

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

Volume II: Users Guide for Decommissioning Emissions Estimation for Platforms (DEEP) Tool and Database



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

Volume II: Users Guide for Decommissioning Emissions Estimation for Platforms (DEEP) Tool and Database

June 2019

Author:
MRS Environmental, Inc.

Prepared under BOEM Contract Number 140M0118P0009

By
MRS Environmental, Inc.
1306 Santa Barbara Street
Santa Barbara, CA 93101-2039

DISCLAIMER

Study concept, oversight, and funding were provided by the US Department of the Interior, Bureau of Ocean Energy Management (BOEM), Pacific OCS Region, Camarillo, CA, under Contract Number 140M0118P0009. Additional funding was provided by the BOEM Environmental Studies Program. This report has been technically reviewed by BOEM, and it has been approved for publication. The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions or policies of the US Government, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

REPORT AVAILABILITY

To download a PDF file of this report, go to the US Department of the Interior, Bureau of Ocean Energy Management Data and Information Systems webpage (<https://www.boem.gov/Environmental-Studies-EnvData/>), click on the link for the Environmental Studies Program Information System (ESPIS), and search on 2019-016.

CITATION

MRS Environmental, Inc. 2019. Air emissions associated with decommissioning operations for Pacific Outer Continental Shelf oil and gas platforms, Volume II: Users Guide for Decommissioning Emissions Estimation for Platforms (DEEP) Tool and Database. Camarillo (CA): US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2019-016 Volume II. 33 p.

ABOUT THE COVER

Cover photo image credit: McDermott, Julia Field
Photo Licensed to MRS Environmental April 2019.

Contents

List of Figures.....	ii
List of Tables.....	ii
List of Abbreviations and Acronyms.....	ii
1 Introduction	1
2 DEEP Database Functionality.....	2
2.1 Home Screen	2
2.2 Parameters and Options	2
2.3 Change Default Parameters.....	8
2.3.1 Change Platform Characteristics	8
2.3.2 Change Default Equipment	10
2.3.3 Construction Parameters	12
2.4 Emission Summaries	16
2.5 Messages.....	19
3 DEEP Configuration and Methodology	20
3.1 Emissions Estimate Methodology	20
3.1.1 Emission Calculations	21
3.1.2 Platform Full or Partial Jacket Removal.....	21
3.1.3 Platform Depth	22
3.1.4 Platform Age and Decommissioning Date	22
3.1.5 Shell Mounds.....	22
3.1.6 Platform Pipelines	22
3.1.7 Platform Well Plugging and Abandonment	23
3.1.8 Crew and Supply Boats.....	23
3.1.9 Mobilization and Demobilization.....	24
3.1.10 Port Selection	24
3.1.11 Defined Area Selection	25
4 User Input Examples.....	27
4.1 Platform Decommissioning Emission Estimates Using Default Values	27
4.2 Platform Decommissioning Emission Estimates Using Custom Values	28
4.3 Platform Decommissioning Summary of All Platforms.....	29
4.4 Platform Decommissioning Emission Estimates Using Custom Construction Parameters.....	30
4.5 Platform Decommissioning Emission Estimates Using Custom Equipment Values.....	31
4.6 Platform Decommissioning Emission Estimates For the Sub Phase Conductor Removal Only	32

List of Figures

Figure 1. DEEP Menu Structure	3
Figure 2. Home Screen	4
Figure 3. Project Parameters Screen.....	5
Figure 4. Change Default Parameters Screen.....	8
Figure 5. Platform Characteristics Screen	9
Figure 6. Change Default Equipment Screen	11
Figure 7. Construction Activity Parameters Screen	13
Figure 8. Emission Summaries	17

List of Tables

Table 1. Piers and Ports.....	24
Table 2. Defined Area Selections	25

List of Abbreviations and Acronyms

4H	Platforms Hazel, Heidi, Hilda, Hope
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
DEEP	Decommissioning Emissions Estimation for Platforms
POCS	Pacific Outer Continental Shelf
P&A	Plug and Abandon
POLA	Port of Los Angeles
POLB	Port of Long Beach
U.K	United Kingdom

1 Introduction

This Users Guide is to assist in the use of the Decommissioning Emissions Estimation for Platforms (DEEP) tool and database. The DEEP tool and user guide were developed as part of a project sponsored by Bureau of Ocean Energy Management (BOEM) to develop detailed estimates of the emissions associated with the future decommissioning of platforms in the Pacific Outer Continental Shelf (POCS) Region. DEEP is based on a series of phases associated with the future decommissioning of POCS Region facilities, including pre-abandonment, topside removal, jacket removal, debris removal and pipelines and power cable removal and provides emission estimates per facility for each of those decommissioning phases. This Users Guide provides information on DEEP configuration as well as descriptions of the approach to estimating the air emissions. Information used in DEEP was compiled based on past reports, interviews with equipment suppliers and current platform operators. DEEP generates the emissions estimates utilizing Excel spreadsheets. Some experience with Excel is useful to utilize DEEP. DEEP allows for the estimate of emissions for individual platforms as well as providing summary information for all the platforms located in the POCS.

Section 2 presents a general overview of DEEP and the associated screens and menus.

Section 3 provides information on the emission estimate methodology used in DEEP.

Section 4 provides some quick-start sample emissions estimates with step-by-step instructions. Following through the six examples in Section 4 allows for a quick introduction to the various capabilities and functionalities of DEEP.

2 DEEP Database Functionality

The DEEP database is arranged with a series of menu screens that allow easy navigation through the various DEEP input and results locations. **Figure 1** shows a schematic of DEEP menus. Each of these menus is discussed in more detail below. Each menu has links where the user can return to the home screen or the previous screen.

The general approach to utilizing DEEP to estimate the emissions from platform decommissioning involves modifying the individual platform parameters if needed, and then viewing the emissions estimates for the individual platform or all platforms or groups of platforms. Generally, the following steps are followed:

1. Selecting the platform of interest from the drop-down menu on the home screen;
2. Modifying the Parameters and Options, if needed;
3. Changing the Default Parameters, including equipment and construction parameters, if needed; and,
4. Viewing the emissions estimates.

Note that DEEP is currently populated with equipment and construction default values for all the platforms and therefore steps 2 and 3 are not needed if only the assumed values are utilized.

The emission estimate summaries are based on the platform characteristics and decommissioning parameters. Emission summaries are presented for the specific platform selected in the home screen, as well as all platforms. The all platforms emission summary can be filtered by phase as well as by platform depth, units or field, and by County.

2.1 Home Screen

The home screen is the first screen encountered and presents 4 options:

- Selection of the platform for analysis,
- Viewing and changing the platform parameters and options,
- Changing the default parameters, and
- Viewing the emissions summaries.

The home screen is shown in **Figure 2**. DEEP allows for detailed emissions calculations for the single platform selected, as well as a summary of the emissions from all platforms. In the home screen, a single platform is selected from a drop-down menu and that platform is the one whose default parameters are input into the emission estimates and whose inputs can be modified with the various screens. If different parameters for a different platform need to be modified, then the user should return to the home screen and select that particular platform. There is also a link to a set of instructions for each of the menu items.

2.2 Parameters and Options

The Parameters and Options screen (**Figure 3**) allow the user to define various parameters and options related to the decommissioning projects. These parameters and options are applied to all platform decommissioning scenarios independent of the platform selected in the home screen drop-down menu.

The Parameters Screen contains a range of inputs to the air emissions spreadsheets and are applied to all platform emissions estimates. Each of these is discussed below.

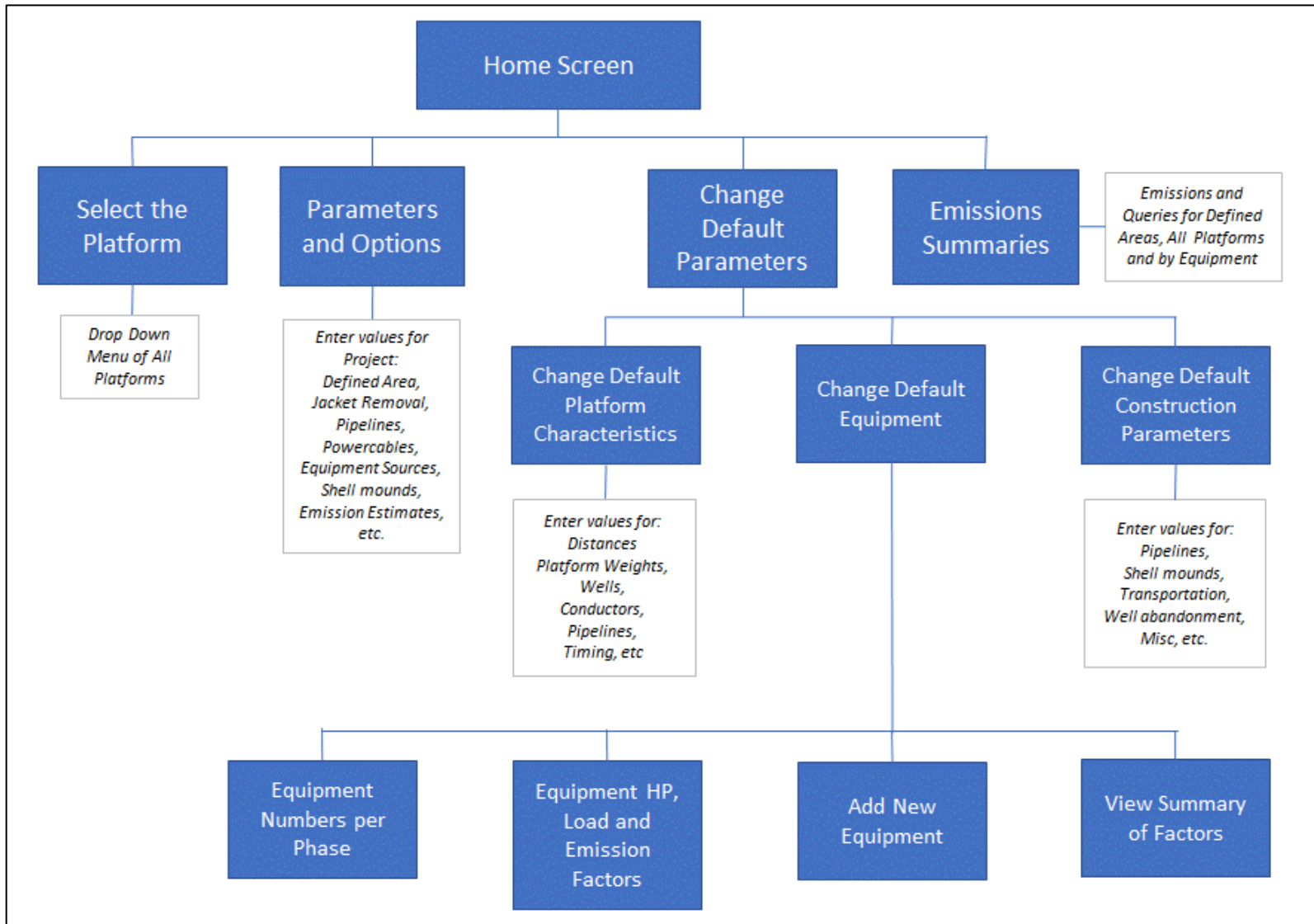


Figure 1. DEEP Menu Structure

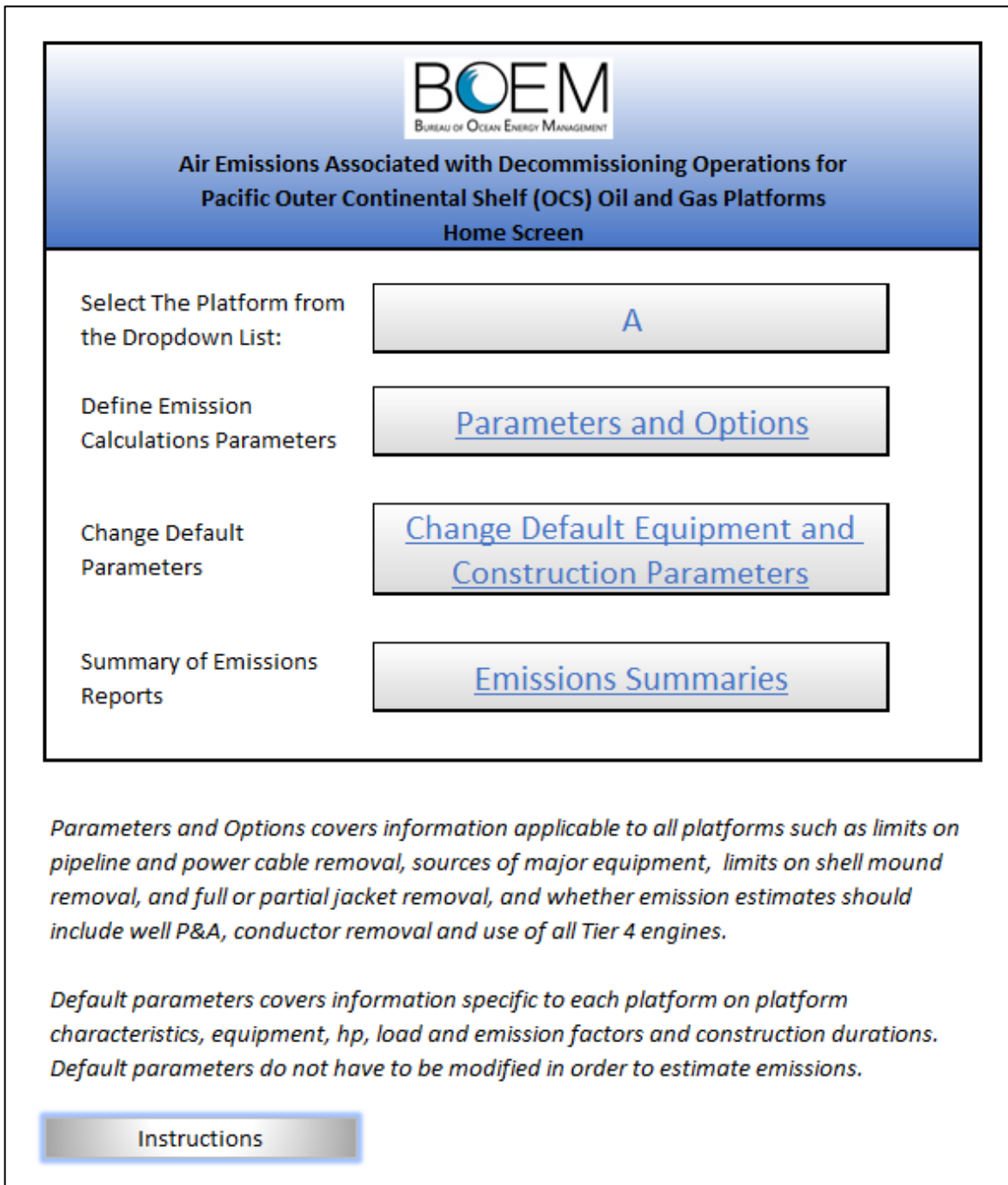


Figure 2. Home Screen

Emission Calculations Parameters and Queries	
Return to Home	
General	Item
Year of Decommissioning	<u>2022</u>
Defined Area (emissions only within in a specific area); Total or Air District	<u>Total</u>
Demobilization port for Toppersides and Jacket (Asia, GOM, POLA, Seattle)	<u>POLA</u>
Jacket Removal Options	Item
Removal option (Full, Partial Laydown, Partial Disposal Offshore, Partial Disposal Onshore)	<u>Full</u>
Partial Removal Option, transport distance, mi (if applicable)	<u>30</u>
Pipelines and Power Cables	Item
OCS Pipeline removal options: All (remove all OCS pipelines), None or Shallow Only?	<u>Shallow</u>
Remove state water pipelines?	<u>No</u>
Remove power cable in OCS?	<u>Yes</u>
Remove power cable in State Waters?	<u>No</u>
<i>Shallow removal includes only removal of pipelines in less than 200 ft of water and not between platforms.</i>	
Barge Origins	Item
Derrick Barge Source (Asia, Europe, GOM)	<u>Europe</u>
Lifting Barge Source (GOM, POLA, Seattle)	<u>GOM</u>
Cargo Barges (GOM, POLA, Seattle)	<u>GOM</u>
Derrick-Lay Barges (GOM, POLA, Seattle)	<u>GOM</u>
ShellMounds	Item
Remove Shell Mounds?	<u>Yes</u>
Emission Estimates	Item
Include Well P&A?	<u>Yes</u>
Include conductor removal?	<u>Yes</u>
Override all Emission Factors with Tier 4?	<u>No</u>
Return to Home	

Figure 3. Project Parameters Screen

Input values are located to the right of each of the items. Many of the input cells are drop-down menus. These are denoted by an underline. Cells in blue can be modified. Cells in grey are protected and cannot be modified.

General Items

The Year of Decommissioning drop-down allows the selection of what year the decommissioning would occur and provides input to the shell mounds removal option defining the amount of shell mounds to be removed. Shell mounds are assumed to increase in volume over time as a worst case. This is the only item

that is changed by modifying the decommissioning year value. Engine models and emissions levels are input separately and are not tied to the year of decommissioning.

The emissions breakdown by Defined area allows for calculations of total emissions (within the three California air districts), or within each of the 3 respective air districts.

The demobilization port for the jackets and topsides is also selected on this screen.

Jacket Removal Options

The Removal Option for the jacket is a drop-down menu where one of the following can be selected:

- **Full removal**, where all the jacket and piles are removed.
- **Partial Laydown**, where the jacket is cut and then pulled with tugs to be dropped to the ocean floor at the platform location.
- **Partial Disposal Offshore**, where the topmost 85' 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.

Under the Partial Disposal Offshore option, a transport distance is applied based on the location of the ocean disposal of the topmost jacket section.

The selection of the partial jacket removal will affect the emissions estimate by reducing the amount of time at the platform required to remove the jacket as well as reducing the number of barge trips needed associated with the platform removal. This is the single largest reduction in emissions associated with decommissioning the deeper Platforms, aside from the use of clean engines. For the partial jacket removal, it is assumed that only the topmost section of the platform is removed and that the platform jacket piles are left in place along with the bottom portion of the jacket. The timing of the partial removal of the topmost portion of the jacket is assumed to be the same as the timing to remove a single jacket section. For some platforms, the removal of the partial jacket is very similar to the removal of the entire jacket due to shallow water depth.

Pipelines/Power Cables

There are several drop down menus for pipelines and power cables located in both POCS and state waters. There are three drop-down POCS Pipeline Removal Options, of which any one can be selected:

- All, which removes all POCS pipelines,
- None, which abandons in place all POCS pipelines, or
- Shallow, which only removes the pipelines shallower than 200 feet and not between platforms.

The remove state water pipelines drop-down menu defines if the state water pipelines are to be removed also. If state water pipelines are selected, then the emissions from removing the state water pipelines is included in the pipeline removal sub-task.

The remove power cables in POCS drop-down menu defines if power cables in the POCS are removed. If they are removed, then emissions from power cable activities will be calculated.

The remove power cables in State Waters drop-down menu defines if power cables in the state waters should be removed also. If state water power cable removal is selected, then the emissions from removing the state water power cables are included in the power cable removal sub-task.

If the “None” option is selected for pipeline or power cable removal, then none of the pipeline/power cable specific options are applicable and will be greyed out on the relevant screens.

Emissions from pipeline and power cable removal are calculated based on the selections above and the pipeline and power cable removal rate as entered in construction parameters screen and the pipeline lengths as entered in the platform characteristics screen. The amount of materials to be transported and the number of barge trips are calculated based on the lengths and sizes of pipeline and the barge capacity, as entered in the construction parameters screen.

Barge Origins

Where the barges are acquired from (barge origin) defines what districts and areas will have emissions from mobilizing and demobilizing the barges. Mobilizing barges from Seattle to be utilized for a platform near Los Angeles will affect the air quality in SBCAPCD and VCAPCD as the barges will need to be transported through these respective air districts whereas if the barge origin is the POLA/LB for a Platform near Los Angeles, mobilization emissions would not affect the air quality in SBCAPCD and VCAPCD. Equipment sources drop-down menus define the equipment mobilization origin. The origin is used to define if emissions occur in different districts due to vessel activity. The equipment source options includes:

- Derrick Barge Source (Asia, Europe, GOM);
- Lifting Barge Source (GOM, POLA, Seattle);
- Cargo Barges (GOM, POLA, Seattle); and
- Derrick-Lay Barges (GOM, POLA, Seattle).

Mobilization and demobilization emissions are associated only with derrick barges and cargo barges and are categorized separately in the mobilization/demobilization sub-tasks.

Shell Mounds

Most platforms have shell mounds located under the platforms that have accumulated over time and might or might not be removed as part of the platform decommissioning project. There is a drop-down option to Remove Shell Mounds or not to remove the Shell Mounds. If not removing the Shell Mounds is selected, then none of the Shell Mounds specific options are applicable and will be greyed out on the relevant screens.

Emissions associated with shell mounds removal are calculated based on the estimate of the volume of the shell mounds at each platform from historical surveys and estimated shell mound accumulation rates. Equipment used to remove the shell mounds include bucket cranes and barges, with assumed levels of bucket volume, lifting speed and barge capacity, which are defined in the construction parameters screen.

If partial removal of the jacket option is selected, the remove shell mounds can still be selected as an option, but there will be a warning message indicating that normally shell mounds would not be removed if a partial option is selected. Under the partial jacket removal, the piles are not removed. If the shell mounds are elected to be removed under the partial jacket removal, the piles would still not be removed.

Emission Estimates

The Project Parameters screen also allows for not including the P&A or conductor removal subtasks in the emission calculations. There is also an option to override all of the emission factors with the most current emission standards for new vessel engines for all equipment, in order to view the emissions results with full implementation of these requirements.

2.3 Change Default Parameters

Changing the default parameters (**Figure 4**) allow for customization of the decommissioning emissions estimates based on updated information and should only be conducted if specific information is available from the platform operator or an administrator. None of the defaults are required to be changed to estimate the emissions. However, this screen allows for platform characteristics, equipment types, sizes and emissions and load factors and construction parameters to be modified. A screen shot of the “change default parameter” screen is shown below. Each of the options in this menu is discussed below.

**Air Emissions Associated with Decommissioning Operations for
Pacific Outer Continental Shelf (OCS) Oil and Gas Platforms
Change Default Parameters Menu**

Define the Platform Characteristics:	Change Default Platform Characteristics
Define the Equipment:	Change Default Equipment Horsepower, Load and Emission Factors
Define Operating Parameters:	Change Default Construction Parameters

Note: Default parameters are already included in the above links based on analysis and previous studies. Emissions can be estimated using these default parameters or, if new and more accurate information is available, it can be entered in the respective links.

[Return to Home](#)

Figure 4. Change Default Parameters Screen

2.3.1 Change Platform Characteristics

This input screen (**Figure 5**) allows for changes to the platform database specific to each platform, such as the number of jacket sections, deck modules, pipelines, well abandonment requirements, etc. A screen shot of the platform characteristics menu is shown below.

Platform A Characteristics		Return to Home
Characteristic	Value	
Distances		
Distance to Supply Port (mi)	104	
Closest Pier Miles	7	
Weights		
Deck Weight (tons)	1357	
Jacket Weight (tons)	1500	
Piles Weight (tons)	600	
Conductors Weight (tons)	1439	
Numbers		
Lifting barges needed, number	0	
Deck Modules	4	
Jacket Sections	1	
Jacket Legs	12	
Wells		
Rigless Low Wells	45	
Rigless Med-Low Wells	5	
Rigless Med-High Wells	1	
Rigless High Wells	1	
Rigged Wells	0	
Conductors		
Conductor Count	55	
Conductor Length Each (ft)	268	
Conductor Removal by Supply Boat or Barge/Tug?	Supply Boat	
Pipelines and Power Cables		
Total Pipeline 4" (feet) (all pipelines OCS and State, combined length)	0	
Total Pipeline 6" (feet)	59200	
Total Pipeline 8" (feet)	0	
Total Pipeline 10" (feet)	0	
Total Pipeline 12" (feet)	236800	
Total Pipeline 14" (feet)	0	
Total Pipeline 16" (feet)	0	
Total Pipeline 20" (feet)	0	
Total Pipeline 24" (feet)	0	
OCS Pipeline Length with depth less than 200' and NOT between platforms (mi)	33.7	
OCS Pipeline Length with depth greater than 200' and NOT between platforms (mi)	0	
Length of OCS Pipeline between platforms (mi)	0	
In-state length of pipelines total (mi)	22.4	
Total Length Power Cable OCS (mi)	0.5	
Additional Length Power Cable State Waters (mi)	0	
Scheduling		
Topside Platform Preparation (days)	90	
Conductor Removal (24 hr days)	53	
Deck Removal Days	10	
Jacket Removal Days	11	
Sever Piles (hours)	48	
Post Removal Site Clearance (days)	15	
Return to Default Parameter Menu		Return to Home

Figure 5. Platform Characteristics Screen

Any changes to this screen will update the data in the platform database for that platform that was selected at the home screen (Section 2.1). This screen is populated with the most recent information related to the platform selected in the home screen and includes the timing estimates for sub-phases of the project, including topside preparation, conductor removal, deck removal, jacket removal, severing the piles and post removal surveys.

Emissions are calculated based on the inputs in the platform characteristics screen a number of ways, such as:

- The emissions from supply vessels based are based on the distance the vessel travels which is input at the distance to port. The selection of the port automatically defines the distance based on the default parameters;
- The closest pier distance defines the distance that the crew boat would travel;
- Deck, jacket, piles, conductors weight define the amount of material that would be moved to port and would therefore affect the emissions through changing the number of barge trips;
- The use of a lifting barge during jacket removal might be required for deeper platforms and would increase the emissions as this barge would also need to be at the platform in addition to a derrick barge;
- The number of deck modules and jacket sections defines the timing to remove the deck and jacket based on the time per module and section;
- The number of wells and their complexity defines the length of time and associated emissions from well P&A;
- The conductor length and weights define the timing and number of barge trips and therefore emissions associated with removing the conductors;
- Pipeline lengths based on sizing defines the total timing and weight of pipeline that would need to be transported, thereby affecting the number of barge trips and associated emissions from pipeline removal; and,
- The timing of different tasks are input and emissions are based on the equipment listing and the sub-task timing.

2.3.2 Change Default Equipment

Changing the default equipment (**Figure 6**) allows for modifications to the equipment, such as the number of equipment assumed in the analysis for each sub-phase, modifying the horsepower, load factors and emission factors for all equipment and adding new equipment if needed. There is also a screen for viewing a summary of all the horsepower, load factor and emission factor values to be used as a way to view all of the factors in one place. A screen shot of the change default equipment menu is shown in **Figure 6**.

Modifying equipment sizes, load factors and numbers affects the emissions by altering the emissions characteristics of the equipment required for the project. Note that the default emissions sizes, factors and numbers are already in place for all the platforms and modifications to the equipment is not required in order to estimate the emissions.

Equipment is stored in DEEP for each platform and the input screens are for the platform that is selected in the home screen. In order to modify the equipment for a different platform, the different platform should be selected at the home screen, and then the equipment modified for that platform.

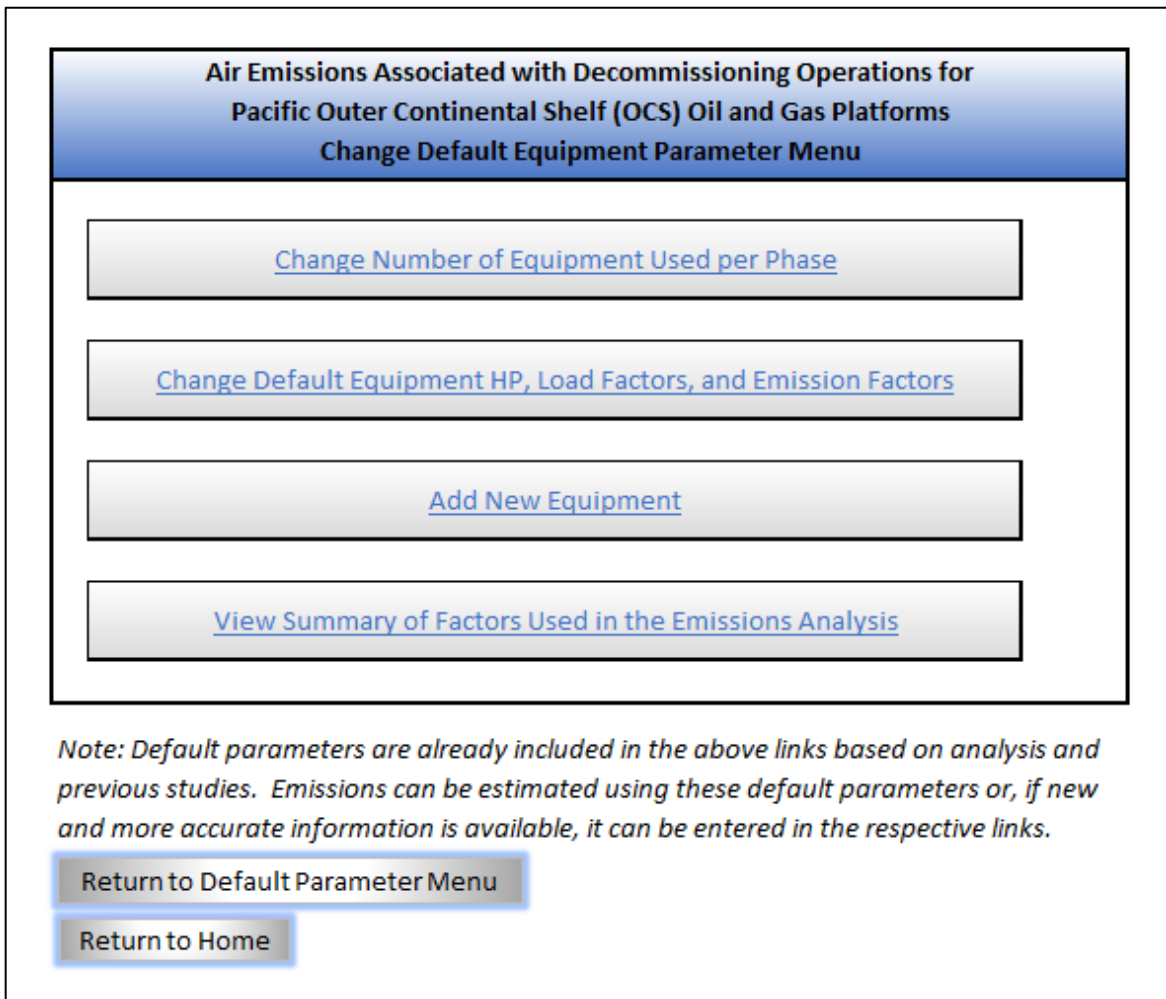


Figure 6. Change Default Equipment Screen

2.3.2.1 Equipment Numbers by Phase

The equipment list used to estimate the emissions are based on a “base” set of equipment that is the basis for the emission calculations. This equipment is listed in the “Equipment Numbers by Phase” screen for each sub-phase of the project. Not all equipment is used in every phase, so only the blue highlighted cells can be modified. If additional equipment is needed, then the “Add Equipment” screens should be used.

Equipment Horsepower, Load and Emission Factors

At the horsepower, load factors and emissions factors screen, all emissions sources are listed for the “base” set of equipment. Some equipment has multiple sources of emissions for each piece equipment, such as a crew boat having both a main engine and an auxiliary engine. All emission sources are listed along with the options for the user to select whether to use the default values, other values or to allow for a “user input” value to be entered.

For the horsepower and load factors, the drop-down menus for each equipment defines whether to use the default value or a value as entered by the user. If the "User Input" value is selected, then the user must

enter a value in the cell to the right of the dropdown. The cell will highlight orange if a value is required to be entered. These entered values will be used in the analysis.

For emission factors, the drop-down menus allow for selecting the options using the default values, user input values or respective engine Tiers. The default values are shown to the right for reference. If the user selects the default value or a Tier value for emission factors, then these values will be used in DEEP emission calculations. If the "User Input" value is selected, then the user must enter a value in all of the cells to the right of the dropdown. The cell will highlight red if a value is required to be entered. These entered values will be used in the analysis.

To view the values used in the analysis, the "View Summary of Factors" screen shows the values used in the analysis.

Add New Equipment

The emission estimates are based on a "base" set of equipment that is the basis for the emission calculations. There is space for up to 10 pieces of Additional Equipment which can be entered. The equipment name should be entered in the "User Data Input for Additional Equipment by Phase" screen, and this equipment name will be propagated throughout the remaining Additional Equipment screens. The equipment name, number, and hp will be propagated through the sheets and emission calculations. The load factor and emission factors for additional equipment must be user entered.

If an additional piece of equipment has multiple emission sources, then each emission source must be entered as a separate piece of additional equipment.

View Summary of Factors

At the Change Default Equipment Parameter menu, the user can also view a summary of the factors used in the emissions analysis. To change any of these factors, the user must return to the respective screen for inputs. The "View Summary of Factors" location can be used to verify the values selected.

2.3.3 Construction Parameters

The "Change Default Construction Parameters" screen (**Figure 7**) allows for changes to the construction activities specific to the decommissioning effort and these values are applied to all the platform decommissioning projects. These include the pipelines and power cable removal rates, shell mound removal rates, transportation arrangements, well abandonment timing, etc. A screen shot of the construction parameters menu is shown below. Each of the key groups of items in the menu are discussed below.

Note that the values are already populated with default values, based on discussions with operators and equipment suppliers and past historical studies. Generally, these default values would not be changed unless the user has additional detailed information. Construction parameters are applied to all platform emission estimates.

Construction Activity Parameters	
Return to Home	
Return to Default Parameter Menu	
Pipelines and Powercables	Item
Pipeline removal rate, days/mile (1.8 average for pipelines >2 miles)	1.8
Powercable removal rate, days/mile (5.6 average for all powercables)	5.6
Powercable weight per mile, tons (default: 45.5 tons/mile)	45.5
ShellMounds	Item
Shell Mounds Removal, bucket size, yds3 (24 yds3 default)	24
Shell Mounds Removal rate, bucket-feet/day (17,000 default)	17000
Shell Mounds Bucket Water Cut Fraction, bucket volume/volume shell mounds (1.54 default)	1.54
Shell Mounds Removal, depth below mudline, ft (2 ft default)	2
Marine Growth Contribution, tons/8-leg-jacket (1,000 tons default)	1000
Shell Mounds Removal, barge capacity, yds3 (3,000 yds default)	3000
Transportation	Item
Supply Boat speed, mph	12
Crew boat speed, mph	12
Barge speed, mph	4
Supply Boat, round trips per day	1
Crew Boat, round trips per day	2
Supply Boat Port	Hueneme
Cargo barge 400' capacity for jackets/topsides, tons (default 2196)	2,196
Mobilization time from Asia, One-Way, days (50 default)	50
Mobilization time from GOM, One-Way, days (50 default)	50
Mobilization time from Europe, One-Way, days (50 default)	50
Mobilization time from Seattle, One-Way, days (15 default)	15
Cargo Barge Capacity, pipelines & conductors, tons (default 10,000)	10,000
Well Abandonment	Item
Well Abandonment, days per rigless-low well (3 default)	3
Well Abandonment, days per rigless-medium-low well (4 default)	4
Well Abandonment, days per rigless-medium-high well (5 default)	5
Well Abandonment, days per rigless-high well (8 default)	8
Well Abandonment, days per Rigged well (21 default)	21
Well Abandonment, days to set up and break down abandonment (7 default)	7
Misc	Item
Well P&A time spent cementing, fraction of total time	0.1
Jacket and Topside contingency for work and weather, fraction of time	0.25
Partial Abandonment contingency jacket removal, days additional	0
Cargo barge/Tugs peak hour number	1
Cargo barge/Tugs peak day number	2
Return to Home	

Figure 7. Construction Activity Parameters Screen

Pipeline and Power cables

These parameters include the pipeline and power cable removal rate in days per mile and the power cable weight per mile. These can be modified by the user. The default values are provided based on past studies.

Emissions are generated for pipeline and power cable removal based on the equipment listings and the duration as calculated from the removal rate and the total pipeline lengths. The emissions from barges transporting the removed pipelines are estimated based on the total pipeline weights and the barge capacity. Power cable transportation is assumed to be conducted by the supply boats.

Shell Mounds

If removal of the Shell Mounds option is chosen, several options are made available. If removing the Shell Mounds is selected, then the following options will be available (not greyed out)

- The crane bucket size is defined (24 cubic yards default).
- The Shell Mounds Removal rate, bucket-feet/day, is defined (17,000 default). This is based on the depth of the water and the rate of bucket movement. For example, in 100 feet of water, 10 buckets could be removed over a 17-hour period.
- Shell Mounds Bucket Water Cut Fraction, bucket volume/volume shell mounds (1.54 default) defines the amount of water in the bucket along with the shell mounds.
- Shell Mounds Removal, depth below mudline, ft (2 ft default) defines the amount of muds that are removed along with the shell mounds pile, using the depth and the area of the shell mounds (which is defined in the platforms database).
- The Marine Growth Contribution, tons/8-leg-jacket (1,000 tons default) defines the amount of marine growth that falls to the ocean floor during marine growth removal during platform preparation. This value is scaled depending on the number of legs per platform.
- Mounds Removal barge capacity, cubic yards (3,000 cubic yards default) defines the capacity of the barge used to transport the shell mounds which is then used to define the number of barge trips based on the estimated shell mounds volume.

All the items above affect the timing and volume required for transport, which subsequently affects the emissions levels based on the equipment selected.

Transportation

This section defines the issues related to transportation, including:

- Supply Boat speed, mph (12 default),
- Crew boat speed, mph (12 default),
- Barge speed, mph, generally pulled by a tug boat (4 default),
- Supply Boat, round trips per day, between the platform site and the Supply boat port,
- Crew Boat, round trips per day, defines the crew boat trips between the platform site and the closest pier,
- Cargo barge 400' capacity for jackets/topsides, tons (default 2196). Barge capacity is substantially less for jackets/topsides than a barges weight capacity due to the sizing constraints,
- For derrick barges, Mobilization time from Asia, One-Way, days (50 default),
- For derrick barges and cargo barges, Mobilization time from GOM, One-Way, days (50 default),
- For derrick barges Mobilization time from Europe, One-Way, days (50 default),
- For derrick barges and cargo barges Mobilization time from Seattle, One-Way, days (15 default),

- For cargo barge pipeline and conductor capacity, capacity for pipelines and conductors is based on a greater capacity than jackets and topsides due to higher density of loading.

All values above can be modified by the user.

Emission estimates are a function of the timing of supply boat, crew boat and barge operations. The barge capacities affect the emissions by defining the number of barge trips needed to transport the jackets, topsides, pipelines and conductors. Mobilization timing defines the amount of time that the mobilization of barges would be needed in order to estimate the emissions within the defined area associated with transporting (mobilizing) the equipment to the platform site.

Well Abandonment

Wells are broken in to 5 categories as follows and the number of days to abandon a well of each category is entered:

- Well Abandonment, rigless-low well type, days to abandon (3 default),
- Well Abandonment, rigless-medium-low well type, days to abandon (4 default),
- Well Abandonment, rigless-medium-high well type, days to abandon (5 default),
- Well Abandonment, rigless-high well type, days to abandon (8 default),
- Well Abandonment, rigged, days per Rigged well (21 default),

There is also an option to provide the days to set up and break down abandonment (7 days default). All of these values can be modified by the user.

Emissions are affected by the well P&A days per well type and the number of wells as the timing of the well P&A affects the duration of the P&A activities how long the P&A associated equipment will operate. DEEP has been populated with these values as defaults for each Platform based on past studies and estimates.

Miscellaneous Items

There are several miscellaneous items that can be modified by the user, including the following:

- Well P&A time spent cementing, fraction of total time, defines the cementing time spent during well P&A (0.10 default),
- The cargo barge peak hour number defines the number of cargo barges (barge plus tug) that are utilized during the peak hour. (1 default),
- The cargo barge peak day number defines the number of cargo barges (barge plus tug) that are utilized during the peak day. (2 default).

The time spent cementing affects the time to P&A the wells, thereby affecting the equipment use duration and the emissions.

As barges would be moving to and from the platform location, the peak hour and peak day numbers for cargo barges affects the number of barges that are actually at the platform or in transit at any one time, thereby affecting the peak hour and peak day emission calculations.

Contingency Factors

A contingency is included which increases the duration of the jacket and topside removal activities and thereby increases the emissions through longer use of the equipment associated with that task. A 0.25 factor means that the timing to remove the jacket would be increased by 25 percent. The jacket

contingency for work and weather, fraction of time, defines an additional factor added to jacket and topside removal due to weather and contingency issues.

2.4 Emission Summaries

The Emissions Summary screen (**Figure 8**) provides for viewing the emissions for the selected platform, the ability to perform queries on the emissions associated with the selected platform by equipment, phase and sub phase, and the ability to perform queries on the emissions from all of the platforms by phase, sub phase or platform groupings (depth or unit/field or County).

Each of the menu items are discussed below.

Emission Summary for Single Platform by Defined Area

This screen provides a summary of the decommissioning emissions for the defined area for the platform selected in the home screen. The summary provides for information on the decommissioning characteristics, including the number of cargo barge trips, decommissioning total time, total crew/supply boats, total volume of shell mounds requiring disposal, and the various options selected for the analysis, including the removal option selected in the input screens for the pipelines, the supply boat port and the emissions factors by equipment category. Emissions in total tons as well as the Potential to Emit (PTE) are provided, depending on the specific needs of the emission estimates. PTE is the emissions from all equipment assuming it is operating at full load, which is the maximum level at which the equipment could operate, or the maximum potential, and is used to satisfy some permitting requirements. The defined area is based upon the selection inputted by the user in the “Parameters and Options” screen from the Home menu.

A more detailed summary is also available from the Emissions Summary by Defined Area screen by utilizing the “Emissions Details” link. This link provides, in addition to the information listed on the emissions summary screen, emission estimates of peak hour, peak day, tons per quarter, tons per year, total ton and PTE total tons by phase and sub phase. Emissions by equipment is also provided.

At the bottom of the Emissions Summary Detail sheet is a listing of all options chosen for the analysis to allow for this sheet to be printed and all the inputs that have been selected summarized.

Emissions Queries for Single Platform by Equipment

This link allows for the summary of emissions by equipment for the platform selected at the home screen. The queries are selected at the top of the screen with pull-down menus. Queries are available for the following areas:

- Emissions types, including peak day, total tons, or PTE;
- Phase, and
- Sub phase

The sub phases that can be selected are only those available for the associated phase. For example, if “topside removal” is selected as the phase, then only Cutting and Removal of Equipment, Mobilization and Demobilization are available as sub phases. If “All” is selected as the phase, then all sub phases are available for selection. This screen also provides information on the selected values in the input screens, including if full or partial removal of the platform jacket has been selected in another screen, the defined area selection, and the current platform and the location of the current platform (what District). In order to revise these values, the user should return to the parameters and inputs screens as discussed above.

If DEEP is saved, the last query arrangement will be saved. Specific queries cannot be recalled, however, and must be set up anew if changed. The query results can be printed (see below).

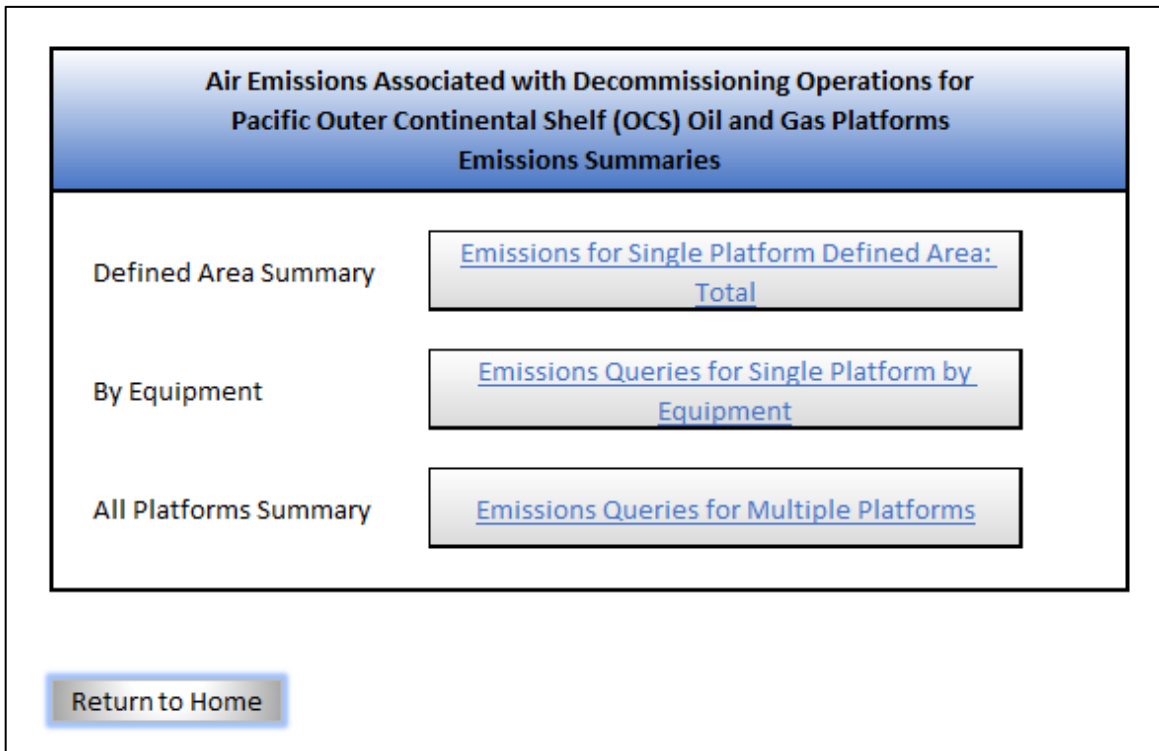


Figure 8. Emission Summaries

Emissions Query for Multiple Platforms

The emissions query for all platforms allows for viewing the emissions summary of total tons for all the platforms and filtering/querying the results by the following areas:

- Phase;
- Sub-phase,
- Platform water depth (less than 250 feet, between 250-750 feet and deeper than 750 feet); and
- Unit/field (All, Beta, Carpinteria Offshore Field, Dos Cuadras Field, Pitas Point, Pt Arguello, Pt Hueneme, Pt Pedernales, Santa Clara, Santa Clara Field, Santa Ynez, State Waters);
- Platform County (All, Los Angeles, Santa Barbara or Ventura).

These queries are selected with drop-down menus at the top of the screen. The sub phases that can be selected are only those available for the associated phase, as discussed above.

Printing

The emissions summaries and summary details can be printed from each location utilizing the Print button which will run a print macro or by using the integrated printing functions in Excel. Print Area has been pre-selected to allow for simple printing of the screens with page breaks and headings. Utilizing the “print” button or the “File-Print” command incorporated into Excel will allow for printing of the selected sheet.

All of the following screens in DEEP have pre-defined print areas and headings.

- Enter the Project Parameters and Options link and select File-Print from the Excel menus to print the following:
 - Project Parameters and Queries;
 - Construction Activity Parameters;
- Enter the Change Default Parameters-Change Default Platform Characteristics links and select File-Print from the Excel menus to print the following:
 - Selected Platform Characteristics
 - Selected Platform Emitting Equipment and Number of Equipment Used per Phase
 - Selected Platform Decommissioning - Equipment Parameters Used in Emission Estimates
 - Selected Platform User Inputted Equipment Horsepower, Load Factors and Emission Factors;
 - Selected Platform User Data Input for Additional Equipment Quantities by Phase;
 - Selected Platform User Data Entry for Additional Equipment;
- To print emission summaries, enter the Emission Summaries sub-screens and select the “print” button or the File-Print;
- Detailed emission spreadsheets can also be printed from the respective tabs

Additional Tabs

Additional tabs are in DEEP and can be accessed by clicking on the Excel tab at the bottom of the screen. In general, utilization of the tabs requires expertise in Excel and an understanding that the links in DEEP are specific to the menu structure. Returning to the Home tab will allow for re-entry into the linked menu system. Modifying or changing any of these tabs could produce calculation errors and modifications should be made carefully. Some tabs are hidden and can be unhidden using Excel functions.

An emission summary tab is provided for “All” areas (EmissionSummary tab) which provides the abbreviated emissions summary for the “All” areas (including areas outside of the Districts and outside of California). See the discussion in Section 3 about the difference between “All” areas and “Defined” areas. The detailed summary tab (EmissionsSummaryDetail tab) also provides the emissions summary for “all” areas related to the selected platform, along with summaries of peak hour, peak day, quarter, annual, total emissions and PTE.

Detailed spreadsheets, including the equipment sizing, horsepower, operating schedule, emissions factors and associated emissions are included in a separate tab for the “All” areas (Emissions tab) and for the “Defined” area (EmissionsArea tab). These spreadsheets are provided in a form similar to those produced as part of the platform District air permits.

A tab is also included which maintains the database of inputs for each of the platforms (platforms tab hidden), such as platform depth and weights as well as calculations related to timing, shell mounds and pipelines. Many cells in the platforms tab refer to the inputs tabs and should not be modified.

The Districts tab maintains information on the respective District permits emission levels and the historical emissions (year 2014, prior to the Plain pipeline spill) as well as the distribution of vessel trip distances between the associated Districts for all platforms and all vessel trip destinations and origins.

The EmissionFactors tab maintains the database of all emission factors used in the analysis.

The References tab maintains information on the derivation of the emissions estimates and many of the assumptions.

The Menus tab maintains the values of the drop-down menus used throughout DEEP.

There is also a tab for each platform which maintains information and inputs specific to that platform as well as emissions calculations specific to that platform.

2.5 Messages

There are a few locations in DEEP which will produce warnings or messages about issues. These include the following:

- Selection of partial jacket abandonment while including the removal of the shell mounds;
- A message defining a “shallow” pipeline removal;
- The selection of “user defined” for adding equipment requires that values are entered, and the cell will highlight a orange warning color to indicate that the cell requires an entry;

3 DEEP Configuration and Methodology

DEEP is based on a series of phases associated with the decommissioning of POCS Region facilities, including pre-abandonment, topside removal, jacket removal, debris removal and pipelines and power cable removal. DEEP utilizes a “default” set of equipment for each phase, including derrick barges, compressors, generators, cranes, and boats based on historical studies and discussions with operators, to estimate potential emissions from those activities for both the complete and partial removal of those facilities. This default set of equipment and parameters can be utilized to generate accurate emissions estimates with minimal effort. Modifications to defaults and additional equipment can be added to the defaults listing if needed by the user and additional information is available.

DEEP is a spreadsheet to be used in Excel version 2007 or later. It is written with several hyperlink menu screens which allows for the entering of parameters related to the platform characteristics, decommissioning construction equipment sizes and characteristics, as well as the various assumptions related to the decommissioning timing and use of ports and facilities. The default case using an assumed set of equipment and default emission factors can be used to produce emission estimates based on the current understanding of the project requirements without having to modify the inputs.

DEEP is populated with information related to the platform characteristics, such as topside and jacket weights, platform depth, pipeline sizes and lengths. This information was obtained from previous reports and BOEM and Bureau of Safety and Environmental Enforcement (BSEE) records. In addition, there are default assumptions about the equipment required for each phase of decommissioning, and default equipment horsepower sizes, emission factors and load factors. These defaults and the resulting emissions estimates are presented in the main report. The emissions estimates are based on the current understanding of the decommissioning level of effort, equipment lists and equipment types that are estimated to be utilized in each phase of decommissioning. These assumptions should be refined over time as the details of the approach and equipment are refined through detailed design, contractor bids, and regulatory permit requirements.

The emissions are calculated in spreadsheets which are tailored to be consistent with those currently used to estimate the emissions associated with the platform air permits maintained by the respective Air Districts. DEEP allows for user inputs to modify and update various parameters such as equipment horsepower, emission factors, load factors, number of crew and supply boat trips per day, source of major equipment such as derrick barges, etc. Different decommissioning scenarios can be selected, including full or partial jacket removal, removal or abandon-in-place for pipelines and power cables, etc.

The information on the platforms is maintained in DEEP, which contains the information relative to each platform, and calculates various inputs needed to estimate the emissions, such as the number of cargo barges needed based on platform component weights.

3.1 Emissions Estimate Methodology

DEEP spreadsheet can be used to estimate the emissions from a hypothetical project related to platform POCS decommissioning utilizing the assumptions provided above. DEEP can be easily updated to estimate the emissions associated with a specific project submitted for permit application. There are a wide range of options and variables that are incorporated into DEEP to estimate the emissions.

There are several different factors related to the decommissioning that affect the emissions estimates that are incorporated into DEEP. Each of these are discussed below.

3.1.1 Emission Calculations

The calculation of emissions uses a standard approach using the following general formula for combustion sources:

$$ER = N \times EF \times EHP \times EL \times U/453.6$$

With

ER = Emission rate, pounds per period or tons per period

N = Number of equipment

EF = Emission factor, g/bhp-hr

EHP = Engine maximum rated horsepower (hp)

EL = Engine load factor (percent of maximum power)

U = Usage factor; fraction of hours per hour (for peak hour), hours per day (for peak day), days per quarter or days per year. Days per quarter and days per year also include multiplication by the hours per day and dividing by the conversion to tons (/2000) for tons per quarter and tons per year.

453.6 is the conversion from grams to pounds.

PM₁₀ to PM ratio is assumed to be 1.0, as per SBCAPCD permits for platforms.

More detailed assumptions and notes are included in DEEP under the references tab.

3.1.2 Platform Full or Partial Jacket Removal

The removal of the entire jacket (Full removal) or just the topmost portion of the jacket (Partial removal) affects the emissions estimates by reducing the amount of time needed to remove the jacket and the number of cargo barge trips to remove materials. In addition, the piles would not be removed as part of the partial removal and the shell mounds would not be removed. Other activities, such as the topside removal and the well plugging and abandonment (P&A), would be the same under both scenarios.

DEEP estimates the emissions from either full or partial jacket removal by estimating the timing to remove jacket “sections” and the timing per section is used to estimate the total time for the jacket removal activity. For the partial jacket removal, it is assumed that only a single jacket section is removed. Additional set-up/break-down time is included in the partial removal option in the “default construction parameters” screen.

Some platform jackets, such as Platforms A, B and C and Gina, Henry and Hillhouse, are only assumed to have a single section as they are in shallower water and would likely require only a single lift for full jacket removal. Given the single section structure of these platforms, the partial removal option for these platforms would involve the removal of the entire jacket, similar to the full jacket removal, but the piles would not be removed to 15 feet below the mudline and the jacket is assumed to be cut above the piles. Although removal of the shell mounds is an option that can be included as part of the partial jacket removal, generally the shell mounds would not be removed under the partial jacket removal case.

The partial or full jacket abandonment options is selected in the “Parameters and Options” screen.

3.1.3 Platform Depth

The water depth of the platform is a primary factor in estimating emissions associated with the various decommissioning activities. Platform depth affects the total weight and the number of sections that the jacket would be cut in to in order to remove. Larger jackets would require more section cuts and will require more time to remove the jackets as well as more cargo barge trips to transport the jacket sections to the disposal location. The number of jacket sections and the total jacket weights are used in DEEP to calculate the number of cargo barge trips associated with the jacket removal.

Platform depth also affects the total length of conductors that must be removed. Conductor weights per foot are included in the platform database. This weight along with the platform depth and an assumed height above the water of 65 feet and a required conductor removal depth below the mudline of 15 feet is used to estimate the total weight of conductors and time required to remove the conductors. It is also used to calculate the total number of barge trips required to transport the conductors to the disposal location.

Platform depth also affects the equipment used, as a lifting barge is assumed to be required for platforms in water deeper than 300 feet. Other equipment would be similar regardless of platform depth, except that the duration of use would be longer for deeper platforms for activities such as conductor and jacket removal.

3.1.4 Platform Age and Decommissioning Date

The decommissioning date is utilized only in the amount of shell mounds that have accumulated under the platform. Surveys were conducted in 2001 on the shell mounds at many of the platforms and based on platform age, depth and bottom slope, these results were extrapolated to all the platforms. The date of the decommissioning affects only the amount of shell mounds that have accumulated based on a linear extrapolation of the amount that has accumulated over the platform life.

The marine growth located on the platform legs that is removed from the platform is also added to the shell mounds volume to be removed as it is assumed that this material is removed at the platform location and allowed to fall to the ocean floor. The amount of marine growth is based on the number of platform legs and studies which estimate the amount of marine growth on historical platforms. While this marine growth may be gathered at the surface during removal, a worst case for air emissions assumes that it is combined with the shell mounds on the ocean floor and then removed by a crane barge during the debris removal phase.

3.1.5 Shell Mounds

The removal of shell mounds is an option in DEEP, as the decision to remove the shell mounds will likely be determined on a case by case basis. Platform depth is a factor in calculating the timing to remove the shell mounds, the time to lift each bucket of shell mounds to the surface, which thereby affects the timing to remove the shell mounds. However, the amount of shell mounds would be less for deeper platforms as surveys have shown a reduction in the size of shell mounds associated with deeper platforms or platforms located in areas with greater bottom slope. The option whether to select the shell mounds for removal is located on the “Parameters and Options” screen with the details of the shell mounds removal activity input in the “Change Default Construction Parameters” screen.

3.1.6 Platform Pipelines

The weights of the pipelines are calculated based on the pipeline size and an assumed weight per foot correlating with the pipeline size based on schedule 80 pipe for pipeline sizes up to 12 inches, and schedule 40 pipe for pipeline sizes above 12 inches. The weight of the pipelines is then used to calculate

the total weight of pipelines associated with each removal scenario, which is used to estimate the number of cargo barges needed in the platform database. Pipeline lengths by size are input in the “Change Default Platform Characteristics” screen.

3.1.7 Platform Well Plugging and Abandonment

The P&A work timing is estimated based on the number of wells as classified into 5 categories of increasing complexity. The days per well for each category is then used to estimate the total timing to P&A all the wells. The number of wells per category and the days per category can be modified by the user or can be left at the default values. 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.
- Wells that require a drilling rig due to well complexity.

Discussion with platform operators indicate that a number of wells would require the use of a drilling rig due to well complexity. Generally, the use of the drilling rig would require additional timing and level of effort. The default 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. Well abandonment timing per well type are input in the “Change Default Platform Characteristics” screen.

3.1.8 Crew and Supply Boats

Because crew and supply boats can have multiple trips per day and can be used in a varied manner, crew and supply boats trips per day is an input to DEEP instead of listing the number of crew and supply boats used in the operations. Crew boats are assumed to utilize the closest pier to the platform (Ellwood, Casitas, Hueneme or POLA/LB). **Table 1** shows the platforms along with the closest piers as used in DEEP. Supply boats are assumed to utilize either Port Hueneme or the POLA/LB, and this is selectable in DEEP. Crew and supply boats are assumed to travel to the platform site and then return from the closest pier (for crew boats) or the selected port, Port Hueneme or the POLA/LB (for supply boats). Dive boats are assumed to be similar to supply boats and to travel to the platform site from the closest pier and then returning each day.

Table 1. Piers and Ports

Platform	Closest Pier
A	Casitas
B	Casitas
C	Casitas
Edith	POLA/LB
Ellen	POLA/LB
Elly	POLA/LB
Eureka	POLA/LB
Gail	Port Hueneme
Gilda	Port Hueneme
Gina	Port Hueneme
Grace	Port Hueneme
Habitat	Casitas
Harmony	Ellwood
Harvest	Ellwood
Henry	Casitas
Heritage	Ellwood
Hermosa	Ellwood
Hidalgo	Ellwood
Hillhouse	Casitas
Hogan	Casitas
Hondo	Ellwood
Houchin	Casitas
Irene	Ellwood

3.1.9 Mobilization and Demobilization

Mobilization and demobilization are the activities associated with moving the equipment from their respective point of origin, such as the GOM. DEEP calculates air emissions associated with mobilization and demobilization of the derrick barges, crane barges, lifting barge and cargo barges only. By selecting a defined area, the mobilization and demobilizations are effectively not included except for the mobilizations and demobilization emissions associated with the use of vessels only while in the defined area (see below for a discussion of the defined area). All other materials brought to and from the platform site are assumed to be transported with supply boats. Supply and crew boats are not included in the mobilization and demobilization emissions subtasks as they are assumed to move back and forth from their respective piers/ports frequently and those emissions are therefore included in each respective subtask.

3.1.10 Port Selection

As the location of the port for mobilization and demobilization activities directly affects air emissions in each applicable air district, the ports for barge use is selected in DEEP. Aside from the supply boat port selection options, mobilization origins for barges are selectable for a range of ports, including the Gulf of Mexico (GOM), Seattle, Europe and Asia. These origin ports are used to calculate the total emissions associated with bringing the barges to the platform as well as the emissions associated with the vessel movement within each respective air district. The destination port for the topsides and jackets is also

selectable in DEEP. Other materials, such as pipeline sections, power cables and shell mounds, are assumed to be removed to the POLA/LB.

3.1.11 Defined Area Selection

Emissions are calculated in the emission spreadsheet for all areas where activities will be conducted as well as a “defined” area, such as within a specific air district. The emissions estimate, as part of the mobilization tasks includes the emissions of tug boats transporting barges from the GOM or other origin, which could take as long as 100 days and travel an extensive distance including in waters offshore of Texas, and through the Panama Canal. However, the primary emission estimates in DEEP are based on activities that would occur only within a “Defined” area. The defined areas are within a District/County or total emissions within all three air districts. The defined area limits the emissions to only those activities that occur within the defined area. Defined areas include the Santa Barbara County Air Pollution Control District (essentially, Santa Barbara County), the Ventura County APCD (Ventura County), the South Coast Air Quality Management District or within all three air districts (Total). **Table 2** describes the different defined area selections.

Table 2. Defined Area Selections

Selection	Area where emission that are counted would occur	Activities Included in the Emissions Estimate
Total	Total emissions within all three air districts	<ul style="list-style-type: none"> • Activities at the platform • Boat trips to and from the platform limited to emissions that occur only while the boat is traveling within the three air districts • Mobilization and demobilization emissions of transporting barges limited to emissions that occur only while the boat is traveling within the three air districts
SBCAPCD	Only emission that occur within Santa Barbara Air District	<ul style="list-style-type: none"> • Activities at the platform if the platform is located within the SBCAPCD boundaries. • Boat trips (crew, supply and dive boats) to and from the platform limited to emissions that occur only while the boat is traveling within Santa Barbara County. • Mobilization and demobilization emissions of transporting barges limited to emissions that occur only while the barge is traveling within Santa Barbara County. • Emissions from the movement of boats and barges/tugs that may pass through Santa Barbara County in route to a platform in another district only while the boats or barge are within Santa Barbara County.
VCAPCD	Only emission that occur within Ventura County	<ul style="list-style-type: none"> • Activities at the platform if the platform is located within the Ventura County boundaries. • Boat trips to and from the platform (if the platform is located within Ventura County boundaries) limited to emissions that occur only while the boat is traveling within Ventura County. • Mobilization and demobilization emissions of transporting barges limited to emissions that occur only while the barge is traveling within Ventura County. • Emissions from the movement of boats and barges/tugs that may pass through the VCAPCD in route to a platform in another district only while the boats or barges are within Ventura County.

Table 2. Defined Area Selections

Selection	Area where emission that are counted would occur	Activities Included in the Emissions Estimate
SCAQMD	Only emission that occur within the South Coast Air Quality Management District	<ul style="list-style-type: none"> • Activities at the platform if the platform is located within the SCAQMD boundaries. • Boat trips to and from the platform (if the platform is located within the SCAQMD boundaries) limited to emissions that occur only while the boat is traveling within the SCAQMD. • Mobilization and demobilization emissions of transporting barges limited to emissions that occur only while the barge is traveling within the SCAQMD. • Emissions from the movement of boats and barges/tugs that may pass through the SCAQMD in route to a platform in another district only while the boats or barges are within the SCAQMD.

For example, for the Platform Heritage decommissioning scenario, by selecting total as the defined area, the emissions at the platform would be included, as well as the emissions from supply boats and other vessels only while they are transiting the three air districts. Emissions from the mobilization of equipment, such as cargo barges, would only be tabulated for that period of time when the cargo barges are located within the three air districts.

As another example, if the platform selected is Platform Gail (in the VCAPCD) and SBCAPCD is selected as the defined area, emissions estimates would be zero, although some emissions may still occur in the SBCAPCD as the defined area if some mobilization of equipment is included that would originate from Asia or Seattle, for example, and the mobilization of the equipment would pass through the SBCAPCD.

Note that selecting a defined area, such as the SBCAPCD, does not apply any specific SBCAPCD rules or regulations; it only defines the area within which emissions are tabulated.

4 User Input Examples

DEEP menu and emission estimate steps are shown for a number of different possible actions below, including:

- Platform Decommissioning Emission Estimates using default values;
- Platform Decommissioning Emission Estimates using custom values;
- Platform Decommissioning Summary of All Platforms;
- Platform Decommissioning Emission Estimates Using Custom Construction Parameters Values;
- Platform Decommissioning Emission Estimates Using Custom Equipment Values
- Platform Decommissioning Emission Estimates Using Custom Values for Conductor Removal only

More detailed discussion of the menu items and approach are discussed in Section 2. Sample problems are discussed below.

4.1 Platform Decommissioning Emission Estimates Using Default Values

For this example, the decommissioning emissions associated with the platform Harmony are estimated for partial removal of the jacket during the year 2025.

Open DEEP excel spreadsheet:

1. If the spreadsheet does not open to the home page, click on the “home” tab at the bottom of the screen to navigate to the “home” screen.
2. Click on the box located to the right of the “Select the Platform from the Dropdown List”.
3. Click on the dropdown box arrow located to the immediate lower right of the box to list all of the platforms.
4. Scroll down to and select the platform name “Harmony”.
5. The platform name “Harmony” should now be shown in the “Select the Platform from the Dropdown List” box.
6. Click on the “Parameters and Options” box. This will take the user to a list of project parameters and queries.
7. Under the general heading, select the area in the blue box located to the right of the text “Year of Decommissioning”.
8. Using the dropdown box, select the year 2025.
9. Select the blue box located to the right of the “Removal Option” under the “Jacket Removal Options” section.
10. Select “partial laydown”.
11. Note that there are many options on this screen allowing for a detailed emissions analysis, including the following:
 - a. OCS pipeline removal options
 - b. Removal of State water pipelines in addition to OCS pipelines.
 - c. Origins of large equipment.
 - d. Whether to remove the shell mounds beneath the platform.
 - e. Whether to include the well P&A and conductor removal in the emissions estimates.
 - f. Whether to require the use of all low emission diesel engines in the analysis in order to reduce emissions.
12. Click on the “Return to Home” button at the top or bottom of the screen.
13. Click on the “Emissions Summaries” box on the home screen.
14. Click on the “Emissions for Single Platform Defined Area Total” box.

15. This screen shows the emissions estimates for the decommissioning of Platform Harmony with the selected options and emissions only within the three air districts. The following items are shown:
 - a. The permitted emissions associated with Platform Harmony.
 - b. The actual emissions associated with Platform Harmony.
 - c. The decommissioning characteristics, including number of barge trips, total platform tonnage, shell mounds removed, total decommissioning timeframe, supply/crew boat trips and the removal options selected.
 - d. Emissions summary in total tons and the PTE
16. This screen can be printed using the “Print” button located on the right of the screen or the standard Excel print function by clicking on “File” from the Excel menus and selecting print.
17. Click on the “Emissions Summaries” box located at the upper right area of the screen to return to the emissions summaries screen.
18. Click on the “Emissions Queries for Single Platform by Equipment” box.
19. This screen allows for viewing estimates of emissions by equipment for each phase and sub phase for Platform Harmony.
20. Select the emissions type from the blue box to the right of the “Emissions Type” heading, and select “TotalTons” from the dropdown menu.
21. Select “All” from the dropdown menu blue box located to the right of the “Phase” heading.
22. Select “All” from the dropdown menu blue box located to the right of the “Subphase” heading.
23. The Emissions in total tons are shown in the table by equipment for All Phases and Sub phases.
24. This screen can be printed using the “Print” button located on the right of the screen or the standard Excel print function by clicking on “File” from the Excel menus and selecting print.
25. Click on the “Return to Home” button in the upper right of the screen to return to home.

4.2 Platform Decommissioning Emission Estimates Using Custom Values

For this example, the decommissioning emissions associated with the platform Harmony are estimated for partial removal of the jacket during the year 2025, with modifications to the derrick barge engines to utilize the cleanest type of diesel engine.

Open DEEP excel spreadsheet:

1. If the spreadsheet does not open to the home page, click on the “home” tab at the bottom of the screen to navigate to the “home” screen.
2. Follow steps 2-12 of the above example.
3. When returning to the home screen, click on the “Change Default Equipment and Construction Parameters” box.
4. Click on the “Change Default Equipment Horsepower, Load and Emission Factors” box.
5. Click on the “Change Default Equipment HP, Load and Emission Factors” box.
6. This screen presents all of the equipment and associated horsepower, load factors and emission factors.
7. Look down the list of equipment for the “Derrick Barge Gen Engines” and under the Emission Factors, Select Option, click on the box labeled “Default” to bring up a dropdown menu.
8. Select “Tier 4” from the dropdown menu.
9. Click on the “Return to Default Equipment Parameter Menu” at the top of the screen.
10. Click on the “View Summary of Factors Used in the Emissions Analysis” box
11. This screen shows a listing of the values used to estimate the emissions. Note that the Derrick Barge Gen Engines NOx emission factor is set to a Tier 4 level (1.34 g/bhp-hr).
12. Click on the “Return to Home” box at the top of the screen.

13. Continue with viewing the emissions estimates from step 13 in the first example above.

4.3 Platform Decommissioning Summary of All Platforms

For this example, the decommissioning emissions associated with all of the platforms located in the OCS are estimated for full removal of the jackets during the year 2025. Emissions by phase and sub phase and other queries are also viewed.

Open DEEP excel spreadsheet:

1. If the spreadsheet does not open to the home page, click on the “home” tab at the bottom of the screen to navigate to the “home” screen.
2. Click on the “Parameters and Options” box in the home screen (selection of a specific Platform from the Platform dropdown list does not affect these emissions levels unless changes to specific platform characteristics are needed).
3. Under the general heading, select the area in the blue box located to the right of the text “Year of Decommissioning”.
4. Using the dropdown box, select the year “2025”.
5. Click on the blue box located to the right on the “Removal Option” and select “Full” from the dropdown menu.
6. Click on the “Return to Home” box on the upper right of the screen.
7. Click on the “Emissions Summaries” box at the home screen.
8. Click on the “Emissions Queries for Multiple Platforms” box.
9. This screen shows the queries, emissions and schedule timing for all Platforms located in the POCS region based on the platform characteristics, equipment and construction parameters selected for each Platform.
10. Click on the blue box to the right of “Phase” to show a dropdown menu and select “All”.
11. Click on the blue box to the right of “Subphase” to show a dropdown menu and select “All”.
12. Click on the blue box to the right of “Platform Depth Category” to show a dropdown menu and select “All”.
13. Click on the blue box to the right of “Platform Unit or Field” to show a dropdown menu and select “All”.
14. Click on the blue box to the right of “Platform County” to show a dropdown menu and select “All”.
15. The emissions shown in the table for each Platform are total tons associated with decommissioning for all phases and sub phases.
16. Scroll down to view the timing of each subtask for each Platform.
17. This screen can be printed using the “Print” button located on the right of the screen or the standard Excel print function by clicking on “File” from the Excel menus and selecting print.
18. In order to view the emissions for only a specific task (such as Pre-abandonment) or subtask (such as Conductor removal), click on the blue box to the right of “Phase” to show a dropdown menu.
19. Selected “Pre-abandonment” from the dropdown box.
20. Click on the blue box to the right of “Subphase” to show a dropdown menu and select “Conductor Removal”.
21. The table below shows the emissions associated with each platform for the conductor removal subtask. Note that not all Platforms have conductors (Elly for example does not have conductors or wells).
22. The “Exceed Threshold (25 TPY)?” also shows if any of the pollutant emissions for that Platform exceed 25 tons per year.

23. In order to view the emissions for Platforms within a specific depth of water category (such as less than 250 feet) only, reset the phase and sub phase dropdowns (from steps 18-20) to all, then click on the blue box to the right of “Platform Depth Category” to show a dropdown menu and select “Less than 250”.
24. This will show the emissions from only those Platforms located in less than 250 feet of water.
25. In order to view the emissions for Platforms within a specific unit or field (such as the Beta Unit) only, reset the dropdowns to “All”, then click on the blue box to the right of “Platform Unit or Field” to show a dropdown menu and select “Beta”.
26. This will show the emissions from only those Platforms located in the Beta Unit.
27. In order to view the emissions for Platforms within a specific County (such as Ventura) only, reset the dropdowns to “All”, then click on the blue box to the right of “Platform County” to show a dropdown menu and select “Ventura”.
28. This will show the emissions from only those Platforms located in Ventura County.
29. Any mix of Phase, sub phase, depth, unit and County can be selected. Note that not all queries will produce results – for example, there are no Platforms deeper than 750 feet located in Ventura County.
30. Click on “Return to Home” at the top right of the screen to return to the home screen.

4.4 Platform Decommissioning Emission Estimates Using Custom Construction Parameters Values

For this example, the decommissioning emissions associated with the platform Harmony are estimated for full removal of the jacket during the year 2025, with modifications to the construction parameters to incorporate a different supply boat port (to POLA), change the estimated timing associated with well P&A (to 30 days for wells requiring a drilling rig) and eliminate the option to remove the shell mounds.

Open DEEP excel spreadsheet:

1. If the spreadsheet does not open to the home page, click on the “home” tab at the bottom of the screen to navigate to the “home” screen.
2. Click on the box located to the right of the “Select the Platform from the Dropdown List”.
3. Click on the dropdown box arrow located to the immediate lower right of the box to list all of the platforms.
4. Scroll down to and select the platform name “Harmony”.
5. The platform name “Harmony” should now be shown in the “Select the Platform from the Dropdown List” box.
6. Click on the Parameters and Options box in the home screen.
7. Under the general heading, select the area in the blue box located to the right of the text “Year of Decommissioning”.
8. Using the dropdown box, select the year “2025”.
9. Click on the blue box located to the right of the “Removal Option” and select “Full” from the dropdown menu.
10. Click on the blue box located to the right of the “Remove Shell Mounds?” and select “No” from the dropdown menu.
11. Click on the “return to home” box on the upper right of the screen.
12. After returning to the home screen, click on the “Change Default Equipment and Construction Parameters” box.
13. Click on the “Change Default Construction Parameters” box.
14. Note that the parameters under the Shell Mounds heading are all greyed out. This is because we have elected to not remove the shell mounds in the previous steps.

15. Click on the blue box next to the “Supply Boat Port” under the transportation heading. Select the “POLA” from the dropdown menu.
16. Click on the blue box next to the “Well Abandonment, days per Rigged well (21 days default)” under the Well Abandonment heading and enter 30 in the blue box.
17. Click on the Return to Home box.
18. View emissions values as discussed in the first example starting at step 13.

4.5 Platform Decommissioning Emission Estimates Using Custom Equipment Values

For this example, the decommissioning emissions associated with the platform Harmony are estimated for partial removal of the jacket during the year 2025, with modifications to the construction equipment to incorporate a different sized derrick barge (18,000 hp), user-defined emission factors (custom) and the addition of a second generator during the jacket removal phase.

Open DEEP excel spreadsheet:

1. If the spreadsheet does not open to the home page, click on the “home” tab at the bottom of the screen to navigate to the “home” screen.
2. Follow steps 2-12 in the first example.
3. When returning to the home screen, click on the “Change Default Parameters” box.
4. Click on the “Change Default Equipment Horsepower, Load and Emission Factors” box.
5. Click on the “Change Default Equipment HP, Load and Emission Factors” box.
6. This screen presents all of the equipment and associated horsepower, load factors and emission factors.
7. Look down the list of equipment for the “Derrick Barge Gen Engines” and under Set Horsepower-Select Option heading, click on the box labeled “Default” to bring up a dropdown menu and select “User Input”.
8. When “User Input” is selected, the cell to the immediate right is highlighted orange, indicating that a value needs to be entered in that cell. Enter the value “18,000” in the orange cell. The cell is then no longer highlighted orange as a value has been entered.
9. Under the Emission Factors-Select Option heading, click on the cell that says default in order to access the dropdown menu. Select the “User Input” from the dropdown menu.
10. All of the emission factor cells to the right will be highlighted orange, indicating that a value must be entered in each of the cells. Enter the appropriate emission factors in each cell - for example 3.0/1.0/3.0/0.005/0.15/0.15/0.15/555 in g/bhp-hr. All cells must have a value entered in it.
11. Click on the “Return to Default Equipment Parameter Menu” at the top of the screen.
12. Click on the “View Summary of Factors Used in the Emissions Analysis” box
13. This screen shows a listing of the values used to estimate the emissions. Note that the Derrick Barge Gen Engines horsepower and emission factors match the values entered and that the emission factor code for the Derrick Barge Gen Engines is labeled as “Entered”.
14. Click on the “Return to Default Equipment Parameter Menu” at the top of the screen.
15. Click on “Add New Equipment” to add a different generator to the equipment used.
16. Click on “Add Number of Equipment Used per Phase”.
17. Under the Equipment Emissions Sources heading, select the cell on the line that says “Additional Equipment 1”.
18. Enter into this cell “Generator”.
19. Under the heading Number of Equipment by Phase that says “Jacket Removal”, in the cell on the row for “Generator”, enter the value “1” in the cell to indicate that 1 generator will be used during this phase.

20. Click on the “Return to New Equipment Menu” box.
21. Click on the “Add Equipment HP, Load Factors and Emission Factors” box.
22. Under the Equipment Emissions Source heading, note the Generator row and enter the respective values in the cells on the Generator row for Horsepower (enter 150 hp as an example), Load Factor (enter 0.50 as an example), and Emission Factors (enter 3.0/1.12/2.6/.005/0.15/0.15/0.15/555). Values must be entered in all cells on the Generator row.
23. Note that there are also generators listed under the defaulting listing of equipment that is also included in the emissions calculations (see “Change Default Parameters”/”Change Default Equipment Horsepower, Load and Emissions Factors”/”Change Number of Equipment Used per Phase” and note that there are 2 generators listed for the subtask Jacket Removal). The additional generator added under this sample problem is added because it is an additional generator being used that has a different horsepower or emission factor characteristic than these default generators and therefore must be added separately.
24. Click “Return to Home”.
25. View emissions values as discussed in the first example starting at step 13.

4.6 Platform Decommissioning Emission Estimates for the Sub Phase Conductor Removal Only

For this example, the decommissioning emissions associated with the platform Hermosa are estimated for only the removal of the conductors, with modifications to the number (13) and length of conductors (700 feet), days for removal (60), the construction equipment (450 hp Tier 4 generator) to incorporate the use of only a supply boat every 2 days instead of cargo barges and different sized equipment.

Open DEEP excel spreadsheet:

1. If the spreadsheet does not open to the home page, click on the “home” tab at the bottom of the screen to navigate to the “home” screen.
2. Click on the box located to the right of the “Select the Platform from the Dropdown List”.
3. Click on the dropdown box arrow located to the immediate lower right of the box to list all of the platforms.
4. Scroll down to and select the platform name “Hermosa”.
5. The platform name “Hermosa” should now be shown in the “Select the Platform from the Dropdown List” box.
6. Click on the “Parameters and Options” box. This will take the user to a list of project parameters and queries.
7. Under the Emission Estimates area, ensure that include conductor removal is “yes”.
8. Return to home
9. Select “Change Default Equipment and Construction Parameters”
10. Select “Change Default Platform Characteristics”
11. Look down for “conductor count” under the Conductor heading and enter “13”
12. Look down for conductor length and enter “700”
13. Look for the “Conductor removal by supply boat or barge/tug?”
14. Select “Supply boat”
15. Look down for conductor removal days under the Scheduling heading and enter “60”
16. Return to Home
17. Select “Change Default Equipment and Construction Parameters”
18. Select “Change Default Equipment Horsepower, Load and Emission Factors”

19. Select “Change Number of Equipment used per Phase”
20. Look for the Conductor Removal Phase heading and ensure that only 1 generator is selected and zero mechanical cutters.
21. Return to Default Equipment Parameter Menu
22. Select “Change Default Equipment HP, Load Factors and Emission Factors”
23. Under the row for Generators, under the “Set horsepower” columns, set the “select option” column to “User Input”.
24. Next to the “User Input” row for generators, under the “Set horsepower” columns, enter “450” into the User Input Value column.
25. Under the emission factors columns, under the select option column, for generators, select Tier 4f from the drop down menu
26. Return to home
27. Select “Change Default Equipment and Construction Parameters”
28. Select “Change Default Construction Parameters”
29. Under the Transportation heading, enter for Supply Boat round trips per day, enter “0.5” for 1 round trip every two days.
30. Return to Home
31. Select emissions summaries
32. Select Emissions Queries for Single Platform by Equipment
33. Under queries, phase, select “pre-abandonment phase”
34. Under sub phase, select “conductor removal”
35. Under the emissions summary the emissions for conductor removal for Hermosa are listed by equipment and as a total.



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).