

A large-scale industrial operation on the ocean. A massive red steel structure, likely a platform deck, is being hoisted by a yellow crane from a dark barge on the left. Another red structure is being lowered by a crane on the right. The background shows a clear blue sky and the ocean.

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

September 17, 2019

**Prepared By:
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OCS Study BOEM 2019-016

The Challenge

- Offshore Platforms since 1968
- 23 Platforms located in Federal Waters
- Platform water depths ranging between 96 and 1,197 ft
- Decommissioning activities are approaching
- Air emissions associated with decommissioning will be one of the largest environmental impacts

The Platforms



The Study

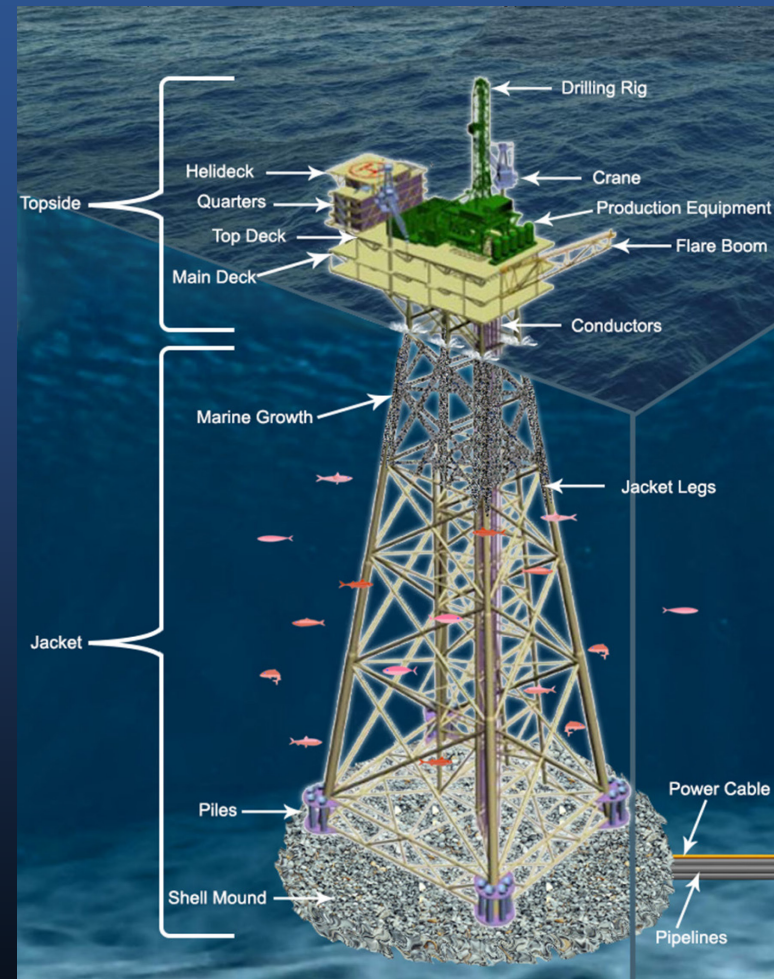
- Examined 6 phases of the decommissioning effort
- Reviewed air regulations and air permitting pathways
- Developed detailed timing: full removal and partial jacket removal options
- Examined vessel and equipment requirements
- Developed a spreadsheet tool for estimating air emissions

Sources of Information

- Decommissioning Cost Update (Smith, 2016)
- California Ocean Science Trust 2008
- Hogan & Houchin Abandonment Cost (Twomey 2000)
- State of the Art of Removing Large Platforms in Deep Water (MMS 2000)
- SBCAPCD 4H Permitting Data
- BP Decommission projects North Sea
- Discussions with operators and vendors

Decommissioning Phases

- Pre-abandonment (well P&A, topside preparation, marine growth removal, conductor removal)
- Topside removal
- Jacket removal
- Debris removal (shell mounds, surveys, site clearance)
- Pipelines and power cable removal
- Processing and disposal



Project Phases: Pre-abandonment

- Well P&A examined for 5 different arrangements (rig-less and rigged)
- Marine growth removal assumes 1,000 tons per 8 leg Platform
- Conductor removal based on 40 foot sections
- Well P&A: up to 457 days per Platform
- Conductor Removal: Up to 290 days per Platform
- Equipment: generators, drill rigs, barges, tugs



Project Phases: Topside Removal

- Use of a derrick barge and cargo barges
- Based on number of deck modules
- Up to 30 hours per module
- Up to 11 days per Platform
- Equipment: generators, derrick barge, barges, tugs



Source: J Rey McDermott

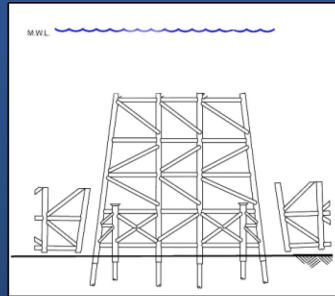
Project Phases: Full - Jacket Removal

- Use of a derrick barge and cargo barges
- Based on number of jacket sections
- Lifting barge used for deeper Platforms
- Up to 43 sections per Platform
- Up to 136 days per Platform
- Equipment: generators, derrick barge, barges, tugs

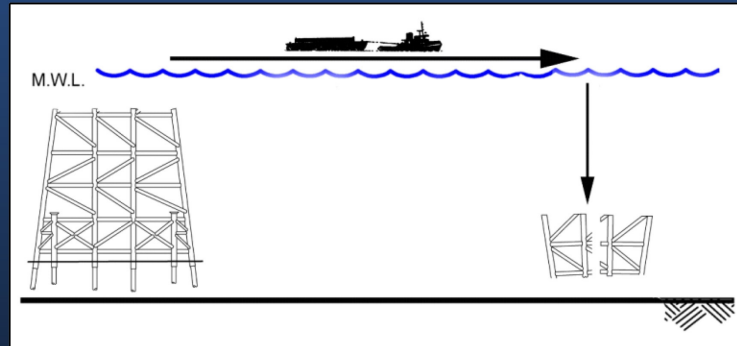
Project Phases: Partial - Jacket Removal

- Use of a derrick barge and cargo barges
- Based on a single jacket section, 85 feet deep
- Shallower Platforms similar as full jacket removal
- Up to 21 days per Platform
- Equipment: generators, derrick barge, barges, tugs

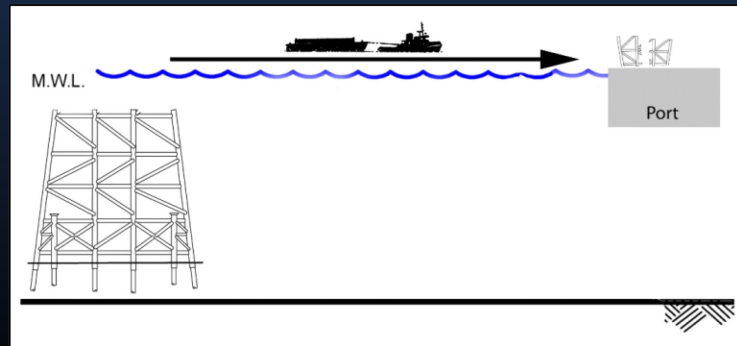
Project Phases: Partial - Jacket Removal



Partial Laydown



Partial Disposal Offshore



Partial Disposal Onshore

Project Phases: Debris Removal

- Shell mounds substantial effort - up to 20,000 yds³
- Shell mounds up to 17 days and 12 barge trips
- Surveys and site clearance
- Equipment: generators, barges, crane barge, tugs

Project Phases: Pipelines and Power Cables

- Pipeline flushing and capping
- Removal of pipelines if required
 - ✓ Remove all pipelines
 - ✓ Removal only those less than 200 ft of water
 - ✓ Abandon in place
- Removal of power cables
- Equipment: generators, derrick lay barge, barges, tugs



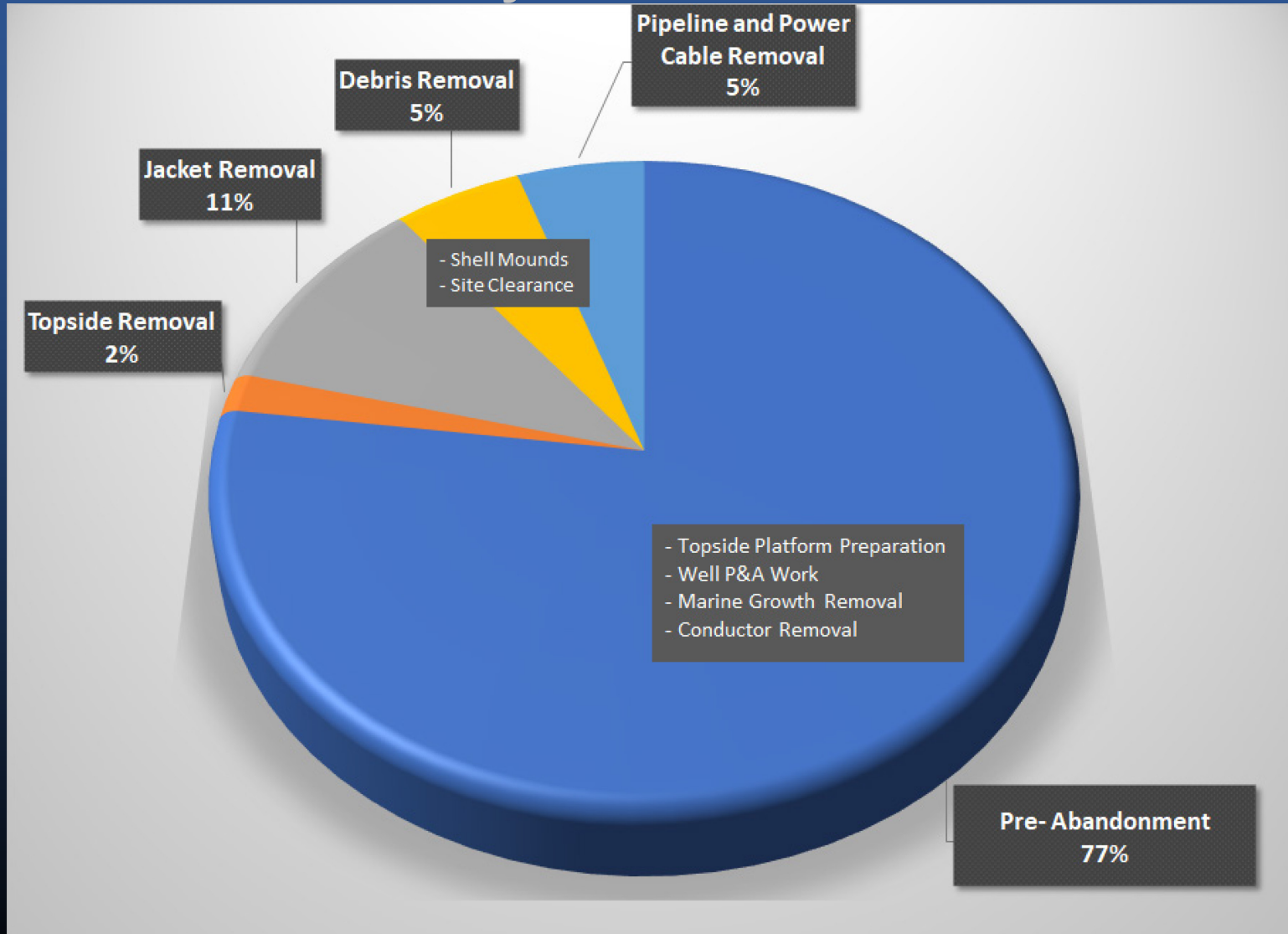
Equipment Feasibility and Availability

- Derrick barge: foreign sourced. Most likely would require clean engine modifications
- Derrick barge assumed 2,500 ton. Could range in size based on Platform size
- Tug boats: 35 Tier 3 & 4 along west coast (Harley, Foss, Sause, Crowley)
- Crew and Supply boat: currently used at Tier 2 and 3

Timeline

- Average Platform up to 400 days for all phases
- Well P&A takes the most time
- Well P&A activities under existing permits
- Possibly conductor removal and some topside prep under existing permits

Timeline: Percent by Phase



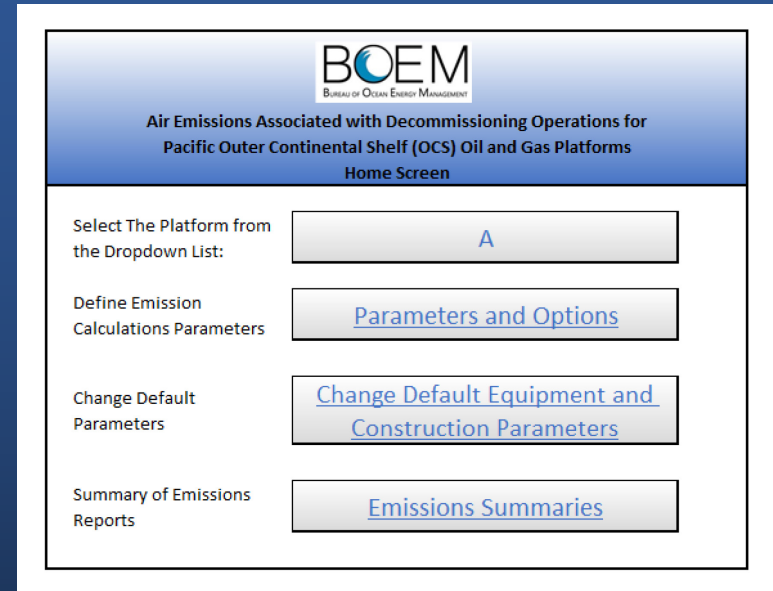
Emissions: Spreadsheet Tool

- Decommissioning Emissions Estimation for Platforms (DEEP)
- Spreadsheet tool developed to estimate emissions
- A number of variables in the tool program, including:

<ul style="list-style-type: none">• Platform specific characteristics (weights, legs, depth, distance to ports and piers, etc.)	<ul style="list-style-type: none">• Shell mounds removal options (remove or not, removal characteristics)
<ul style="list-style-type: none">• Year of decommissioning (to estimate shell mounds volumes)	<ul style="list-style-type: none">• Transportation options (crew and supply boat speeds, cargo barge/tug speeds, cargo barge capacities, mobilization timing, numbers of crew/supply boat trips/day)
<ul style="list-style-type: none">• Jacket removal options (full, partial with laydown in place or transport)	<ul style="list-style-type: none">• Selection of “area” to limit emissions to a subarea of the project, including the total emissions, within air districts
<ul style="list-style-type: none">• Pipeline and power cable removal options (all, only shallow water and State waters)	<ul style="list-style-type: none">• Other items (demobilization port for topsides/jackets, contingency factors)
<ul style="list-style-type: none">• Emission factors (uncontrolled, Tier 3 or Tier 4)	<ul style="list-style-type: none">• Equipment sources (Asia, Europe, GOM, Seattle, POLA/LB)

Emissions: Spreadsheet Tool

- DEEP allows for selecting a wide range of variables through linked menus
- Generates outputs including:



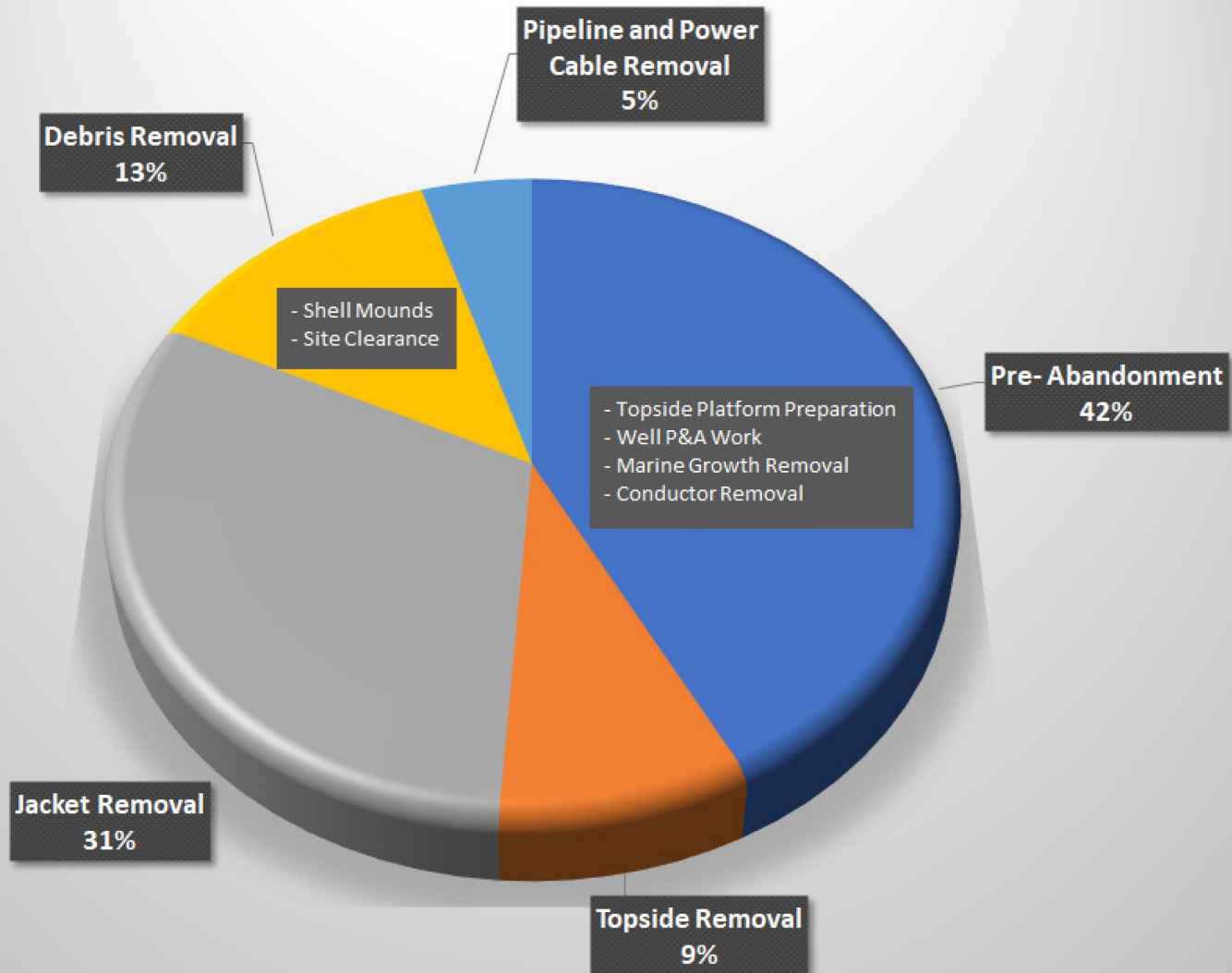
BOEM
BUREAU OF OCEAN ENERGY MANAGEMENT

Air Emissions Associated with Decommissioning Operations for Pacific Outer Continental Shelf (OCS) Oil and Gas Platforms
Home Screen

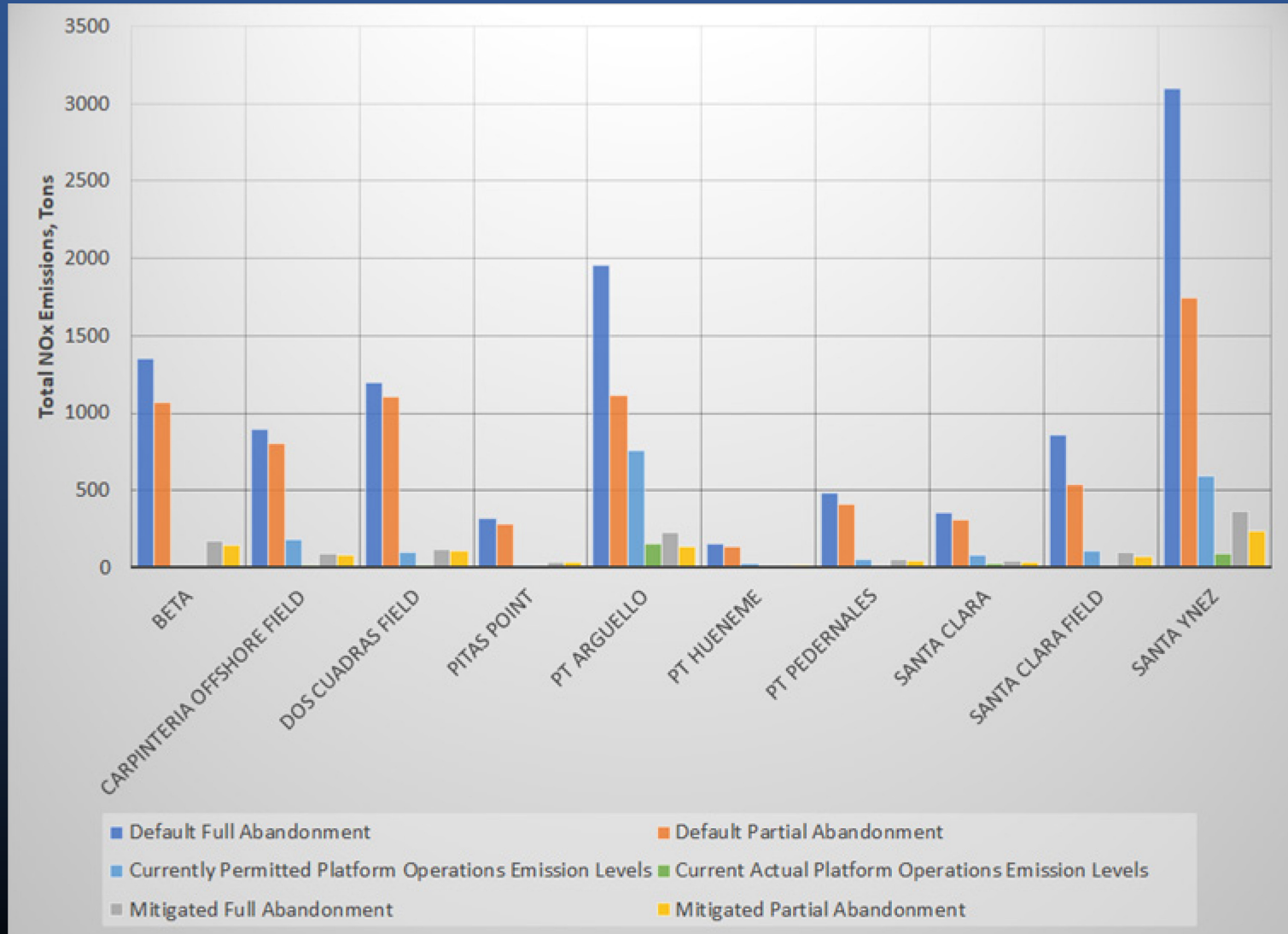
Select The Platform from the Dropdown List:	<input type="text" value="A"/>
Define Emission Calculations Parameters	Parameters and Options
Change Default Parameters	Change Default Equipment and Construction Parameters
Summary of Emissions Reports	Emissions Summaries

- Emission summaries and details by Platform (peak hour, peak day, total tons, PTE)
- Emissions for groups of Platforms (by Unit, Air District, Platform Depth)
- Emissions by phase or subphase
- Emissions by equipment type
- Equipment usage: barge trips, disposal tonnage, supply/crew boat trips, etc.

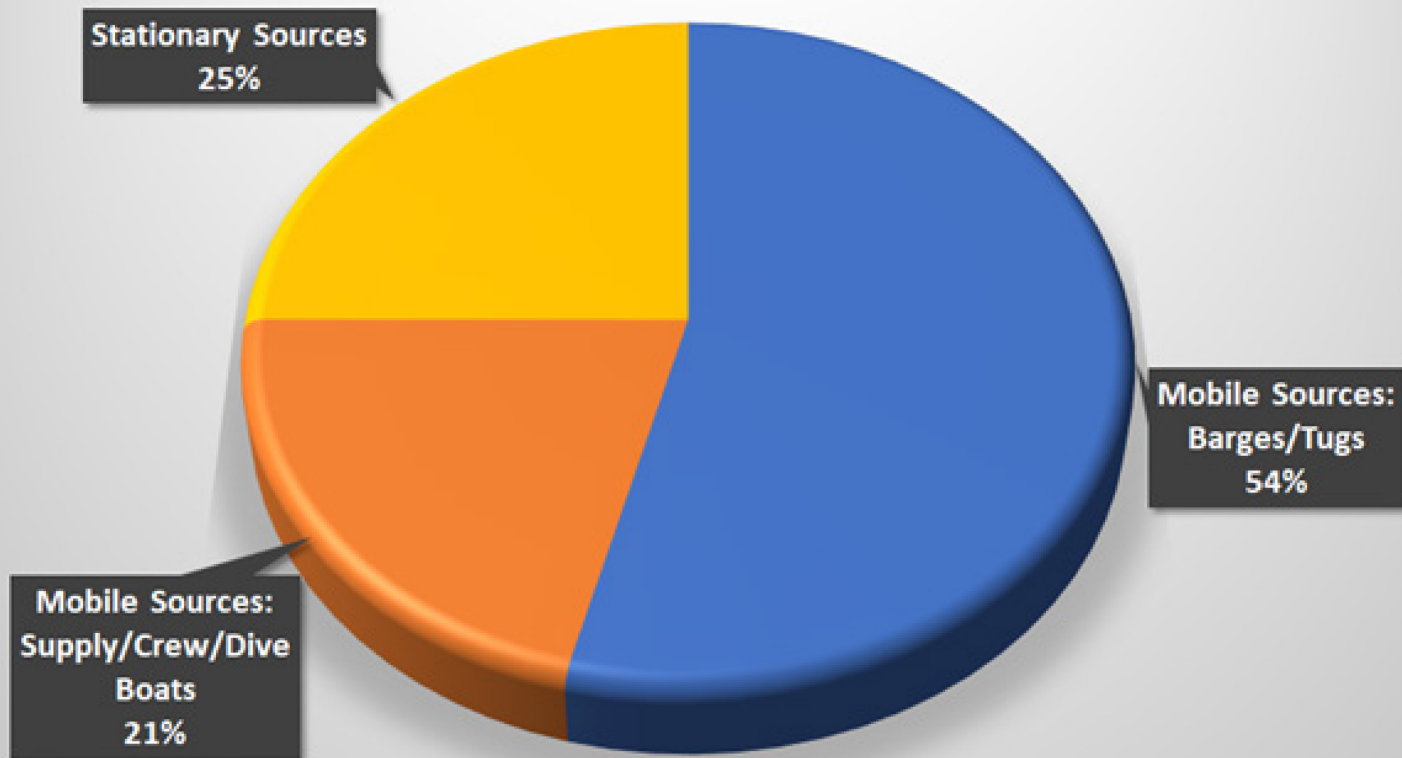
Emissions: NOx Percentage by Phase



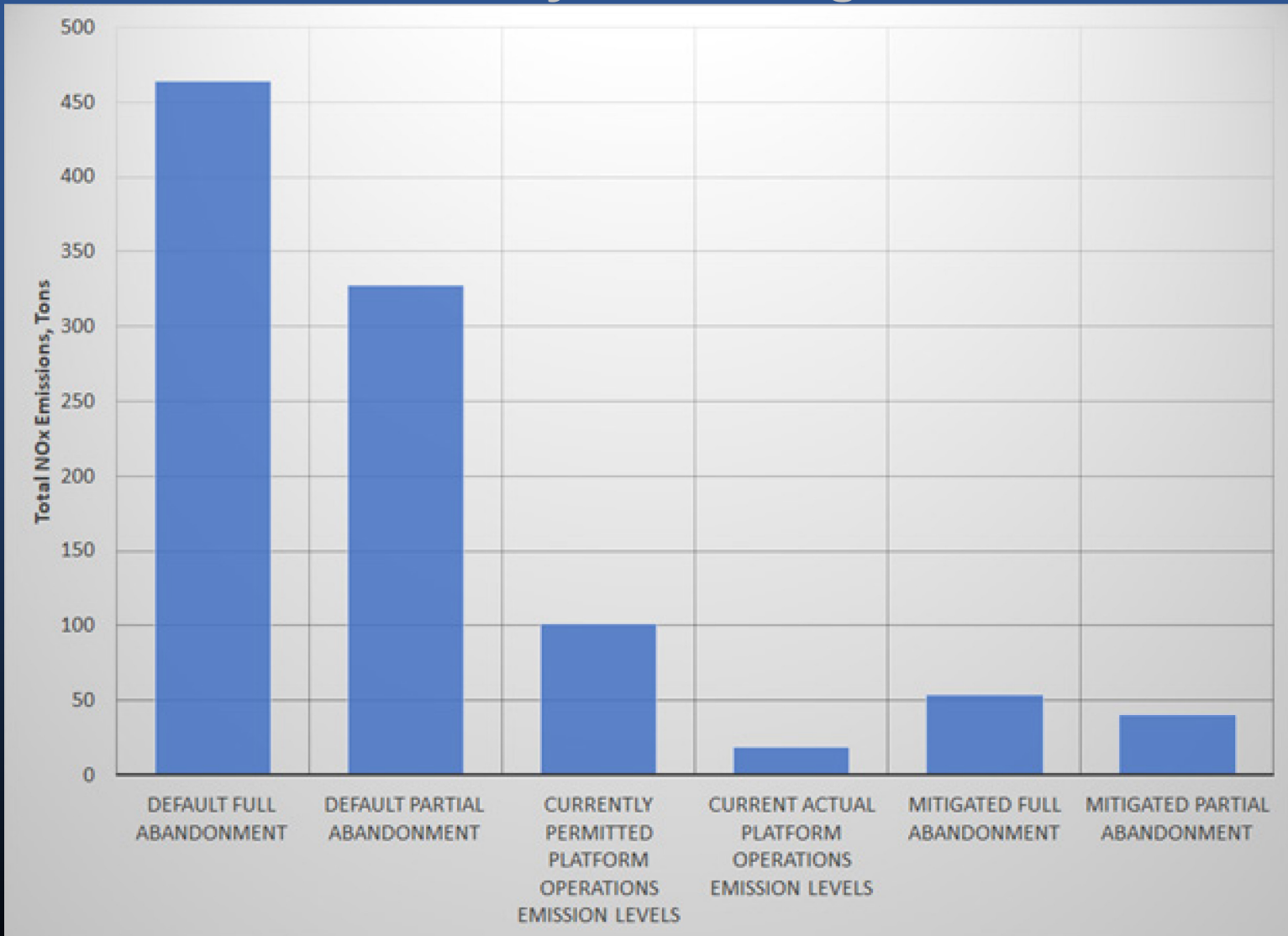
Emissions: NOx by Platform



Emissions: Average NOx Percentage by Equipment



Emissions: Summary for Average Platform



Conclusions

- Total emissions over 10,000 tons NO_x, reduced to 7,500 tons with partial jacket option
- Clean diesel reduces emissions to 1,200 tons for full removal and 900 tons for partial jacket removal
- The Santa Ynez Unit produces about 30% of all emissions
- Shallow water Platforms are about 300 tons NO_x each, while deep water Platforms over 1,000 tons each

Conclusions

- Cleaner engines are feasible and available, or could be commissioned
- Partial removal provides substantial reductions for deep water Platforms
- With clean engines, emissions would be below current operational permitted levels and for some Platforms, below the current operational emissions
- Additional mitigation strategies (vessel speed reduction) could allow for additional reductions
- A net air quality benefit to the region could be realized through the removal of these ongoing emissions sources