for stationary sources that emit attainment air contaminants.
1702	Definitions	Stationary Source is defined as any grouping of permit units or other air contaminant emitting activities which are located on one or more contiguous properties within the District, in actual physical contact or separated solely by a public roadway or public right of way.
1703	PSD Analysis	Requirements for issuance of a permit under PSD.
1714	PSD GHG	PSD greenhouse gas regulations.
1901	General Conformity Federal Rules	Adoption of Part 51, Subchapter C, Chapter I, Title 40, of the Code of Federal Regulations (CFR)
2000	RECLAIM	Emissions trading and credit system.

Appendix B: Data Tables

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B.1 Emissions Assumptions and Methodology

Emission Factors

Emission factors define the air emissions generated by equipment on a per unit of horsepower utilized. Emission factors in this study are based on engine horsepower. Emission factors are listed in DEEP for the range of equipment listed in Section 4.

For tugboats and derrick barges, the EPA AP-42 uncontrolled emission factors are utilized as specified by the platform air permits and in Table 3.3-1 of the EPA AP-42. As an option, the EPA Tier 4 for large engines (greater than 4,961 hp) is also selectable in DEEP.

For the platform cranes, the emission factors as specified in the respective air district permits are utilized. For additional equipment, AP-42 emission factors are utilized as the uncontrolled value, with the option for Tier 3 or Tier 4 emission factors as an option.

Load Factors

Load factors define the level at which equipment is operating. For example, equipment may operate for only a few hours per day or operate at a low load for a period of time. Operating at loads below an equipment's peak load produces fewer emissions. Load factors are listed in DEEP for the range of equipment listed in Section 4 alongside the emission factors.

Load factors for crew and supply boats utilize the respective air district load factors. The load factors in the SBCAPCD air permits are based on data developed by the SBCAPCD (SBCAPCD 1987). These range from 50 percent load factor for auxiliary engines to 85 percent load for crew boats during cruise mode. For periods when the boats are maneuvering, a load of 10 percent was used as per SBCAPCD (SBCAPCD 1987).

Load factors for derrick barges are based on a range of studies, including actual fuel use data from the 4H project, actual fuel use data from the ExxonMobil power cable replacement project conducted in 2015, and EPA and BOEM studies. The 4H project compiled fuel use data by day and equipment during the entire abandonment process of the 4H platforms. Although this project was completed in the 1990s, the fuel use data as compiled gives a good indication of the load factors for a similar type of decommissioning project and is still relevant. Fuel use data indicated an average load factor for the derrick barge of 15 percent. The 4H calculated load factors for the actual fuel use are shown in Appendix B. For the ExxonMobil power cable replacement project, which utilized a derrick lay barge, load factors for the derrick lay barge averaged 9 – 10 percent for the auxiliary generators (5,332 hp total) with a peak daily load of 13 percent. BOEM studies (BOEM 2017) on the vessel load factors and emissions utilizing the AIS systems estimated load factors for pipelaying operations of 15 percent while in cruise mode. The BOEMs study also indicated that propulsion engines operate at a 10 percent load to maintain a vessels position, which is in line with the SBCAPCD load factors for supply boats when maneuvering. Therefore, for this analysis, it is assumed that 15 percent load for the derrick barges and lay barges with an additional 10 percent load associated with maneuvering and positioning for a total of 25 percent load average for derrick barges.

Load factors for cranes, compressors, drill rigs, generators and welders utilized the load factors compiled by the CalEEMod program and the California Air Resources Board Carl Moyer program to be consistent with onshore air district practice and requirements.

Usage Factors

Usage factors are based on the timing estimates shown in Section 3. Generally, equipment is assumed to operate for periods of 24 hours per day, including cargo and derrick barge mobilization and at-platform activities. Crew and supply boats and barges in transit are assumed to operate at their specified loads only during periods of operations. For vessels, such as crew boats and supply boats, the emission factors specified in the platform air permits were utilized to assign an emission factor which is equivalent to an uncontrolled emission level for non-crew/supply boats and the permitted levels for existing crew/supply boats. In addition, the EPA Tier 3 and Tier 4 levels for marine diesel engines are also selectable as options.

Platforms Database

Information related to each of the platforms is compiled into a platform database, which is then utilized to generate the emissions estimates based on equipment specifications and usage. Some platform information was not available and was therefore extrapolated based on other platform data. For example, Platforms Edith, Elly, Ellen, Eureka, Harmony, Harvest, Heritage do not have shell mound data from previous studies. Amounts are therefore estimated based on the depth, slope and age of the respective platforms. The Harvest Shell mound was assumed to be similar to Hermosa (MMS 2003). The Ocean bottom slope for Edith, Elly, Ellen, Eureka, Heritage, Harmony are based on Google Maps bathymetry data.

In order to estimate the amount of shells mounds located under a platform at the time of decommissioning, the shell mound volume was assumed to increase linearly from the 2001 MMS study to the removal date based on the platform installation date.

The conductor removal rate was based on 40-foot sections and 4 hours per section, 24 hours per day plus 2 days for setup/breakdown.

Cargo barges can carry weights ranging up to 15,000 tons. However, due to the spacing requirements, it was assumed that a cargo barge would carry substantially less weight associated with topsides and jackets. This weight amount was based on the average weight carried by cargo barges during the topside and jacket removal phases in the Smith 2016 study of 1,647 to 2,196 tons/barge depending on the barge size. For cargo barges carrying conductors or pipelines, the maximum weight carried is assumed to be 10,000 tons.

The platforms database is shown in Appendix B.

Emissions Estimates Assumptions

A number of assumptions are made in order to calculate the emissions associated with platform decommissioning in the Pacific OCS. These include the following:

- Marine growth removal requires 50% of the time of platform preparation;
- Contingency for weather (10%) and miscellaneous work provisions (15%) was added to topside and jacket removal;
- Removal of jacket sections includes severing piles for full removal;
- Crew and supply boats travel to the site to deliver crew and supplies, then return;
- Dive boats travel to site, then operate during duration of task in maneuver mode;
- Crew and Dive boats assumed to commute from closest pier, which are Ellwood, Casitas, Hueneme, and POLA/LB;
- Derrick barge tugboats transport the barges to site, then remain in maneuver mode;
- Cargo barge tugboats travel to site then remain in maneuver mode;
- Mobilization and demobilization apply to derrick, pipeline lay, crane, lift and cargo barges only;

- Demobilization of all materials/equipment aside from topsides and jackets (selectable) assumes that all materials removed are delivered to the POLA;
- Potential to Emit means 24 hours per day at 100% load;
- Demobilization of the derrick, lay and lift barges are not specified as their destination is not known - defaults to POLA;
- All diesel fuel assumed to have a 15ppm sulfur content;
- Distances of vessel transport within Districts based on Carl Moyer (CARB 2011) California Coastal Waters delineation boundary; and
- Cargo Barge capacity based on average in Smith report for jackets and topside removals which includes spacing constraints.

Table B-1 Tugboat Inventory- West Coast

Operator	Fleet Size Approx	Count Tier 2-4	Tier 2	Tier 3	Tier 4	HP range
American Marine Corp	6	0	0	0	0	-
Bay and Delta	8	2	0	1	1	5350-6772
Brusco	35	2	0	2	0	-
Crowley	70	6	6	0	0	6000 - 10880
Curtin Marine	8	0	0	0	0	-
Foss Ocean Tugs	70	16	9	2	5	3600 - 7268
Greger Pacific	4	0	0	0	0	-
Harley Marine	60	30	9	14	7	2000 - 6850
Marine Express	5	0	0	0	0	-
Oscr Niemeth	2	0	0	0	0	-
Pacific Tugboat Service	7	1	0	1	0	1500
Sause Brothers	24	5	4	1	0	3600-3750
Western	23	1	0	1	0	3980
Westar	12	0	0	0	0	-
Total	334	63	28	22	13	-

Source: http://www.tugboatinformation.com/index.cfm

Table B-2 Tugboat Inventory Details, Greater than 2000 hp

Tug	Owner	Year Built	Tier	HP	Hailing Port
Alta June	Foss	2008	2	5080	Long Beach
Caden Foss	Foss	2017	4	6772	San Francisco
Carolyn Dorthy	Foss	2008	2	5080	Long Beach
Denise Foss	Foss	2016	2	7268	Seattle
Independence	Foss	2007	2	5080	San Francisco
Kapena Bob Purdy	Foss	2018	4	6000	Hawaii

Table B-2 Tugboat Inventory Details, Greater than 2000 hp

Tug	Owner	Year Built	Tier	HP	Hailing Port
Kapena George Panui	Foss	2018	4	6000	Hawaii
Kapena Jack Young	Foss	2018	4	6000	Hawaii
Kapena Raymond Alapai	Foss	2018	4	6000	Hawaii
Michele Foss	Foss	2015	2	7268	Seattle
Montana	Foss	2015	3	6000	Wilmington, DE
Nicole Foss	Foss	2017	2	7268	Seattle
Patricia Ann	Foss	2008	2	5080	San Francisco
Revolution	Foss	2006	2	5080	San Francisco
Sandra Hugh	Foss	2007	2	5080	San Francisco
Wynema Spirit	Foss	2000	3	3600	Seattle
Ahbra Franco	Harley	2013	3	6850	Portland
Alamo	Harley	2013	2	2000	Portland
BARRY SILVERTON	Harley	2016	3	4070	Portland
Bill Gobel	Harley	2016	4	4070	Portland
Bob Franco	Harley	2013	3	5360	Portland
C.E.	Harley	2010	3	4000	Portland
Dale R. Lindsey	Harley	2016	3	6000	Portland
DR. HANK KAPLAN	Harley	2017	3	5300	Portland
DR. MILTON WANER	Harley	2010	3	4000	Portland
Duke	Harley	2013	3	2000	Portland
Earl W. Redd	Harley	2016	4	5000	Portland
Emery Zidel	Harley	2014	3	4070	Portland
Fury	Harley	2013	2	2000	Portland
HMS Justice	Harley	2013	2	2000	Portland
Hull #C-1186	Harley	2019	4	3000	
Jake Shearer	Harley	2015	3	4070	Portland
Kestrel	Harley	2012	2	3000	Portland
Lela Franco	Harley	2015	3	5800	Portland
Lela Joy	Harley	2008	2	2400	Seattle
Lightning	Harley	2012	2	2000	Portland
Michelle Sloan	Harley	2015	3	5800	Portland
Min Zidell	Harley	2017	4	4070	Portland
OneCURE	Harley	2017	4	4070	Portland
Rich Padden	Harley	2017	3	5300	Portland
Robert Franco	Harley	2013	3	6850	Portland
Shelby Withington	Harley	2018	4	3000	
Silver	Harley	2013	2	2000	Portland

Table B-2 Tugboat Inventory Details, Greater than 2000 hp

Tug	Owner	Year Built	Tier	HP	Hailing Port
Stardust	Harley	2013	2	2000	Portland
Thunder	Harley	2012	2	2000	Portland
Todd E Prophet	Harley	2017	4	4070	Portland
Hawaii	Crowley	2014	2	6000	Wilmington, DE
Ocean Sky	Crowley	2012	2	10880	Lake Charles, LA
Ocean Sun	Crowley	2012	2	10880	Lake Charles, LA
Ocean Wave	Crowley	2012	2	10880	Lake Charles, LA
Ocean Wind	Crowley	2012	2	10880	Lake Charles, LA
Washington	Crowley	2014	2	6000	Wilmington, DE
Pacific Patriot	Pacific	2017	3	1500	San Diego
Black Hawk	Sause	2012	2	3700	Portland
Cochise	Sause	2007	2	3750	Portland
Henry Sause	Sause	1976	2	3600	Portland
Mikiona	Sause	2006	2	3750	Portland
Tecumseh	Sause	1979	3	3750	Portland
Mariner	Western	2018	3	3980	Seattle
Simone Brusco	Brusco	2013	3	4000	Seattle
Wynema Spirit	Brusco	2000	3	3600	Seattle
Delta Teresa	Bay	2019	3	5350	San Francisco
Hull 005	Bay	2017	4	6772	San Francisco

Source: http://www.tugboatinformation.com/index.cfm

Table B-3 Emission Factors

Equipment	Code	Based On	Load Factor	Emission Factor, g/bhp-hr											Source
				NOx	ROC	CO	SOX	PM	PM10	PM2.5	CO2	CH4	N2O	CO2e	
Crew Boat-Cruise	CB	M/V Alan/Adel Elise	0.85	8.40	1.06	3.70	0.005	1.06	1.02	1.02	554.70	0.0225	0.0045	556.6	From SBCAPCD Permits, GHG from Irene, SBCAPCD load factors
Crew Boat-Aux	CBA	M/V Alan/Adel Elise	0.50	8.40	1.06	3.70	0.005	1.06	1.02	1.02	554.70	0.0225	0.0045	556.6	From SBCAPCD Permits, GHG from Irene, SBCAPCD load factors
Supply Boat-Main	SB	M/V Santa Cruz	0.65	5.99	0.37	3.70	0.005	0.73	0.73	0.73	554.70	0.0225	0.0045	556.6	From SBCAPCD Permits, GHG from Irene, SBCAPCD load factors
Supply Boat-Aux	SBA	M/V Santa Cruz	0.50	15.07	1.03	3.25	0.005	1.06	1.02	1.02	554.70	0.0225	0.0045	556.6	From SBCAPCD Permits, GHG from Irene, SBCAPCD load factors
Supply Boat-Maneuver	SBM	M/V Santa Cruz	0.10	15.07	1.03	3.25	0.005	1.06	1.02	1.02	554.70	0.0225	0.0045	556.6	From SBCAPCD Permits, GHG from Irene, SBCAPCD load factors
Supply Boat-Main Uncontrolled SBC	SBUSB	M/V Santa Cruz	0.65	14.00	1.06	3.70	0.005	0.82	0.82	0.82	554.70	0.0225	0.0045	556.6	From SBCAPCD Permits, GHG from Irene, SBCAPCD load factors
Supply Boat-Main Uncontrolled VC	SBUVC	VCAPCD	0.65	14.00	0.83	2.54	0.005	0.84	0.84	0.84	554.70	0.0225	0.0045	556.6	From VCAPCD Permits, except for SO2, which is based on 15ppm fuel
Tier 3-Cummins	T3C	Heritage Cement Skid	1.00	2.8	0.2	3.03	0.005	0.15	0.15	0.15	554.70	0.0225	0.0045	556.6	From Heritage permit
Tier 3-CARB, 175-750hp	T3CA750	CARB 2017	1.00	3	1.12	2.6	0.005	0.15	0.15	0.15	554.70	0.0225	0.0045	556.6	CARB 2017
Tier 3-CARB, 175-750hp crane	T3CA750Cr	CARB 2017	0.29	3	1.12	2.6	0.005	0.15	0.15	0.15	554.70	0.0225	0.0045	556.6	CARB 2017
Tier 3-CARB, 175-750hp compressor	T3CA750C	CARB 2017	0.48	3	1.12	2.6	0.005	0.15	0.15	0.15	554.70	0.0225	0.0045	556.6	CARB 2017, CalEEMod load factors
Tier 3-CARB, 175-750hp generator	T3CA750G	CARB 2017	0.74	3	1.12	2.6	0.005	0.15	0.15	0.15	554.70	0.0225	0.0045	556.6	CARB 2017, CalEEMod load factors
Tier 3-CARB, 175-750hp welder	T3CA750W	CARB 2017	0.45	3	1.12	2.6	0.005	0.15	0.15	0.15	554.70	0.0225	0.0045	556.6	CARB 2017, CalEEMod load factors
Tier 3-CARB, >750hp	T3CA750+	CARB 2017	1.00	4.8	1.12	2.6	0.005	0.15	0.15	0.15	554.70	0.0225	0.0045	556.6	CARB 2017
Tier 3-CARB, >750hp drill rig	T3CA750+D	CARB 2017	0.50	4.8	1.12	2.6	0.005	0.15	0.15	0.15	554.70	0.0225	0.0045	556.6	CARB 2017, CalEEMod load factors
Tier 4i-CARB, 175-750hp	T4iCA750	CARB 2017	1.00	1.5	0.14	2.6	0.005	0.02	0.02	0.02	554.70	0.0225	0.0045	556.6	CARB 2017
Tier 4i-CARB, 175-750hp crane	T4iCA750Cr	CARB 2017	0.29	1.5	0.14	2.6	0.005	0.02	0.02	0.02	554.70	0.0225	0.0045	556.6	CARB 2017
Tier 4i-CARB, 175-750hp compressor	T4iCA750C	CARB 2017	0.48	1.5	0.14	2.6	0.005	0.02	0.02	0.02	554.70	0.0225	0.0045	556.6	CARB 2017, CalEEMod load factors
Tier 4i-CARB, 175-750hp generator	T4iCA750G	CARB 2017	0.74	1.5	0.14	2.6	0.005	0.02	0.02	0.02	554.70	0.0225	0.0045	556.6	CARB 2017, CalEEMod load factors

Table B-3 Emission Factors

Equipment	Code	Based On	Load Factor	Emission Factor, g/bhp-hr											Source
				NOx	ROC	CO	SOX	PM	PM10	PM2.5	CO2	CH4	N2O	CO2e	
Tier 4i-CARB, 175-750hp welder	T4iCA750W	CARB 2017	0.45	1.5	0.14	2.6	0.005	0.02	0.02	0.02	554.70	0.0225	0.0045	556.6	CARB 2017, CalEEMod load factors
Tier 4i-CARB, >750hp	T4iCA750+	CARB 2017	1.00	2.6	0.3	2.6	0.005	0.07	0.07	0.07	554.70	0.0225	0.0045	556.6	CARB 2017
Tier 4i-CARB, >750hp drill rig	T4iCA750+D	CARB 2017	1.00	2.6	0.3	2.6	0.005	0.07	0.07	0.07	554.70	0.0225	0.0045	556.6	CARB 2017
Tier 4f-CARB, 175-750hp	T4fCA750	CARB 2017	1.00	0.3	0.14	2.2	0.005	0.02	0.02	0.02	554.70	0.0225	0.0045	556.6	CARB 2017
Tier 4f-CARB, 175-750hp crane	T4fCA750Cr	CARB 2017	0.29	0.3	0.14	2.2	0.005	0.02	0.02	0.02	554.70	0.0225	0.0045	556.6	CARB 2017
Tier 4f-CARB, 175-750hp compressor	T4fCA750C	CARB 2017	0.48	0.3	0.14	2.2	0.005	0.02	0.02	0.02	554.70	0.0225	0.0045	556.6	CARB 2017, CalEEMod load factors
Tier 4f-CARB, 175-750hp generator	T4fCA750G	CARB 2017	0.74	0.3	0.14	2.2	0.005	0.02	0.02	0.02	554.70	0.0225	0.0045	556.6	CARB 2017, CalEEMod load factors
Tier 4f-CARB, 175-750hp welder	T4fCA750W	CARB 2017	0.45	0.3	0.14	2.2	0.005	0.02	0.02	0.02	554.70	0.0225	0.0045	556.6	CARB 2017, CalEEMod load factors
Tier 4f-CARB, >750hp	T4fCA750+	CARB 2017	1.00	2.6	0.14	2.6	0.005	0.07	0.07	0.07	554.70	0.0225	0.0045	556.6	CARB 2017
Tier 4f-CARB, >750hp drill rig	T4fCA750+D	CARB 2017	0.50	2.6	0.14	2.6	0.005	0.07	0.07	0.07	554.70	0.0225	0.0045	556.6	CARB 2017, CalEEMod load factors
Crane CalEEMod-crane <250hp	CrCE250	CalEEMod year 2020	0.29	4.6	0.4	1.8	0.005	0.19	0.19	0.17	472.95	0.153	0.0045	478.1	CalEEMod crane
Crane CalEEMod-crane <>250hp	CrCE500	CalEEMod year 2020	0.29	3.9	0.3	2.7	0.005	0.16	0.16	0.14	472.56	0.153	0.0045	477.7	CalEEMod crane
EPA Marine Tier 3 <4961 hp-tugboat full load	EPAMT3T	EPA	1.00	5.45	0.36	3.73	0.005	0.10	0.10	0.10	521.64	0.0225	0.0045	523.5	From EPA regs 1042.101 Table 2, CO 1042.101.a.2.iv, GHG from AP-42, SBCAPCD load factors
EPA Marine Tier 3 <4961 hp-crew boat cruise	EPAMT3C	EPA	0.85	5.45	0.36	3.73	0.005	0.10	0.10	0.10	521.64	0.0225	0.0045	523.5	From EPA regs 1042.101 Table 2, CO 1042.101.a.2.iv, GHG from AP-42, SBCAPCD load factors
EPA Marine Tier 3 <4961 hp-crew boat aux	EPAMT3AC	EPA	0.50	5.45	0.36	3.73	0.005	0.10	0.10	0.10	521.64	0.0225	0.0045	523.5	From EPA regs 1042.101 Table 2, CO 1042.101.a.2.iv, GHG from AP-42, SBCAPCD load factors
EPA Marine Tier 3 <4961 hp-supply boat cruise	EPAMT3	EPA	0.65	5.45	0.36	3.73	0.005	0.10	0.10	0.10	521.64	0.0225	0.0045	523.5	From EPA regs 1042.101 Table 2, CO 1042.101.a.2.iv, GHG from AP-42, SBCAPCD load factors
EPA Marine Tier 3 <4961 hp-supply boat aux	EPAMT3A	EPA	0.50	5.45	0.36	3.73	0.005	0.10	0.10	0.10	521.64	0.0225	0.0045	523.5	From EPA regs 1042.101 Table 2, CO 1042.101.a.2.iv, GHG from AP-42, SBCAPCD load factors

Table B-3 Emission Factors

Equipment	Code	Based On	Load Factor	Emission Factor, g/bhp-hr											Source
				NOx	ROC	CO	SOX	PM	PM10	PM2.5	CO2	CH4	N2O	CO2e	
EPA Marine Tier 3 <4961 hp-boat manuever	EPAMT3M	EPA	0.10	5.45	0.36	3.73	0.005	0.10	0.10	0.10	521.64	0.0225	0.0045	523.5	From EPA regs 1042.101 Table 2, CO 1042.101.a.2.iv, GHG from AP-42, SBCAPCD load factors
EPA Marine Tier 4 <4961 hp-tugboat full load	EPAMT4T	EPA	1.00	1.34	0.14	3.73	0.005	0.03	0.03	0.03	521.64	0.0225	0.0045	523.5	From EPA regs 1042.101 Table 3, CO as per 1042.101.a.2.iv, GHG from AP-42, SBCAPCD load factors
EPA Marine Tier 4 <4961 hp-crew boat cruise	EPAMT4C	EPA	0.85	1.34	0.14	3.73	0.005	0.03	0.03	0.03	521.64	0.0225	0.0045	523.5	From EPA regs 1042.101 Table 3, CO as per 1042.101.a.2.iv, GHG from AP-42, SBCAPCD load factors
EPA Marine Tier 4 <4961 hp-crew boat aux	EPAMT4AC	EPA	0.50	1.34	0.14	3.73	0.005	0.03	0.03	0.03	521.64	0.0225	0.0045	523.5	From EPA regs 1042.101 Table 3, CO as per 1042.101.a.2.iv, GHG from AP-42, SBCAPCD load factors
EPA Marine Tier 4 <4961 hp-supply boat cruise	EPAMT4	EPA	0.65	1.34	0.14	3.73	0.005	0.03	0.03	0.03	521.64	0.0225	0.0045	523.5	From EPA regs 1042.101 Table 3, CO as per 1042.101.a.2.iv, GHG from AP-42, SBCAPCD load factors
EPA Marine Tier 4 <4961 hp-supply boat aux	EPAMT4A	EPA	0.50	1.34	0.14	3.73	0.005	0.03	0.03	0.03	521.64	0.0225	0.0045	523.5	From EPA regs 1042.101 Table 3, CO as per 1042.101.a.2.iv, GHG from AP-42, SBCAPCD load factors
EPA Marine Tier 4 <4961 hp-boat manuever	EPAMT4M	EPA	0.10	1.34	0.14	3.73	0.005	0.03	0.03	0.03	521.64	0.0225	0.0045	523.5	From EPA regs 1042.101 Table 3, CO as per 1042.101.a.2.iv, GHG from AP-42, SBCAPCD load factors
EPA Marine Large Tier 3 >4961 hp-full load	EPAMLT3	EPA	1.00	5.45	0.36	3.73	0.005	0.10	0.10	0.10	521.64	0.0225	0.0045	523.5	From EPA regs 1042.101 Table 2, CO 1042.101.a.2.iv, GHG from AP-42, SBCAPCD load factors
EPA Marine Large Tier 3 >4961 hp-part load	EPAMLT3P	EPA	0.25	5.45	0.36	3.73	0.005	0.10	0.10	0.10	521.64	0.0225	0.0045	523.5	From EPA regs 1042.101 Table 2, CO 1042.101.a.2.iv, GHG from AP-42, 4H load factors
EPA Marine Large Tier 3 >4961 hp-manuever	EPAMLT3M	EPA	0.10	5.45	0.36	3.73	0.005	0.10	0.10	0.10	521.64	0.0225	0.0045	523.5	From EPA regs 1042.101 Table 2, CO 1042.101.a.2.iv, GHG from AP-42, SBCAPCD load factors
EPA Marine Large Tier 4, >4961 hp full load	EPAMLT4	EPA	1.00	1.34	0.14	3.73	0.005	0.03	0.03	0.03	521.64	0.0225	0.0045	523.5	From EPA regs 1042.101 Table 3, CO as per 1042.101.a.2.iv, GHG

Table B-3 Emission Factors

Equipment	Code	Based On	Load Factor	Emission Factor, g/bhp-hr											Source
				NOx	ROC	CO	SOX	PM	PM10	PM2.5	CO2	CH4	N2O	CO2e	
															from AP-42, SBCAPCD load factors
EPA Marine Large Tier 4, >4961 hp part load	EPAMLT4P	EPA	0.25	1.34	0.14	3.73	0.005	0.03	0.03	0.03	521.64	0.0225	0.0045	523.5	From EPA regs 1042.101 Table 3, CO as per 1042.101.a.2.iv, GHG from AP-42, load factors 4H
EPA Marine Large Tier 4, >4961 hp manuever	EPAMLT4M	EPA	0.10	1.34	0.14	3.73	0.005	0.03	0.03	0.03	521.64	0.0225	0.0045	523.5	From EPA regs 1042.101 Table 3, CO as per 1042.101.a.2.iv, GHG from AP-42, SBCAPCD load factors
AP-42 Diesel Uncontrolled	AP42	AP-42	1.00	14.06	1.12	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	Table 3.3-1 Uncontrolled industrial diesel engines, CalEEMod load factor
AP-42 Diesel Uncontrolled crane	AP42Cr	AP-42	0.29	14.06	1.12	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	Table 3.3-1 Uncontrolled industrial diesel engines, CalEEMod load factor
AP-42 Diesel Uncontrolled compressor	AP42C	AP-42	0.48	14.06	1.12	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	Table 3.3-1 Uncontrolled industrial diesel engines, CalEEMod load factor
AP-42 Diesel Uncontrolled drill rig	AP42D	AP-42	0.50	14.06	1.12	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	Table 3.3-1 Uncontrolled industrial diesel engines, CalEEMod load factor
AP-42 Diesel Uncontrolled generator	AP42G	AP-42	0.74	14.06	1.12	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	Table 3.3-1 Uncontrolled industrial diesel engines, CalEEMod load factor
AP-42 Diesel Uncontrolled welder	AP42W	AP-42	0.45	14.06	1.12	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	Table 3.3-1 Uncontrolled industrial diesel engines, CalEEMod load factor
AP-42 Diesel Uncontrolled-SBCAPCD Rule 333	AP42SB	AP-42	1.00	8.40	1.12	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	Table 3.3-1 Uncontrolled industrial diesel engines, assume 15ppm fuel sulfur
EPA Diesel Uncontrolled-supply boat cruise	EPASBC	EPA2009	0.85	9.96	0.10	1.85	0.005	0.24	0.24	0.23	521.64	0.0225	0.0045	523.5	EPA 2009 Table 3-5
EPA Diesel Uncontrolled-supply boat maneuver	EPASBM	EPA2009	0.10	9.96	0.10	1.85	0.005	0.24	0.24	0.23	521.64	0.0225	0.0045	523.5	EPA 2009 Table 3-5

Table B-3 Emission Factors

Equipment	Code	Based On	Load Factor	Emission Factor, g/bhp-hr											Source
				NOx	ROC	CO	SOX	PM	PM10	PM2.5	CO2	CH4	N2O	CO2e	
AP-42 Diesel Uncontrolled-Barge part load	AP42BPL	AP-42	0.25	14.06	1.12	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	Table 3.3-1 Uncontrolled industrial diesel engines, 4H load factor
AP-42 Diesel Uncontrolled-Barge maneuver	AP42BM	AP-42	0.10	14.06	1.12	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	Table 3.3-1 Uncontrolled industrial diesel engines, 4H load factor
AP-42 Large Diesel Uncontrolled	AP42L	AP-42	1.00	10.89	0.29	2.49	0.005	0.32	0.26	0.26	526.18	0.0225	0.0045	528.1	Table 3.4-1 Large Stationary Diesel (>600hp)
AP-42 Large Diesel Uncontrolled ITR	AP42LITR	AP-42	1.00	5.90	0.29	2.49	0.005	0.32	0.26	0.26	526.18	0.0225	0.0045	528.1	Table 3.4-1 Large Stationary Diesel (>600hp) with ignition timing retard
Crane-Platform A	CrA	Permits	0.29	8.7	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	SBCAPCD permit for Nox, AP-42 table 3.3-1 for all others, CalEEMod load factor
Crane-Platform B	CrB	Permits	0.29	8.7	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	SBCAPCD permit for Nox, AP-42 table 3.3-1 for all others, CalEEMod load factor
Crane-Platform C	CrC	Permits	0.29	8.7	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	SBCAPCD permit for Nox, AP-42 table 3.3-1 for all others, CalEEMod load factor
Crane - Platform Edith	CrEdith	Permits	0.29	14.06	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	Table 3.3-1 Uncontrolled industrial diesel engines, CalEEMod load factor
Crane - Platform Ellen	CrEllen	Permits	0.29	14.06	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	Table 3.3-1 Uncontrolled industrial diesel engines, CalEEMod load factor
Crane - Platform Elly	CrElly	Permits	0.29	14.06	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	Table 3.3-1 Uncontrolled industrial diesel engines, CalEEMod load factor
Crane - Platform Eureka	CrEureka	Permits	0.29	14.06	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	Table 3.3-1 Uncontrolled industrial diesel engines, CalEEMod load factor
Crane - Platform Gail	CrGail	Permits	0.29	14.06	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	Table 3.3-1 Uncontrolled industrial diesel engines, CalEEMod load factor
Crane - Platform Gilda	CrGilda	Permits	0.29	14.06	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	Table 3.3-1 Uncontrolled industrial diesel engines, CalEEMod load factor

Table B-3 Emission Factors

Equipment	Code	Based On	Load Factor	Emission Factor, g/bhp-hr											Source
				NOx	ROC	CO	SOX	PM	PM10	PM2.5	CO2	CH4	N2O	CO2e	
Crane - Platform Gina	CrGina	Permits	0.29	14.06	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	Table 3.3-1 Uncontrolled industrial diesel engines, CalEEMod load factor
Crane - Platform Grace	CrGrace	Permits	0.29	14.06	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	Table 3.3-1 Uncontrolled industrial diesel engines, CalEEMod load factor
Crane - Platform Habitat North Crane	CrHabitat	Permits	0.29	9.29	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	SBCAPCD permit for Nox, AP-42 table 3.3-1 for all others, CalEEMod load factor
Crane - Platform Harmony	CrHarmony	Permits	0.29	8.4	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	SBCAPCD permit for Nox, AP-42 table 3.3-1 for all others, CalEEMod load factor
Crane - Platform Harvest	CrHarvest	Permits	0.29	8.4	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	SBCAPCD permit for Nox, AP-42 table 3.3-1 for all others, CalEEMod load factor
Crane - Platform Henry North Crane	CrHenry	Permits	0.29	8.7	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	SBCAPCD permit for Nox, AP-42 table 3.3-1 for all others, CalEEMod load factor
Crane - Platform Heritage	CrHeritage	Permits	0.29	8.4	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	SBCAPCD permit for Nox, AP-42 table 3.3-1 for all others, CalEEMod load factor
Crane - Platform Hermosa	CrHermosa	Permits	0.29	8.4	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	SBCAPCD permit for Nox, AP-42 table 3.3-1 for all others, CalEEMod load factor
Crane - Platform Hidalgo	CrHidalgo	Permits	0.29	8.4	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	SBCAPCD permit for Nox, AP-42 table 3.3-1 for all others, CalEEMod load factor
Crane - Platform Hillhouse	CrHillhouse	Permits	0.29	8.7	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	SBCAPCD permit for Nox, AP-42 table 3.3-1 for all others, CalEEMod load factor
Crane - Platform Hogan	CrHogan	Permits	0.29	8.4	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	SBCAPCD permit for Nox, AP-42 table 3.3-1 for all others, CalEEMod load factor
Crane - Platform Hondo	CrHondo	Permits	0.29	8.4	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	SBCAPCD permit for Nox, AP-42 table 3.3-1 for all others, CalEEMod load factor

Table B-3 Emission Factors

Equipment	Code	Based On	Load Factor	Emission Factor, g/bhp-hr											Source
				NOx	ROC	CO	SOX	PM	PM10	PM2.5	CO2	CH4	N2O	CO2e	
Crane - Platform Houchin	CrHouchin	Permits	0.29	8.4	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	SBCAPCD permit for Nox, AP-42 table 3.3-1 for all others, CalEEMod load factor
Crane - Platform Irene	CrIrene	Permits	0.29	8.4	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	SBCAPCD permit for Nox, AP-42 table 3.3-1 for all others, CalEEMod load factor
Crane - Platform Holly	CrHolly	Permits	0.29	2.69	0.31	2.60	0.006	0.01	0.01	0.01	521.64	0.0225	0.0045	523.5	SBCAPCD permit, CalEEMod load factor
Crane - Platforms GroupSB	CrGroupSB	Permits	0.29	8.4	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	SBCAPCD permit for Nox, AP-42 table 3.3-1 for all others, CalEEMod load factor
Crane - Platforms GroupVC	CrGroupVC	Permits	0.29	14.06	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	Table 3.3-1 Uncontrolled industrial diesel engines, CalEEMod load factor
Crane - Platforms GroupSC	CrGroupSC	Permits	0.29	14.06	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	Table 3.3-1 Uncontrolled industrial diesel engines, CalEEMod load factor
Crane - Platforms GroupD	CrGroupD	Permits	0.29	8.4	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	SBCAPCD permit for Nox, AP-42 table 3.3-1 for all others, CalEEMod load factor
Crane - Platforms Group 1	CrGroup 1	Permits	0.29	8.4	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	SBCAPCD permit for Nox, AP-42 table 3.3-1 for all others, CalEEMod load factor
Crane - Platforms Group 2	CrGroup 2	Permits	0.29	14.06	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	Table 3.3-1 Uncontrolled industrial diesel engines, CalEEMod load factor
Crane - Platforms Group 3	CrGroup 3	Permits	0.29	8.4	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	SBCAPCD permit for Nox, AP-42 table 3.3-1 for all others, CalEEMod load factor
Crane - Platforms Group 4	CrGroup 4	Permits	0.29	8.4	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	SBCAPCD permit for Nox, AP-42 table 3.3-1 for all others, CalEEMod load factor
Crane - Platforms Group 5	CrGroup 5	Permits	0.29	8.4	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	SBCAPCD permit for Nox, AP-42 table 3.3-1 for all others, CalEEMod load factor
Crane - Platforms Group 6	CrGroup 6	Permits	0.29	8.4	1.02	3.03	0.005	1.00	1.00	1.00	521.64	0.0225	0.0045	523.5	SBCAPCD permit for Nox, AP-42 table 3.3-1 for all others, CalEEMod load factor

Table B-4 4H Project Calculated Load Factors

Equipment Summaries	
Equipment	Average Load Factor
All Dive compressors	0.22
Derrick Barge Wotan DB main power only	0.31
Derrick Barge Wotan total hp average HP weighted average (w/o dive compressors)	0.15
All Support boats main engines	0.01
All Support boats aux engines	0.19
All Crew Boats Main Engines	0.08

Table B-5 4H Project Equipment Use Details

Equipment Specifics								
Engine ID#	equip description	engine model	permitted or exempt	Engine hp	Days Active	Average Daily Fuel Use, gal	Hours per day	Average Load Factor
027	Am Endeavor Gen	Isuzu QD100	Exempt	52	50	12.3	24	0.19
025	Am Endeavor Main Eng #1	CAT 343TA	Exempt	350	107	27.4	24	0.06
026	Am Endeavor Main Eng #2	CAT 343TA	Exempt	350	108	27.0	24	0.06
034	Am Endeavor Winch	Yanmar 4TN84TE	Perm	64	7	16.9	24	0.22
006	Am Patriot Anchor Winch #1	DD6v-71	Perm	180	85	3.0	24	0.01
007	Am Patriot Anchor Winch #2	DD6v-71	Perm	180	88	4.2	24	0.02
005	Am Patriot Crane 40 ton	DD6V-53	Perm	180	94	4.6	24	0.02
016	Am Patriot Dive Compr 370	Lister ST3	Perm	20	35	9.1	24	0.37

Table B-5 4H Project Equipment Use Details

Equipment Specifics								
Engine ID#	equip description	engine model	permitted or exempt	Engine hp	Days Active	Average Daily Fuel Use, gal	Hours per day	Average Load Factor
017	Am Patriot Dive Compr #1 5120	Lister HR3	Perm	38	9	6.4	24	0.14
018	Am Patriot Dive Compr #2 5120	Lister HR3	Perm	38	51	8.4	24	0.18
019	Am Patriot Dive Compr #1 325	Lister T51	Perm	20	1	3.0	24	0.12
003	Am Patriot Gen #1	DD 6V-71	Exempt	176	117	29.7	24	0.14
004	Am Patriot Gen #2	DD 6V-71	Exempt	176	115	31.3	24	0.14
008	Am Patriot Jet Pump	Deutz F6L413FR	Perm	125	36	25.1	24	0.16
001	Am Patriot Main Eng #1	CAT 398 TA	Exempt	800	61	14.4	24	0.01
002	Am Patriot Main Eng #2	CAT 398 TA	Exempt	800	60	10.6	24	0.01
012	Am Patriot Rotoscrew #1	Deutz BF6L913	Perm	91	98	35.3	24	0.32
013	Am Patriot Rotoscrew #2 375 CFM	Cummins 6 B5.9	Perm	91	23	26.7	24	0.24
009	Am Patriot Welding Mach #1	Perkins 4.236	Perm	63	24	8.9	24	0.12
010	Am Patriot Welding Mach #2	Perkins 4.236	Perm	63	45	9.2	24	0.12
011	Am Patriot Welding Mach #3	Perkins 4.236	Perm	63	39	9.6	24	0.12
023	Am Progress Gen	DD 2-71	Exempt	49	103	29.8	24	0.50
021	Am Progress Main Eng #1	DD12V-71TI	Exempt	600	103	56.0	24	0.08
022	Am Progress Main Eng #2	DD 12V-71TI	Exempt	600	103	56.0	24	0.08
066	Cargo Barge Light Tower #3	Kubota	Exempt	14	2	12.7	24	0.74
067	Cargo Barge Light Tower Gen #4	Kubota	Exempt	14	37	5.4	24	0.31
044	Cond Cutting Water Pump #1	Deutz BF 6L 513 R	Perm	204	0	0.0	24	0.00
045	Cond Cutting Water Pump #2	Deutz BF 6L 513 R	Perm	204	24	61.8	24	0.25
080	Patriot 400 amp Welder	Perkins 4.236	Perm	63	10	11.1	24	0.14
080	Patriot 400 amp Welder	Perkins 4.236	Perm	63	2	8.9	24	0.12

Table B-5 4H Project Equipment Use Details

Equipment Specifics								
Engine ID#	equip description	engine model	permitted or exempt	Engine hp	Days Active	Average Daily Fuel Use, gal	Hours per day	Average Load Factor
115	Pelican Outboard 165 HP	165 Merc Cruiser	Exempt	165	4	31.3	24	0.15
038	Plat/Wotan Welding Mach #1	Perkins D3.152	Perm	38	14	3.0	24	0.06
039	Plat/Wotan Welding Mach #2	Perkins D3.152	Perm	38	23	7.4	24	0.16
069	Standyby Cond Cutting Water Pump	Deutz BF 6L 513 R	Perm	204	24	63.3	24	0.25
081	Wotan 400 amp Welder	Perkins 4.236	Perm	38	11	5.3	24	0.11
041	Wotan Crane 20 ton	DD 353T	Perm	105	16	11.2	24	0.09
042	Wotan orig Dive Compr #1 5120	Lister HR3	Perm	38	18	9.1	24	0.19
029	Wotan Main Hoist	CAT 3412TA	Perm	655	49	57.5	24	0.07
030	Wotan Main Power	CaAT 398TA	Perm	970	43	370.0	24	0.31
031	Wotan Auxillary Power	DD 6-71	Perm	133	14	11.8	24	0.07
032	Wotan Base Lifting Hoist	DD 12V-71	Perm	359	35	9.3	24	0.02
033	Wotan Deck Hoist	DD 12V-71	Perm	359	34	8.7	24	0.02
035	Wotan Rotoscrew #1 175 CFM	Deutz F4L1011E	Perm	49	55	18.5	24	0.31
036	Wotan Rotoscrew #2 175 CFM	Deutz F4L1011E	Perm	49	30	13.8	24	0.23
085	Wotan Dive Compr #1 390	Lister TL3	Perm	38	21	7.4	24	0.16
043	Wotan Dive Compr #2 5120	Deutz F3L912/W	Perm	38	42	17.4	24	0.37

Table B-6 Platform Database

Platform	#	General						
		Platform Air District	Unit/Field	Operator	Year Installed	Water Depth (feet)	Distance to Port (mi)	Closest Pier Miles
A	1	SBCAPCD	Dos Cuadras Field	DCOR	1968	188	104	7
B	2	SBCAPCD	Dos Cuadras Field	DCOR	1968	190	104	8
C	3	SBCAPCD	Dos Cuadras Field	DCOR	1977	192	103	8
Edith	4	SCAQMD	Beta	DCOR	1983	161	11	10
Ellen	5	SCAQMD	Beta	BETA	1980	265	12	11
Elly	6	SCAQMD	Beta	BETA	1980	255	12	11
Eureka	7	SCAQMD	Beta	BETA	1984	700	14	13
Gail	8	VCAPCD	Santa Clara Field	Venoco	1987	739	81	11
Gilda	9	VCAPCD	Santa Clara	DCOR	1981	205	84	12
Gina	10	VCAPCD	Pt Hueneme	DCOR	1980	95	75	4
Grace	11	VCAPCD	Santa Clara Field	Venoco	1979	318	86	15
Habitat	12	SBCAPCD	Pitas Point	DCOR	1981	290	99	8
Harmony	13	SBCAPCD	Santa Ynez	ExxonMobil	1989	1,198	129	15
Harvest	14	SBCAPCD	Pt Arguello	FMOG	1985	675	160	43
Henry	15	SBCAPCD	Carpinteria Offshore Field	DCOR	1979	173	100	5
Heritage	16	SBCAPCD	Santa Ynez	ExxonMobil	1989	1,075	134	21
Hermosa	17	SBCAPCD	Pt Arguello	FMOG	1985	603	158	41
Hidalgo	18	SBCAPCD	Rocky Point Field	FMOG	1986	430	162	45
Hillhouse	19	SBCAPCD	Dos Cuadras Field	DCOR	1969	190	103	7
Hogan	20	SBCAPCD	Carpinteria Offshore Field	POOI	1967	154	99	4
Hondo	21	SBCAPCD	Santa Ynez	ExxonMobil	1976	842	127	12
Houchin	22	SBCAPCD	Carpinteria Offshore Field	POOI	1968	163	100	4
Irene	23	SBCAPCD	Pt Pedernales	FMOG	1985	242	168	53
Holly	24	SBCAPCD		Beacon	1966	211	118	3
Minimum							11.0	
Maximum							168.0	
Average							96.7	
Total								

Table B-6 Platform Database

Platform	Platform Weight Summaries												
	Deck Weight (tons)	Jacket Weight (tons)	Piles Weight (tons)	Conductors Weight (tons)	DB Lift Capability for Jackets & Decks (tons)	TSB Study Project Group	Lifting barge, 4x500 ton winches	Deck Modules	Jacket Sections	Jacket Sections Weight per Section Avg, tons	Jacket Sections Height per Section Avg, feet	Jacket Weight per 85 Vertical Foot (tons)	Jacket Legs
A	1,357	1,500	600	1,439	2,000	3	0	4	1	1,500	253	504	12
B	1,357	1,500	600	1,502	2,000	3	0	4	1	1,500	255	500	12
C	1,357	1,500	600	2,261	2,000	3	0	4	1	1,500	257	496	12
Edith	4,134	3,454	450	518	2,000	2	0	12	3	1,151	75	1,299	12
Ellen	5,300	3,200	1,100	2,065	2,000	2	0	12	2	1,600	165	824	8
Elly	4,700	3,300	1,400	0	2,000	2	0	10	3	1,100	107	877	12
Eureka	8,000	19,000	2,000	4,377	2,000	2	1	10	19	1,000	40	2,111	8
Gail	7,693	18,300	4,000	7,064	2,000	5	1	7	19	963	42	1,935	8
Gilda	3,792	3,220	1,030	3,251	2,000	4	0	6	3	1,073	90	1,014	12
Gina	447	434	125	374	2,000	4	0	2	1	434	160	231	6
Grace	3,800	3,090	1,500	4,684	2,000	5	1	6	3	1,030	128	686	12
Habitat	3,514	2,550	1,500	2,047	2,000	4	0	6	2	1,275	178	611	8
Harmony	9,839	42,900	12,350	21,424	2,000	6	1	13	43	998	29	2,887	8
Harvest	9,024	16,633	3,383	6,110	2,000	5	1	9	17	978	44	1,911	8
Henry	1,371	1,311	150	1,174	2,000	3	0	4	1	1,311	238	468	8
Heritage	9,826	32,420	13,950	12,996	2,000	6	1	13	33	982	35	2,417	8
Hermosa	7,830	17,000	2,500	3,538	2,000	5	1	8	17	1,000	39	2,163	8
Hidalgo	8,100	10,950	2,000	2,334	2,000	5	1	8	11	995	45	1,880	8
Hillhouse	1,200	1,500	400	2,734	2,000	3	0	4	1	1,500	255	500	8
Hogan	2,259	1,263	150	1,426	500	1	0	12	5	253	44	490	12
Hondo	8,450	12,200	2,900	5,928	2,000	6	1	13	13	938	70	1,143	8
Houchin	2,591	1,486	150	1,388	500	1	0	9	5	297	46	554	8
Irene	2,500	3,100	1,500	1,662	2,000	5	0	5	2	1,550	154	858	8
Holly	829	1,105	642	1,414	2,000	-	0	4	3	368	92	340	8
Minimum	447	434	125	0	500.0			2.0	1.0	252.6	29.4	230.6	6
Maximum	9,839	42,900	13,950	21,424	2,000.0			13.0	43.0	1,600.0	257.0	2,887.2	12
Average	4,715	8,774	2,363	3,926				7.9	9.0	1,083.9	119.4	1,146.0	9
Total	108,441	201,811	54,338	90,296				181.0	206.0				

Table B-6 Platform Database

Platform	Wells to P&A										
	Wells to P&A	Rigless Low Wells	Rigless Med-Low Wells	Rigless Med-High Wells	Rigless High Wells	Rig	Crane HP	Flare, mmbtu/hr	Sulfur Content, %	Conductor Count	Average Well Depth (ft)
A	52	45	5	1	1	0	230	2,500	0.0239	55	2,500
B	57	49	6	1	1	0	230	2,500	0.0239	56	2,500
C	38	33	3	1	1	0	230	2,500	0.0239	37	2,500
Edith	18	12	4	1	1	0	331	2,100	0.7400	29	4,500
Ellen	63	18	41	3	1	0	331	2,100	0.7400	64	6,700
Elly	0	0	0	0	0	0	331	2100	0.7400	0	0
Eureka	50	6	38	5	1	0	331	2,100	0.7400	60	6,500
Gail	28	0	21	2	3	2	545	1,313	1.0000	29	8,400
Gilda	62	8	47	6	1	0	325	100	1.0000	62	7,900
Gina	12	7	3	1	1	0	325	142	1.0000	12	6,000
Grace	27	0	13	13	1	0	300	1006.3	1.0000	38	0
Habitat	20	1	16	2	1	0	350	2,100	0.0080	21	12,000
Harmony	35	0	0	20	10	5	450	3,820	2.0000	54	11,900
Harvest	19	0	0	14	3	2	503	1,200	1.0000	25	10,000
Henry	23	20	1	1	1	0	475	2,500	0.0239	24	2,500
Heritage	51	0	0	25	17	9	450	3,820	2.0000	49	10,300
Hermosa	13	0	0	10	2	1	400	2,070	1.0000	29	9,500
Hidalgo	14	0	0	8	4	2	400	3,800	2.0700	14	10,700
Hillhouse	47	40	5	1	1	0	238	2,500	0.0239	50	2,500
Hogan	40	13	18	4	3	2	230	850	0.0239	39	5,400
Hondo	29	0	0	24	3	2	160	6,791	1.5000	28	12,700
Houchin	35	12	15	5	2	1	230	850	0.0239	35	5,100
Irene	26	0	2	20	3	1	210	625	0.3000	28	9,800
Holly	30	0	0	0	0	30	250	1,447	3.5000	30	5,000
Minimum	0	0	0	0	0	0	160	100	0.01	0.0	0.0
Maximum	63	49	47	25	17	9	545	6,791	2.07	64.0	12,700.0
Average	33	11	10	7	3	1	331	2,147	0.74	36.4	6,517.4
Total	759	264	238	168	62	27	7,605	49,387	17	838.0	

Table B-6 Platform Database

Platform	Shell Mounds				
	2001 Shell Mound Volume (yds3)	Shell Mound Height (ft)	Bottom Slope (%)	Shell Mound Accumulation Rate to 2001 (yds3/yr)	2022 Shell Mound Volume Estimated (yds3)
A	7260	20	1.02	220	11880
B	8590	18	1.03	260	14056
C	4590	13	1.14	191	8606
Edith	7370	18	0.20	409	15968
Ellen	6840	19	2.20	326	13680
Elly	6840	19	2.20	326	13680
Eureka	1500	9	3.80	88	3353
Gail	500	3	3.60	36	1250
Gilda	7370	18	1.10	369	15109
Gina	4200	13	1.01	200	8400
Grace	5500	13	0.38	250	10750
Habitat	6840	19	0.40	342	14022
Harmony	500	2	7.30	42	1375
Harvest	500	2	5.00	31	1156
Henry	7200	19	0.67	327	14073
Heritage	500	2	2.00	42	1375
Hermosa	500	2	5.00	31	1156
Hidalgo	500	2	4.30	33	1200
Hillhouse	6800	22	0.88	213	11263
Hogan	12500	26	0.33	368	20221
Hondo	1500	9	5.60	60	2760
Houchin	10922	21	0.38	331	17872
Irene	3720	9	0.71	233	8603
Holly	7607	18	0.00	309	12171
Minimum	500.0	2.0	0.2	31.3	1,156
Maximum	12,500	26.0	7.3	409.4	20,221
Average	4,893	13.0	2.2	205.5	9,209
Total	112,542				211,808

Table B-6 Platform Database

Platform	Casing and Conductors												
	Conductor Length Each (ft)	Total Conductor Lengths (ft)	Conductor OD (in)	Conductor Weight per foot (lbs)	Number of Casings	Casing #1 OD (in)	Casing #1 Weight per Foot (lbs)	Casing #2 OD (in)	Casing #2 Weight per Foot (lbs)	Casing #3 OD (in)	Casing #3 Weight per Foot (lbs)	Total Weight per Foot (lbs)	Total Weight per Conductor (tons)
A	268	14,740	13.375	68	2	9.625	40	6.625	24			195.3	26.2
B	270	15,120	13.375	68	2	9.625	40	6.625	24			198.7	26.8
C	272	10,064	20	106.5	1	13.375	54.5					449.3	61.1
Edith	241	6,989	13.375	54.5	1	9.625	36					148.2	17.9
Ellen	345	22,080	13.375	54.5	1	9.625	36					187.0	32.3
Elly	0	0			0							0.0	0.0
Eureka	780	46,800	13	55	1	10	36					187.1	73.0
Gail	819	23,751	24	201	3	18.625	94.5	13.375	68	9.625	43.5	594.8	243.6
Gilda	285	17,670	20	94	2	13.375	54.5	9.625	43.5			368.0	52.4
Gina	175	2,100	20	94	2	13.375	54.5	9.625	43.5			356.2	31.2
Grace	398	15,124	24	201	3	18.625	106	13.375	72	9.625	47	619.4	123.3
Habitat	370	7,770	24	201	2	18.625	87.5	13.375	72			526.9	97.5
Harmony	1,278	69,012	24	201	3	18.625	87.5	13.375	68	7	26	620.9	396.7
Harvest	755	18,875	24	201	3	18.625	106	13.375	68	9.625	43.5	647.4	244.4
Henry	253	6,072	20	106.5	1	13.375	54.5					386.7	48.9
Heritage	1,155	56,595	20	133	3	16	75	13.375	68	9.625	47	459.3	265.2
Hermosa	683	19,807	24	201	3	18.625	106	13.375	68	9.625	43.5	357.2	122.0
Hidalgo	510	7,140	24	201	3	18.625	106	13.375	72	9.625	47	653.8	166.7
Hillhouse	272	13,600	20	106.5	1	13.375	54.5					402.1	54.7
Hogan	234	9,126	18.625	87.5	2	10.75	40.5	9.625	47			312.5	36.6
Hondo	922	25,816	20	133	3	16	75	13.375	68	9.625	47	459.3	211.7
Houchin	243	8,505	18.625	87.5	2	10.75	40.5	7	23			326.4	39.7
Irene	322	9,016	20	133	2	13.375	61	9.625	47			368.7	59.4
Holly	291	8,730	18	97	2							323.9	47.1
Minimum	0.0	0.0	13.4	54.5	0.0	9.6	36.0	6.6	23.0	7.0	26.0	0.0	0.0
Maximum	1,278	69,012	24.0	201.0	3.0	18.6	106.0	13.4	72.0	9.6	47.0	653.8	397
Average	472	18,512	19.6	126.7	2.0	14.2	65.7	11.2	54.8	9.3	43.1	383.7	106
Total	10,850	425,772											2,431

Table B-6 Platform Database

Platform	Pipelines & Power Cables												
	Total OCS Pipeline 4" (feet)	Total OCS Pipeline 6" (feet)	Total OCS Pipeline 8" (feet)	Total OCS Pipeline 10" (feet)	Total OCS Pipeline 12" (feet)	Total OCS Pipeline 14" (feet)	Total OCS Pipeline 16" (feet)	Total OCS Pipeline 20" (feet)	Total OCS Pipeline 24" (feet)	Pipeline Average Weight pounds per foot	Total Length Pipeline OCS+ State (mi)	OCS Pipeline Length depth< 200' and NOT between platforms (mi)	Weight of pipelines depth< 200' NOT between Platforms in OCS (tons)
A	0	59200	0	0	236800	0	0	0	0	76.7	56.1	33.7	6823
B	0	2600	5200	0	5200	0	0	0	0	58.6	2.5	0	0
C	0	7800	0	0	0	0	0	0	0	28.6	1.5	0	0
Edith	0	41000	0	0	0	0	0	0	0	28.6	7.8	0	0
Ellen	0	0	0	0	0	0	0	0	0	0.0	0.0	0	0
Elly	0	0	0	0	0	0	80200	0	0	82.9	15.2	4.5	984
Eureka	0	8500	0	25150	8400	0	0	0	0	62.1	8.0	0	0
Gail	0	0	97700	0	0	0	0	0	0	43.4	18.5	0	0
Gilda	0	52000	0	52000	52000	0	0	0	0	60.6	29.5	12.5	2000
Gina	0	31690	0	31690	0	0	0	0	0	46.5	12.0	0.6	74
Grace	0	0	0	80600	80600	0	0	0	0	76.6	30.5	4.6	930
Habitat	0	0	0	0	43980	0	0	0	0	88.7	8.3	0.9	211
Harmony	0	0	0	0	66350	0	0	50950	0	103.7	22.2	1.1	301
Harvest	0	0	15050	0	15500	0	0	0	0	66.4	5.8	0	0
Henry	0	12900	25800	0	0	0	0	0	0	38.5	7.3	0	0
Heritage	0	0	0	0	35350	0	0	35800	0	106.1	13.5	0	0
Hermosa	0	0	0	0	0	0	0	54800	54900	147.4	20.8	1.1	428
Hidalgo	0	0	0	25100	0	0	25450	0	0	73.7	9.6	0	0
Hillhouse	0	5120	5120	0	0	0	0	0	0	36.0	1.9	0	0
Hogan	30250	0	0	60500	30250	0	0	0	0	58.2	22.9	0.6	92
Hondo	0	0	0	0	36400	15350	0	0	0	81.2	9.8	0.6	129
Houchin	3800	0	0	7600	3800	0	0	0	0	58.2	2.9	0	0
Irene	0	0	106100	0	0	0	0	53050	0	70.0	30.1	4.6	850
Holly	15150	30300	0	0	0	0	0	0	0	24.1	8.6	0	0
Minimum	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0
Maximum	30,250	59,200	106,100	80,600	236,800	15,350	80,200	54,800	54,900	147	56.1	33.7	6,823
Average	1,480	9,600	11,086	12,289	26,723	667	4,593	8,461	2,387	65	14.6	2.8	557
Total	34,050	220,810	254,970	282,640	614,630	15,350	105,650	194,600	54,900		336.7	64.8	12,822

Table B-6 Platform Database

Platform	Pipelines & Power Cables (Continued)						
	Length of Pipeline depth> 200' (mi)	Length of OCS Pipeline between platforms (mi)	Weight of pipelines depth> 200' and between Platforms in OCS (tons)	In-state length of pipeline (mi)	State Pipelines Weight, tons	Total Length Power Cable OCS (mi)	Additional Length Power Cable State Waters (mi)
A	0	0	0	22.4	4535	0.5	0
B	0	2.46	380	0	0	0.5	0
C	0	1.47	111	0	0	5	4.5
Edith	0	6.3	476	1.5	113	7	7.5
Ellen	0	0	0	0	0	0	0
Elly	3.2	0	700	7.5	1640	0	0
Eureka	8	0	1311	0	0	2.9	0
Gail	18.5	0	2121	0	0	0	0
Gilda	6	0	960	11.1	1776	7	3.7
Gina	0	0	0	11.4	1401	0.3	5.7
Grace	18	0	3640	7.8	1577	0	0
Habitat	3.5	0	820	4	937	3.7	4
Harmony	11.5	0	3148	9.6	2628	11.3	19.2
Harvest	5.8	0	1017	0	0	0	0
Henry	7.3	0	742	0	0	2.5	0
Heritage	13.5	0	3781	0	0	27.2	5.1
Hermosa	11.3	0	4396	8.4	3268	0	0
Hidalgo	9.6	0	1869	0	0	0	0
Hillhouse	1.9	0	181	0	0	3.4	3
Hogan	0	0	0	22.3	3425	0.9	5.6
Hondo	4.1	0	879	5.1	1094	9	5.1
Houchin	0	2.9	445	0	0	0.7	0
Irene	5.5	0	1017	20.1	3716	2.8	6.7
Holly	0	0	0	8.6	546	0	2.9
Minimum	0.0	0.0	0	0.0	0	0.0	0.0
Maximum	18.5	6.3	4396	22.4	4535	27.2	19.2
Average	5.6	0.6	1217	5.7	1135	3.7	3.0
Total	127.7	13.1	27,993	131.2	26,110	84.7	70.1

Table B-6 Platform Database

Platform	Scheduling Platform															
	Topside Platform Prep (days)	Well P&A Work Days	Conductor Removal (24 hr days)	Deck Hours per module (cut and remove deck and equip.) hours	Deck Removal Days	Jacket hours per section (cut and remove) hours	Jacket Removal Days	Sever Piles (hours)	Partial Removal Option: Deck & Jacket Removal (24 hr days)	Post Removal Site Clearance (days)	Cargo Barge Mobilize Time OW (Hours)	Avg speed (from BSEE 2016 report calc.), mph	Platform Total Removal - Prep, WellPA, Topside, Jacket, Piles, Post (days)	Platform Partial Removal - Prep, WellPA, Topside, Jacket, Piles, Post (days)	Platform Total Removal no WellPA, - Prep, Topside, Jacket, Piles, Post (days)	Platform Partial Removal no Well PA- Prep, Topside, Jacket, Piles, Post (days)
A	90	175	53	60	10.0	264	11	48	21.0	15	22.6	4.6	356	354	181	179
B	90	191	55	60	10.0	264	11	48	21.0	15	22.6	4.6	374	372	183	181
C	90	131	41	60	10.0	264	11	48	21.0	15	22.6	4.6	300	298	169	167
Edith	90	72	21	14	7.0	144	18	48	13.0	15	10.0	1.1	225	211	153	139
Ellen	90	248	94	14	7.0	96	8	54	11.0	15	10.0	1.2	464	458	216	210
Elly	90	0	0	14	6.0	88	11	70	9.7	15	10.0	1.2	125	115	125	115
Eureka	90	210	197	14	6.0	87	69	162	9.6	15	10.0	1.4	594	522	384	312
Gail	90	167	101	17	5.0	104	82	146	9.3	15	17.0	4.8	466	382	299	215
Gilda	90	257	62	24	6.0	152	19	48	12.3	15	17.6	4.8	451	436	194	179
Gina	60	53	10	60	5.0	192	8	24	13.0	15	17.6	4.3	152	151	99	98
Grace	90	132	65	16	4.0	104	13	110	8.3	15	17.6	4.9	324	310	192	178
Habitat	90	92	35	16	4.0	108	9	50	8.5	15	22.0	4.5	247	241	155	149
Harmony	90	292	290	15	8.0	71	128	233	11.0	15	25.4	5.1	833	698	541	406
Harvest	90	143	81	16	6.0	107	76	207	10.5	15	36.0	4.4	420	339	277	196
Henry	90	84	22	48	8.0	192	8	32	16.0	15	22.6	4.4	228	227	144	143
Heritage	90	457	238	15	8.0	83	114	285	11.5	15	25.6	5.2	934	811	477	354
Hermosa	90	94	85	15	5.0	99	70	115	9.1	15	36.0	4.4	364	293	270	199
Hidalgo	90	121	32	18	6.0	116	53	115	10.8	15	36.0	4.5	322	269	201	148
Hillhouse	90	160	50	48	8.0	288	12	32	20.0	15	22.6	4.5	336	335	176	175
Hogan	90	204	40	22	11.0	72	15	58	14.0	15	22.2	4.5	377	363	173	159
Hondo	90	193	110	15	8.0	120	65	121	13.0	15	25.2	5.0	486	421	293	228
Houchin	90	165	38	29	11.0	67	14	47	13.8	15	22.2	4.5	335	322	170	157
Irene	90	160	25	48	10.0	204	17	32	18.5	15	37.8	4.4	318	309	158	149
Holly	90	637	39	30	5.0	56	7	48	7.3	15	29.5	-	795	788	158	151
Minimum	60.0	0.0	0.0	14.0	4.0	67.2	8.0	24.0	8.3	15.0	10.0	1.1	125	115	99	98
Maximu m	90.0	457	290	60	11	288	128	285	21	15.0	37.8	5.2	934	811	541	406
Average	88.7	165	76	29	7	143	37	93	13	15.0	22.2	4.0	393	358	227	193
Total	2040	3,80 1	1,745	-	169	-	842	2,133	306	345.0			9,031	8,237	5,230	4,436

Table B-6 Platform Database

Platform	Scheduling Pipelines, Power Cables, Shell mounds											
	OCS shallow Pipelines removal or abandon (24 hr days)	Pipelines removal or abandon rate from Smith (day/mile)	OCS other Pipelines removal or abandon (24 hr days)	State Water Pipelines removal or abandon (24 hr days)	OCS Shallow Pipeline Barge CB300 Loads	OCS Other Pipelines CB300 Barge Loads	State Water Pipelines CB300 Barge Loads	OCS Power cable removal (days)	State Waters Power cable removal (days)	Partial Option: Total Barge Loads- topside, jacket, pipelines, power cables	Shell Mounds removal (days)	Shell Mounds removal, number of barge trips (RT)
A	61	0.30	0.00	40.32	1	0	1	2.8	0.0	4.0	10.0	7.2
B	0	0.00	4.43	0.00	0	1	0	2.8	0.0	3.0	11.8	8.5
C	0	0.00	2.65	0.00	0	1	0	28.0	25.2	3.0	7.8	5.6
Edith	0	0.00	11.34	2.70	0	1	1	39.2	42.0	4.0	11.1	9.4
Ellen	0	0.00	0.00	0.00	0	0	0	0.0	0.0	4.0	15.4	7.9
Elly	8	1.91	8.64	13.50	1	1	1	0.0	0.0	5.0	15.3	8.2
Eureka	0	0.00	21.60	0.00	0	1	0	16.2	0.0	6.0	12.4	2.4
Gail	0	0.00	49.95	0.00	0	1	0	0.0	0.0	5.0	7.2	1.3
Gilda	23	0.48	16.20	19.98	1	1	1	39.2	20.7	5.0	13.5	8.9
Gina	1	6.67	0.00	20.52	1	0	1	1.7	31.9	4.0	3.5	5.0
Grace	8	3.50	48.60	14.04	1	1	1	0.0	0.0	4.0	15.7	6.7
Habitat	2	6.62	9.45	7.20	1	1	1	20.7	22.4	5.0	17.2	8.1
Harmony	2	16.93	31.05	17.28	1	1	1	63.3	107.5	8.0	13.0	1.5
Harvest	0	0.00	15.66	0.00	0	1	0	0.0	0.0	6.0	6.8	1.4
Henry	0	0.00	19.71	0.00	0	1	0	14.0	0.0	3.0	10.3	8.1
Heritage	0	0.00	36.45	0.00	0	1	0	152.3	28.6	7.0	11.7	1.5
Hermosa	2	13.71	30.51	15.12	1	1	1	0.0	0.0	6.0	6.0	1.4
Hidalgo	0	0.00	25.92	0.00	0	1	0	0.0	0.0	5.0	4.4	1.4
Hillhouse	0	0.00	5.13	0.00	0	1	0	19.0	16.8	3.0	9.2	6.6
Hogan	1	26.25	0.00	40.14	1	0	1	5.0	31.4	5.0	13.2	11.6
Hondo	1	18.47	11.07	9.18	1	1	1	50.4	28.6	7.0	13.0	2.1
Houchin	0	0.00	5.22	0.00	0	1	0	3.9	0.0	4.0	12.3	10.2
Irene	8	2.83	14.85	36.18	1	1	1	15.7	37.5	5.0	9.5	5.4
Holly	0	-	0.00	15.48	0	0	1	0.0	16.2	2.0	11.2	7.2
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	3.5	1.3
Maximum	61	26.3	50.0	40.3	1.0	1.0	1.0	152.3	107.5	8.0	17.2	11.6
Average	5	1.8	16.0	10.3	0.5	0.8	0.5	20.6	17.1	4.8	10.9	5.7
Total	117		368.4	236.2	11.0	19.0	12.0	474.3	392.6	111.0	250.4	130.4

Table B-7 DEEP Output: Platform: Gail

Permitted and Actual Historical Emissions for Platform Gail

Platform Gail is located in the VCAPCD	Tons per Year						
PHASE	**NOx**	**ROC**	**CO**	**SOx**	**PM10**	**PM2.5**	**GHG MT**
Permitted: permit number 1494	60.9	24.2	203	3.5	8.13	-	-
Actual 2014: Platform Gail	10.4	8.1	140.6	1.7	4.4	4.3	-

Decommissioning Characteristics			
Number of cargo barges/trips	7	Decommissioning total time, days	497
Total platform tonnage for disposal, tons	37,057	Total supply boat trips, RT	482
Total shell mounds for disposal, yds3	3,978	Total crew boat trips, RT	963
Jacket Removal Option	Full	Pipelines and Power Cables Option	Shallow
Shell Mounds Removal	Yes	Supply Boat Port Option	Hueneme
Emission Factor Options: Crew Boats: Default, Supply Boats: Default, Tugboats: Default, Derrick Barge: Default, Lay Barge: Default, Lifting Barge: Default			

Decommissioning Emissions Summary for Platform Gail within Calif

PHASE	NOx	ROC	CO	SOx	PM	PM10	PM2.5	GHG MT
Peak Day								
Pre-Abandonment	1,638	134	389	0.6	124	123	123	-
Topside Removal	19,140	1,525	4,124	6.8	1,358	1,358	2,284	-
Jacket Removal	18,849	1,502	4,062	6.7	1,338	1,338	5,317	-
Debris Removal	15,739	1,254	3,391	5.6	1,117	1,117	1,117	-
Pipelines and Power Cable Removal	4,330	345	933	1.5	307	307	307	-

Decommissioning Emissions Summary for Platform Gail within Calif

PHASE	NOx	ROC	CO	SOx	PM	PM10	PM2.5	GHG MT
Total Tons								
Pre-Abandonment	193	16	50	0.1	15	15	15	7,431
Topside Removal	40	3	9	0.0	3	3	3	1,349
Jacket Removal	230	18	53	0.1	17	17	17	8,085
Debris Removal	22	2	5	0.0	2	2	2	783
Pipelines and Power Cable Removal	3	0	1	0.0	0	0	0	99
Total	*488*	*39*	*117*	*0.2*	*37*	*37*	*37*	*17,746*
Potential to Emit Total Tons								
Pre-Abandonment	698	55	161	0.3	51	51	51	24,628
Topside Removal	71	6	15	0.0	5	5	5	2,386
Jacket Removal	838	66	185	0.3	60	60	60	28,597
Debris Removal	58	4	13	0.0	4	4	4	2,022
Pipelines and Power Cable Removal	3	0	1	0.0	0	0	0	99
Total	*1,667*	*131*	*376*	*0.6*	*121*	*120*	*120*	*57,732*

Decommissioning Emissions Estimate in the Calif

Platform Gail	**Pounds per Hour**						
PHASE	**NOx**	**ROC**	**CO**	**SOx**	**PM**	**PM10**	**PM2.5**
Pre-Abandonment							
Mobilization	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Well Plugging and Abandonment: Rigless	92.9	8.2	33.4	0.0	9.0	8.9	8.9
Well Plugging and Abandonment: Rigs	123.9	10.7	40.1	0.1	11.2	11.1	11.1
Topside Platform Preparation	124.7	10.4	46.1	0.1	12.0	11.8	11.8
Marine Growth Removal	48.2	3.5	16.3	0.0	4.2	4.1	4.1
Conductor Removal	117.7	10.2	38.7	0.1	10.8	10.6	10.6
Demobilization	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Decommissioning Emissions Estimate in the Calif

Platform Gail	Pounds per Hour						
PHASE	**NOx**	**ROC**	**CO**	**SOx**	**PM**	**PM10**	**PM2.5**
Topside Removal							
Mobilization	525.9	41.9	113.3	0.2	37.3	37.3	37.3
Cutting and Removal of Equipment/Modules	143.3	12.2	44.3	0.1	12.6	12.4	12.4
Demobilization	271.7	21.6	58.5	0.1	19.3	19.3	19.3
Jacket Removal							
Mobilization	405.0	32.3	87.3	0.1	28.7	28.7	28.7
Removal of Jacket Sections	184.5	15.2	59.0	0.1	16.3	16.1	16.1
Demobilization	659.2	52.5	142.0	0.2	46.8	46.8	46.8
Debris Removal							
Mobilization	405.0	32.3	87.3	0.1	28.7	28.7	28.7
Removal of Shell Mounds	115.9	9.7	44.2	0.1	11.4	11.2	11.2
Surveys of Platform and Pipelines Areas	57.7	3.7	25.2	0.0	5.7	5.6	5.6
Demobilization	405.0	32.3	87.3	0.1	28.7	28.7	28.7
Pipelines and Power Cable Removal							
Mobilization	180.4	14.4	38.9	0.1	12.8	12.8	12.8
Pipeline Removal	33.9	2.2	14.2	0.0	3.3	3.2	3.2
Power Cable Removal	67.7	4.4	28.4	0.0	6.5	6.4	6.4
Demobilization	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Platform Gail	Pounds per Day						
PHASE	**NOx**	**ROC**	**CO**	**SOx**	**PM**	**PM10**	**PM2.5**
Pre-Abandonment							
Mobilization	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Well Plugging and Abandonment: Rigless	893.8	74.4	229.0	0.4	70.8	70.3	70.3

Platform Gail	Pounds per Day						
PHASE	**NOx**	**ROC**	**CO**	**SOx**	**PM**	**PM10**	**PM2.5**
Well Plugging and Abandonment: Rigs	1,637.8	133.7	389.3	0.6	123.6	123.1	123.1
Topside Platform Preparation	1,285.3	102.9	334.9	0.5	101.3	100.3	100.3
Marine Growth Removal	785.7	60.0	190.9	0.3	58.4	58.0	58.0
Conductor Removal	1,487.8	121.7	357.0	0.6	113.0	112.4	112.4
Demobilization	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Topside Removal							
Mobilization	19,140.1	1,525.0	4,124.4	6.8	1,358.3	1,358.3	2,283.7
Cutting and Removal of Equipment/Modules	2,755.0	222.7	630.1	1.0	202.9	202.3	202.3
Demobilization	11,001.9	876.6	2,370.7	3.9	780.8	780.8	1,561.6
Jacket Removal							
Mobilization	16,238.5	1,293.8	3,499.1	5.8	1,152.4	1,152.4	5,316.6
Removal of Jacket Sections	2,722.3	218.3	644.6	1.0	203.2	202.3	202.3
Demobilization	18,848.8	1,501.8	4,061.6	6.7	1,337.7	1,337.7	4,851.2
Debris Removal							
Mobilization	15,738.7	1,254.0	3,391.4	5.6	1,116.9	1,116.9	1,116.9
Removal of Shell Mounds	1,076.0	87.1	289.8	0.4	86.4	85.4	85.4
Surveys of Platform and Pipelines Areas	264.5	17.5	91.2	0.1	23.0	22.5	22.5
Demobilization	13,701.3	1,091.7	2,952.4	4.9	972.3	972.3	972.3
Pipelines and Power Cable Removal							
Mobilization	4,330.1	345.0	933.1	1.5	307.3	307.3	307.3
Pipeline Removal	62.1	4.0	26.0	0.0	6.0	5.9	5.9
Power Cable Removal	124.2	8.1	52.1	0.1	12.0	11.8	11.8
Demobilization	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Decommissioning Emissions Estimate in the Calif

Platform Gail	Tons per Quarter						
PHASE	**NOx**	**ROC**	**CO**	**SOx**	**PM**	**PM10**	**PM2.5**
Pre-Abandonment							
Mobilization	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Well Plugging and Abandonment: Rigless	15.4	1.4	5.0	0.0	1.4	1.4	1.4
Well Plugging and Abandonment: Rigs	22.5	1.9	5.6	0.0	1.8	1.7	1.7
Topside Platform Preparation	57.8	4.6	15.1	0.0	4.6	4.5	4.5
Marine Growth Removal	17.7	1.3	4.3	0.0	1.3	1.3	1.3
Conductor Removal	67.7	5.5	16.2	0.0	5.1	5.1	5.1
Demobilization	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Topside Removal							
Mobilization	22.0	1.7	4.7	0.0	1.6	1.6	1.6
Cutting and Removal of Equipment/Modules	8.6	0.7	2.0	0.0	0.6	0.6	0.6
Demobilization	9.3	0.7	2.0	0.0	0.7	0.7	0.7
Jacket Removal							
Mobilization	51.1	4.1	11.0	0.0	3.6	3.6	3.6
Removal of Jacket Sections	123.9	9.9	29.3	0.0	9.2	9.2	9.2
Demobilization	28.8	2.3	6.2	0.0	2.0	2.0	2.0
Debris Removal							
Mobilization	10.0	0.8	2.2	0.0	0.7	0.7	0.7
Removal of Shell Mounds	3.9	0.3	1.0	0.0	0.3	0.3	0.3
Surveys of Platform and Pipelines Areas	2.0	0.1	0.7	0.0	0.2	0.2	0.2
Demobilization	5.8	0.5	1.2	0.0	0.4	0.4	0.4
Pipelines and Power Cable Removal							
Mobilization	3.0	0.2	0.6	0.0	0.2	0.2	0.2
Pipeline Removal	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Decommissioning Emissions Estimate in the Calif

Platform Gail	Tons per Quarter						
PHASE	**NOx**	**ROC**	**CO**	**SOx**	**PM**	**PM10**	**PM2.5**
Power Cable Removal	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Demobilization	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Platform Gail	Tons per Year							
PHASE	**NOx**	**ROC**	**CO**	**SOx**	**PM**	**PM10**	**PM2.5**	**GHG MT**
Pre-Abandonment								
Mobilization	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Well Plugging and Abandonment: Rigless	20.3	1.8	6.6	0.0	1.9	1.9	1.9	950
Well Plugging and Abandonment: Rigs	22.5	1.9	5.6	0.0	1.8	1.7	1.7	845
Topside Platform Preparation	57.8	4.6	15.1	0.0	4.6	4.5	4.5	2,252
Marine Growth Removal	17.7	1.3	4.3	0.0	1.3	1.3	1.3	652
Conductor Removal	75.1	6.1	18.0	0.0	5.7	5.7	5.7	2,732
Demobilization	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Topside Removal								
Mobilization	22.0	1.7	4.7	0.0	1.6	1.6	1.6	736
Cutting and Removal of Equipment/Modules	8.6	0.7	2.0	0.0	0.6	0.6	0.6	302
Demobilization	9.3	0.7	2.0	0.0	0.7	0.7	0.7	311
Jacket Removal								
Mobilization	51.1	4.1	11.0	0.0	3.6	3.6	3.6	1,713
Removal of Jacket Sections	149.9	12.0	35.5	0.1	11.2	11.1	11.1	5,406
Demobilization	28.8	2.3	6.2	0.0	2.0	2.0	2.0	966
Debris Removal								
Mobilization	10.0	0.8	2.2	0.0	0.7	0.7	0.7	336
Removal of Shell Mounds	3.9	0.3	1.0	0.0	0.3	0.3	0.3	155

Platform Gail	Tons per Year							
PHASE	NOx	ROC	CO	SOx	PM	PM10	PM2.5	GHG MT
Surveys of Platform and Pipelines Areas	2.0	0.1	0.7	0.0	0.2	0.2	0.2	98
Demobilization	5.8	0.5	1.2	0.0	0.4	0.4	0.4	194
Pipelines and Power Cable Removal								
Mobilization	3.0	0.2	0.6	0.0	0.2	0.2	0.2	99
Pipeline Removal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Power Cable Removal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Demobilization	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0

Decommissioning Emissions Estimate in the Calif

Platform Gail	Total Tons							
PHASE	NOx	ROC	CO	SOx	PM	PM10	PM2.5	GHG MT
Pre-Abandonment								
Mobilization	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Well Plugging and Abandonment: Rigless	20.3	1.8	6.6	0.0	1.9	1.9	1.9	950
Well Plugging and Abandonment: Rigs	22.5	1.9	5.6	0.0	1.8	1.7	1.7	845
Topside Platform Preparation	57.8	4.6	15.1	0.0	4.6	4.5	4.5	2,252
Marine Growth Removal	17.7	1.3	4.3	0.0	1.3	1.3	1.3	652
Conductor Removal	75.1	6.1	18.0	0.0	5.7	5.7	5.7	2,732
Demobilization	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Topside Removal								
Mobilization	22.0	1.7	4.7	0.0	1.6	1.6	1.6	736
Cutting and Removal of Equipment/Modules	8.6	0.7	2.0	0.0	0.6	0.6	0.6	302
Demobilization	9.3	0.7	2.0	0.0	0.7	0.7	0.7	311
Jacket Removal								
Mobilization	51.1	4.1	11.0	0.0	3.6	3.6	3.6	1,713
Removal of Jacket Sections	149.9	12.0	35.5	0.1	11.2	11.1	11.1	5,406

Decommissioning Emissions Estimate in the Calif

Platform Gail	Total Tons							
PHASE	NOx	ROC	CO	SOx	PM	PM10	PM2.5	GHG MT
Demobilization	28.8	2.3	6.2	0.0	2.0	2.0	2.0	966
Debris Removal								
Mobilization	10.0	0.8	2.2	0.0	0.7	0.7	0.7	336
Removal of Shell Mounds	3.9	0.3	1.0	0.0	0.3	0.3	0.3	155
Surveys of Platform and Pipelines Areas	2.0	0.1	0.7	0.0	0.2	0.2	0.2	98
Demobilization	5.8	0.5	1.2	0.0	0.4	0.4	0.4	194
Pipelines and Power Cable Removal								
Mobilization	3.0	0.2	0.6	0.0	0.2	0.2	0.2	99
Pipeline Removal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Power Cable Removal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Demobilization	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0

Platform Gail	Potential to Emit, Total Tons							
PHASE	NOx	ROC	CO	SOx	PM	PM10	PM2.5	GHG MT
Pre-Abandonment								
Mobilization	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Well Plugging and Abandonment: Rigless	42.8	3.5	12.3	0.0	3.6	3.6	3.6	1,797
Well Plugging and Abandonment: Rigs	45.7	3.7	10.9	0.0	3.4	3.4	3.4	1,654
Topside Platform Preparation	156.6	11.8	37.4	0.1	11.7	11.5	11.5	5,678
Marine Growth Removal	53.1	3.8	12.2	0.0	3.8	3.8	3.8	1,862
Conductor Removal	399.4	31.9	88.5	0.1	28.8	28.8	28.8	13,637
Demobilization	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Topside Removal								
Mobilization	22.0	1.7	4.7	0.0	1.6	1.6	1.6	736
Cutting and Removal of Equipment/Modules	39.4	3.1	8.6	0.0	2.8	2.8	2.8	1,339

Platform Gail	Potential to Emit, Total Tons							
PHASE	**NOx**	**ROC**	**CO**	**SOx**	**PM**	**PM10**	**PM2.5**	**GHG MT**
Demobilization	9.3	0.7	2.0	0.0	0.7	0.7	0.7	311
Jacket Removal								
Mobilization	51.1	4.1	11.0	0.0	3.6	3.6	3.6	1,713
Removal of Jacket Sections	757.7	59.7	167.8	0.3	54.5	54.2	54.2	25,918
Demobilization	28.8	2.3	6.2	0.0	2.0	2.0	2.0	966
Debris Removal								
Mobilization	10.0	0.8	2.2	0.0	0.7	0.7	0.7	336
Removal of Shell Mounds	30.3	2.4	6.8	0.0	2.2	2.2	2.2	1,050
Surveys of Platform and Pipelines Areas	11.8	0.8	2.9	0.0	0.9	0.9	0.9	442
Demobilization	5.8	0.5	1.2	0.0	0.4	0.4	0.4	194
Pipelines and Power Cable Removal								
Mobilization	3.0	0.2	0.6	0.0	0.2	0.2	0.2	99
Pipeline Removal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Power Cable Removal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Demobilization	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0

Gail, Emissions By Equipment, total tons

Equipment	NOx	ROC	CO	SOx	PM	PM10	PM2.5	GHG MT
Cargo Barges & Tugs	188.3	15.0	40.6	0.1	13.4	13.4	13.4	6,305
Cement Pumping Skid	3.1	0.2	0.7	0.0	0.2	0.2	0.2	104
Compressors	10.1	0.8	2.2	0.0	0.7	0.7	0.7	338
Crane	21.4	1.6	4.6	0.0	1.5	1.5	1.5	718
Crane Barge	2.5	0.2	0.5	0.0	0.2	0.2	0.2	83
Crew Boats	25.4	3.2	11.2	0.0	3.2	3.1	3.1	1,516
Derrick Barge	65.7	5.2	14.2	0.0	4.7	4.7	4.7	2,201
Derrick Lay Barge	3.0	0.2	0.6	0.0	0.2	0.2	0.2	99

Gail, Emissions By Equipment, total tons

Equipment	NOx	ROC	CO	SOx	PM	PM10	PM2.5	GHG MT
Dive Boats	27.1	1.8	8.7	0.0	2.3	2.2	2.2	1,260
Drilling Rig	15.6	1.2	3.4	0.0	1.1	1.1	1.1	524
Generators	77.6	6.2	16.7	0.0	5.5	5.5	5.5	2,600
Lifting Barge	13.6	1.1	2.9	0.0	1.0	1.0	1.0	454
Mechanical Cutter	5.6	0.4	1.2	0.0	0.4	0.4	0.4	186
Supply Boats	15.4	1.0	6.5	0.0	1.5	1.5	1.5	906
Welding Machine	13.3	1.1	2.9	0.0	0.9	0.9	0.9	444
Well Kill Pump	0.2	0.0	0.1	0.0	0.0	0.0	0.0	8
Additional Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0

Appendix C: AIR QUALITY GUIDANCE OFFSHORE OIL & GAS PLATFORM DECOMMISSIONING

apcd
SANTA BARBARA COUNTY

South Coast
AQMD

Ventura County
APCD

AIR QUALITY GUIDANCE
OFFSHORE OIL & GAS PLATFORM DECOMISSIONING

Q1. *Are air quality permits required for the decommissioning and dismantling of an offshore oil and gas platform?*

A1. Yes. An air district Authority to Construct permit is required. The local and state rules and regulations that are incorporated into the OCS Air Regulation (40 C.F.R. Part 55) apply. Depending upon the potential-to-emit of the project, a federal PSD permit and/or a Title V permit may also be required. Operators are advised to contact the air district well in advance to discuss the permitting requirements. We suggest that operators build in at least 12-18 months into the schedule to obtain the required permits.

Q2. *What equipment is subject to permit?*

A2. Two criteria must first be met to require a permit. First, the equipment must meet the definition for an OCS source as defined in 40 C.F.R. Part 55. This definition includes vessels that are physically attached to either the platform or the seafloor (see 40 C.F.R. § 55.2). Second, the equipment needs to be subject to the air district's permitting regulations. The decommissioning process has distinct phases. The first phase includes plugging and permanent abandonment of the oil and gas wells as well as conductor removal. By the end of this phase, all hydrocarbons are removed from the process equipment. The second phase includes platform topsides dismantling and removal, platform jacket structure removal, subsea cable and pipeline removal, and shell mounds removal. Examples of the types of equipment that may be subject to permit include: drill rig engines, flares, oil storage tanks/vessels, support/utility boat main propulsion and auxiliary engines, support/utility boat main work engines (water blasters, welding, jet pumps, rotoscrews, compressors, pumps, winches, cranes), derrick barge/heavy lift vessel work engines (main power, winches, hoists, cranes, compressors, welding, backup power).

For the well plugging and abandonment phase, the air districts recommend using the existing platform permits to the extent possible. This would include existing permitted drilling equipment, flares, and crew and supply boats. New permits may be required for equipment not covered by the existing platform permits. This may include unique equipment such as specialized diesel engines powering pulling and jacking units for well conductor removal. Due to different permit exemption rules, the operator needs to check with each air district to assess if any of the equipment qualifies for an exemption from permit.

For the topsides and jacket structure removal phase, the operator will need to obtain a new Authority to Construct permit. Given the logistics of mobilizing for such a large project, operators are advised to contact the air district well in advance to discuss the permitting requirements and to build in at least 12-18 months to obtain the required permits. Permits for subsea cables and pipeline removal, as well as shell mound removal, will be dependent upon the phasing of the project.

Q3. *At what point in the decommissioning process will an offshore oil and gas platform cease to be a 'stationary source' subject to air district permitting authority?*

A3. Each air district has its own definition of "stationary source" consistent with federal definitions under the Clean Air Act (see 42 U.S.C. §7602). Operators should refer to the applicable air district regulation for the specific definition. Generally, an offshore oil and gas platform will remain an active stationary source subject to air district permitting authority through the completion of all activities related to the platform decommissioning and dismantling process. This includes well plugging and abandonment, topsides removal, and platform jacket structure removal. Once the platform jacket structure is removed (or is left in place as part of an authorized rigs-to-reef program), the stationary source ceases to exist.

Q4. *At what point in the decommissioning process are permits required?*

A4. Permits are required prior to installing and/or using any piece of equipment. Operators are advised to contact the air district well in advance to discuss the permitting requirements and to build in at least 12-18 months to obtain the required permits.

Q5. *Is best available control technology (BACT) required?*

A5. BACT may be required, and is determined on a case-by-case basis. Operators are encouraged to meet with air district staff once their project description is defined. This should be done before an Authority to Construct application is submitted. At this time, the air districts anticipate that BACT for project work engines will be at least Tier 4 Final diesel engines (or equivalent).

Q6. *Are the propulsion and auxiliary engines for a support/utility boat subject to BACT requirements?*

A6. Emissions from marine vessel propulsion engines (main/auxiliary) typically do not meet the definition of an OCS source since they are not physically attached to either the platform or the seafloor (see 40 C.F.R. Part 55), and in that case, they are not subject to BACT requirements.

Q7. *How do I address BACT for barges/heavy lift vessels when the main engines provide power to both the propulsion system and work engines?*

A7. Although BACT is not applied to the main engines while "in transit", once the vessel meets the definition for an OCS source (by being physically attached to either the platform or the seafloor), BACT is then applied to the main engines if these engines are used to provide power to the work equipment used in the decommissioning / dismantling process. At this time, the air districts anticipate that BACT for project work engines will be at least Tier 4 Final engine standards (or equivalent).

Q8. *Are offsets required for platform decommissioning?*

A8. Offsets are not required for the air district permits. (See Cal. Health and Safety Code § 42301.13). However, alternative mitigation may be required as part of NEPA and/or CEQA review.

Q9. *Is an air quality impact analysis (AQIA) required for platform decommissioning?*

A9. An air quality impact analysis (AQIA) may be required depending on the applicable air district's New Source Review requirements. Generally, an AQIA is required if the project triggers Federal Prevention of Deterioration (PSD). An AQIA may also be required as part of NEPA and/or CEQA review.

Q10. *If an AQIA is required, where are the receptors located for the modeling?*

A10. Air districts require receptors to be placed onshore.

Q11. *Is a health risk assessment (HRA) required for platform decommissioning?*

A11. A health risk assessment (HRA) is not required for the air district permits. However, an HRA may be required as part of NEPA and/or CEQA review.

Q12. *Are air district permits issued for the decommissioning and dismantling of an offshore oil and gas platform in the OCS subject to California Environmental Quality Act (CEQA) review?*

A12. Yes, "emissions and discharges" from the project are subject to CEQA review. (See 14 C.C.R. sec. 15277.) This analysis will include all project air emissions, not just those emissions from permitted equipment. The air districts expect to be the lead agency under CEQA for the Authority to Construct permits issued for these OCS platform decommissioning and dismantling projects.

Q13. *Will the State's "Airborne Toxic Control Measure For Diesel Particulate Matter from Portable Engines" (CCR Section 93116) and "Airborne Toxic Control Measure for Stationary Compression Ignition Engines" (CCR Section 93115) apply to engines used for the decommissioning of an OCS oil and gas platform?*

A13. The answer depends on whether these regulations are included in Appendix A of the OCS Air Regulation (40 CFR Part 55). As of May 2019, only the Stationary Diesel Engine ATCM is included in the OCS Air Regulation. This regulation exempts OCS Platforms from the requirements in Sections 93115.6 (Emergency Engine Emission Standards) and Section 93115.7 (Prime Engine Emission Standards). The standards of Section 93115.5 (Fuel and Fuel Additive Requirements) do apply to any stationary engine rated greater than 50 bhp. Since the Portable Diesel Engine ATCM is not included in the OCS Air Regulation, the requirements of that regulation would not be applicable on the OCS.

Department of the Interior (DOI)

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors the Nation’s trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

Bureau of Ocean Energy Management (BOEM)

The mission of the Bureau of Ocean Energy Management is to manage development of U.S. Outer Continental Shelf energy and mineral resources in an environmentally and economically responsible way.

BOEM Environmental Studies Program

The mission of the Environmental Studies Program is to provide the information needed to predict, assess, and manage impacts from offshore energy and marine mineral exploration, development, and production activities on human, marine, and coastal environments. The proposal, selection, research, review, collaboration, production, and dissemination of each of BOEM’s Environmental Studies follows the DOI Code of Scientific and Scholarly Conduct, in support of a culture of scientific and professional integrity, as set out in the DOI Departmental Manual (305 DM 3).