CALIFORNIA COASTAL COMMISSION
45 FREMONT, SUITE 2000
SAN FRANCISCO, CA 94105-2219
VOICE AND TDD (415) 904-5200
FAX (415) 904-5400

Click here
to see
the April 11, 2007
addendum to this report.

Th7a

STAFF REPORT AND RECOMMENDATION
CONSISTENCY CERTIFICATION

Consistency Certification	**CC-079-06**
Staff:	Energy-SF
File Date:	February 20, 2007
3 Months:	May 20, 2007
6 Months:	August 20, 2007
Commission Hearing:	April 12, 2007

APPLICANT: BHP Billiton LNG International, Inc.

PROJECT LOCATION: Ormond Beach, state and federal waters out to 14 miles offshore Ventura and Los Angeles Counties.

PROJECT DESCRIPTION: Construction and operation of a liquefied natural gas (LNG) terminal (called "Cabrillo Port), consisting of an offshore floating storage and regasification unit (FSRU), subsea pipelines, and associated onshore facilities.

STAFF RECOMMENDATION: Objection (see Page 17 for Recommended Motion).

SUBSTANTIVE FILE DOCUMENTS: See Appendix A

Click here to go to the appendices.

Click here to go to the exhibits.

SUMMARY OF STAFF RECOMMENDATION

This report evaluates whether BHP Billiton's Liquefied Natural Gas (LNG) terminal proposed to be constructed and operated in federal waters offshore of Southern California is consistent with the enforceable policies of the California Coastal Management Program (CCMP). Coastal Commission staff reviewed the proposal to identify reasonably foreseeable project-related impacts to coastal resources and to determine mitigation measures necessary to address those impacts. Staff concludes that the project would result in numerous substantial impacts to coastal resources. Staff further concludes that although the proposal includes mitigation measures that would allow it to conform to most of the CCMP's enforceable policies, the proposal would not be fully consistent with policies related to air quality, would not be mitigated to the maximum extent feasible to address its impacts to air quality, including its expected greenhouse gas emissions, and that it would not be in the public welfare to approve such a project. Staff therefore recommends the Coastal Commission **object** to the applicant's certification that the proposal is consistent with the policies of the CCMP.

This summary briefly describes the proposed project, explains the regulatory aspects of this review, and describes the project's principal adverse impacts and mitigation measures. Complete descriptions are provided in the staff report.

Project Description

The applicant, BHP Billiton LNG International Inc. (BHP) proposes to construct and operate an LNG terminal, regasification facility, and pipeline system known as the "Cabrillo Port" project. The main component of the proposed project is a floating LNG terminal and regasification facility, known as a "Floating Storage and Regasification Unit" or FSRU. The FSRU would be located in federal waters about fourteen miles off the coast of Los Angeles and Ventura Counties, south of the City of Oxnard. The proposal also includes two subsea pipelines that would deliver natural gas from the FSRU to shore and an onshore pipeline that would deliver gas from the shore to the existing pipeline system used to distribute natural gas throughout Southern California.

LNG is essentially the same as natural gas used in homes and businesses, except that it is cooled to a temperature at which it becomes a liquid, about minus 259^{o} Fahrenheit. BHP anticipates that most of the LNG delivered to Cabrillo Port would be from one of its gas fields in Australia, which contains very low concentrations of carbon dioxide and is anticipated to meet California's natural gas quality standards without requiring additional treatment. If Cabrillo Port were to receive LNG from other sources, that gas would have to meet the same California standards.

The proposed FSRU would be about 971 feet long and 213 feet wide, and would rise to about 266 feet above the ocean surface. Its appearance would be similar to a large ship. It would be permanently anchored in place with anchor cables and pipeline risers but would be designed to “weathervane” around a pivot point to allow it to respond to wind and wave conditions. It would store up to about 9.6 million cubic feet of natural gas in three large, spherical tanks, known as Moss tanks, each with a diameter of about 184 feet, which would be located within the FSRU’s double-hulled outer structure.

BHP expects the facility to handle an average annual throughput of about 800 million cubic feet of natural gas per day[1], which would be delivered by up to 99 LNG carriers per year. The facility would use two types of carriers – the smaller of the two would hold about 4.8 million cubic feet of gas and the larger would hold about 7.4 million cubic feet. Each berthing, offloading, and de-berthing would take about 18 to 24 hours.

LNG offloaded from the carriers would be pumped to the Moss Tanks and then “regasified,” or warmed from its liquid state to its gaseous state. This process would use a closed-loop water heat exchange system to heat the LNG. Once regasified, the natural gas would be pumped to shore through two pipelines that would be installed on the seafloor until they are within about four thousand feet of the shoreline. At that point, the pipelines would go subsurface to a location near the Ormond Beach Generating Station, where they would connect to a new metering station and a new, single pipeline that would be routed underground for about 14 miles to connect with the existing Southern California Gas Company pipeline distribution system.

The FSRU as currently proposed includes a single berth on the starboard side for the carriers to offload LNG. Any future proposal to add a second berth would require an amendment to the MARAD license and would be subject to additional federal consistency review by the Commission. The facility is expected to have an operating life of about 40 years.

Regulatory Setting

The proposed project is subject to a number of state and federal laws and regulations, including the federal Deepwater Port Act, which establishes a licensing system for facilities such as this that are used to transport, store, or otherwise handle oil and natural gas and are located more than three miles from shore. The Act requires these facilities to obtain a license from the federal Maritime Administration (MARAD). MARAD cannot issue the required license unless the Governor of the affected state approves the proposed project and unless the state agency charged with administering the state’s federally approved program for managing coastal resources determines that the proposal is consistent with the enforceable policies of that program.

[1] 800 million cubic feet is about 10% of California’s daily average natural gas use.

In California, the Coastal Commission administers the CCMP, and the Commission is therefore responsible for determining whether the proposed project is consistent with the CCMP's enforceable policies. Those policies, as approved by the National Oceanic and Atmospheric Administration (NOAA) pursuant to the provisions of the federal Coastal Zone Management Act (CZMA), include the coastal resource protection and use policies of Chapter 3 of California's Coastal Act and include any state or local regulations established to meet requirements of both the federal Clean Air Act and Clean Water Act.

To determine whether a proposed project would be consistent with these policies, the Coastal Commission reviews a certification submitted by an applicant that describes how the proposal would conform to applicable policies and describes the mitigation and monitoring measures necessary to achieve such conformity that would be included as part of the proposed project. The Commission may concur in or object to the applicant's certification that the proposed project is consistent with the CCMP, or may conditionally concur in it by identifying additional mitigation measures that would need to be included for the proposal to be fully consistent with the CCMP.

This staff report only evaluates the proposed project's conformity to the CCMP, and the scope of the Commission's review in this report covers activities in federal waters, state waters, and onshore within the coastal zone.[2]

Summary of Key Project Impacts and Mitigation Measures

As a hazardous industrial facility, the proposed Cabrillo Port project would result in significant adverse impacts to coastal resources. The principal significant project-related impacts include:

- Emissions of air pollutants in excess of federal and local thresholds established to protect public health and welfare.
- Emissions of greenhouse gases at levels that would result in adverse effects to coastal resources in the form of sea level rise, ocean warming, increased erosion, habitat displacement, and others.
- Underwater noise at levels that would affect marine mammals.
- Use of vessels and equipment that would create a risk to marine mammals due to entanglement and vessel strikes.
- Use of about three billion gallons of seawater per year, which would entrain fish eggs, larvae, and other planktonic organisms.
- Use of lighting at levels that can reasonably be expected to affect seabirds.

[2] The proposed project will also require a coastal development permit from the City of Oxnard for onshore portions of the project within the City's coastal zone, pursuant to the City's certified Local Coastal Program. Any decision by the City regarding a coastal development permit would be appealable to the Coastal Commission. The proposal would also require a coastal development permit from the Coastal Commission for those portions of the project within state waters.

- o Placing pipelines and permanent anchors on the seafloor that would disturb benthic habitat.
- o Discharges from the FSRU of liquid wastes that could adversely affect water quality.
- o Health and safety risks associated with storing and transporting natural gas.
- o Construction activities in or near habitat used by sensitive species.
- o Loss of commercial fishing grounds, potential for fishing gear entanglement, and interference with commercial fishing activities in port.
- o Potential spills or releases of natural gas, fuel, other petroleum products, and other hazardous substances.
- o Locating the FSRU and pipelines in areas subject to seismic hazards, including ground shaking, fault rupture, liquefaction, failure of subsea slopes, and tsunamis.
- o Creating visual impairment due to the facility’s location and lighting affecting views along several miles of the California coast.

To minimize or avoid these impacts, BHP has agreed to comply with the mitigation measures identified in the EIS/EIR as well as a number of additional mitigation measures, including:

- o Constructing the project outside of the gray whale migration season.
- o Establishing a 1000-foot safety zone around construction activities and directing activities to stop if marine mammals or sea turtles enter the zone.
- o Using marine mammal monitors on construction and operation vessels.
- o Maintaining high flight altitudes for helicopters.
- o Preparing a monitoring plan to measure facility-related noise and to determine its effects on marine mammals.
- o Providing $5.4 million to fund artificial reef habitat creation for the project’s anticipated entrainment impacts, conducting an entrainment study to determine actual impacts, and providing additional artificial reef funding if deemed necessary by the study results.
- o Providing $300,000 to augment existing seabird habitat restoration and population enhancement on the Channel Islands and $100,000 to fund monitoring of the project’s effects on seabirds.
- o Developing a lighting plan to minimize adverse effects on seabirds while maintaining levels needed for safety and security.
- o Eliminating safety risks to populated areas by locating the FSRU about 14 miles from the shoreline and reducing safety risks by implementing pipeline hazard reduction plans.
- o Adhering to waste discharge limits in the project’s NPDES permit.
- o Adhering to international standards for ballast water exchange.
- o Conducting onshore construction activities outside of nesting seasons and using methods to minimize the construction footprint.

Commission staff recommends that the Commission find that the proposal as mitigated is consistent with CCMP policies related to marine resources, water quality, hazardous development siting, terrestrial biology, commercial fishing, public access and recreation, and cultural resources. Commission staff also recommends that the Commission find that the proposal is not consistent with federal Clean Air Act requirements, and thus with CCMP policies related to air quality, as well as with CCMP policies regarding spill prevention and response, geology, and visual resources, even with implementation of mitigation measures.

The project as proposed would result in emissions of air pollutants above thresholds established by the air quality regulations of the local Ventura County Air Pollution Control District, which are promulgated pursuant to Clean Air Act requirements. Key pollutants of concern are nitrogen oxides (NO_x) and reactive organic compounds (ROCs), which are precursors to ozone. Ozone (O_3) is one of the seven criteria pollutants regulated under the federal Clean Air Act. The Cabrillo Port emissions would be at levels requiring BHP to use "Best Available Control Technology" (BACT) and to obtain offsets for those emissions. Additionally, the proposed project, including its associated supply change and end users, would result in emissions of several million tons annually of greenhouse gases, primarily carbon dioxide (CO_2). The contribution of these emissions to global warming would result in numerous adverse effects to coastal resources due to sea level rise, ocean warming, and ocean acidification, which lead to secondary effects such as loss of habitat and species, increased coastal erosion, adverse economic effects to California's ports and fisheries, and other serious impacts to the California coast.

Applying the Coastal Act's "Override" Policy for Coastal-Dependent Industrial Facilities

Because the proposed Cabrillo Port project is a coastal-dependent industrial facility, its inconsistencies with CCMP policies contained in Chapter 3 of the Coastal Act may be "overridden" pursuant to CCMP section 30260.[3] That policy allows the Commission to approve coastal-dependent industrial facilities that are not consistent with other CCMP policies contained in Chapter 3 if the proposal meets three tests. Those tests require: (1) that there be no feasible and less environmentally damaging locations for the proposed project; (2) that the project's impacts be mitigated to the maximum extent feasible; and, (3) that objection to the proposed project would adversely affect the public welfare.

---

[3] CCMP section 30101 defines a "coastal-dependent development or use" as "any development or use which requires a site on, or adjacent to, the sea to be able to function at all."

CCMP section 30260 states: "Coastal-dependent industrial facilities shall be encouraged to locate or expand within existing sites and shall be permitted reasonable long-term growth where consistent with this division. However, where new or expanded coastal-dependent industrial facilities cannot feasibly be accommodated consistent with other policies of this division, they may nonetheless be permitted in accordance with this section and sections 30261 and 30262 if (1) alternative locations are infeasible or more environmentally damaging; (2) to do otherwise would adversely affect the public welfare; and (3) adverse environmental effects are mitigated to the maximum extent feasible."

In applying these tests to the proposed project, Commission staff recommends the Commission find the following:

- There are no feasible and less environmentally damaging alternative locations for the proposed project.

- The proposed project is mitigated to the maximum extent feasible for its adverse effects on spill prevention and response, geology, and visual resources, but is <u>not</u> mitigated to the maximum extent feasible for its impacts to air quality. As noted above, the project as proposed would result in emissions of air pollutants above levels at which BACT is required and for which offsets must be obtained. BHP has not yet committed to use BACT, has not obtained the necessary offsets, and has not shown that it would be infeasible to meet these requirements. Regarding greenhouse gas emissions, although BHP has offered mitigation to address some of these emissions, the Commission has identified additional feasible measures that would result in further reductions, but BHP has not yet committed to these additional measures. Therefore, the proposal is not mitigated to the maximum extent feasible, as required by this second test.

- Objection to the proposed project would not adversely affect the public welfare for two main reasons. First, the project's above-mentioned non-conformity to air quality requirements, which would result in levels of pollutants in excess of those established to protect public health and welfare, outweigh the benefits associated with the additional source of natural gas fuel that the project would provide. Further, the project's global warming-inducing greenhouse gas emissions and the resulting adverse effects to a wide range of coastal resources also outweigh the project's public benefits. Staff therefore recommends that the Commission find that, on balance, the proposed project is not in the public welfare and therefore does not meet the third test of section 30260.

Conformity to CCMP Policies Not Subject to the "Override"

As noted above, the three tests of section 30260 of the Coastal Act apply only to the proposed project's nonconformity to CCMP policies contained in Chapter 3 of the Coastal Act. The project's nonconformity to Clean Air Act requirements incorporated into the CCMP by section 307(f) of the Coastal Zone Management Act (16 USC § 1456(f)) cannot be overridden through application of section 30260. Therefore, even if the Commission were to find that the proposed project met all three tests of section 30260, the proposal would still not satisfy the Clean Air Act requirements incorporated into the CCMP by CZMA section 307(f) and would therefore still not be consistent with the enforceable policies of the CCMP.

Conclusion

For the reasons expressed above, Commission staff recommends that the Commission **object** to BHP's consistency certification for the proposed Cabrillo Port project.

TABLE OF CONTENTS

APPENDICES

Click here to see the appendices.

Click here to see the exhibits.

1 REGULATORY BACKGROUND

1.1 Regulatory Setting

On September 3, 2003, BHP Billiton LNG International Inc. (BHP" or "the applicant) submitted to the federal Maritime Administration (MARAD) an application for a license under the Deepwater Port Act of 1974, as amended, to construct and operate a liquefied natural gas (LNG) receiving terminal (or port) and regasification facility approximately 14 miles off the coast of Ventura and Los Angeles counties.

The Deepwater Port Act establishes a licensing system for ownership, construction, and operation of deepwater port oil and natural gas facilities (33 USC §1501(a)(5)). Federal law (33 USC §1502(9) *et seq*.) defines a deepwater port as:

> *…[A]ny fixed or floating manmade structures other than a vessel, or any group of structures, located [three or more nautical miles from shore]… and which are used or intended for use as a port or terminal for the transportation, storage, and further handling of oil for transportation to any State…*

Under the Act, the Secretary of the US Department of Transportation has the authority to issue a license for a deepwater port facility. The Secretary has delegated the processing of deepwater port applications to the US Coast Guard and MARAD. The Coast Guard is taking the lead to prepare jointly with the California State Lands Commission a combined environmental impact statement and environmental impact report (EIS/EIR) for the proposed Cabrillo Port, and MARAD will decide whether to issue the requested license.

MARAD may not issue a license unless the Governor of the adjacent coastal state has given his or her approval. 33 USC §1503(c)(8). Should the Governor notify MARAD that the Deepwater Port Act application is inconsistent with California programs related to environmental protection, land and water use, and/or coastal zone management, but is otherwise acceptable, MARAD must impose conditions on the license, proposed by the Governor, to make it consistent with California's environmental protection programs.

A port must meet all federal and State regulatory requirements, and is required to obtain air and water discharge permits from the US Environmental Protection Agency (EPA). MARAD may not issue a license if the Administrator of EPA states that the port will not conform to all applicable provisions of the Clean Air Act, the Federal Water Pollution Control Act (Clean Water Act), the Marine Protection, Research and Sanctuaries Act, or any applicable State permits. In addition, MARAD may not issue a license if the Coastal Commission determines that the project would not be carried out consistent with the enforceable policies of California's Coastal Management Program unless an objection by the Coastal Commission is overturned by the Secretary of Commerce on appeal (see Section 1.2, "Coastal Commission Authority," below).

1.2 Coastal Commission Authority

Section 307(c)(3) of the Coastal Zone Management Act (16 USC §1456(c)(3)(A)), provides that no federal agency can issue a license for a project within or affecting California's coastal zone unless the California Coastal Commission concurs with the applicant's certification of federal consistency. The standard of review for federal consistency is the enforceable policies of the California Coastal Management Plan, of which the substantive policy component is the Chapter 3 coastal resource protection and use policies of the Coastal Act. On October 6, 2006, the Coastal Commission received from BHP a consistency certification for this project. The Commission must decide whether to concur with or object to the consistency certification.

In addition to federal consistency review, BHP must also obtain from the Coastal Commission a coastal development permit to authorize project-related activities located within State waters. To approve the coastal development permit, the Coastal Commission must find that the project would be constructed and operated in a manner consistent with the coastal resource protection and use policies of Chapter 3 of the Coastal Act. To date, BHP has not submitted a coastal development permit application.

Onshore project-related components (*e.g.*, pipelines and a metering station) located within the coastal zone will require a separate coastal development permit from the City of Oxnard under its certified Local Coastal Program. That coastal permit decision may be appealed to the Coastal Commission.

This report evaluates BHP's certification of federal consistency and covers project-related effects in federal and State waters and onshore within the coastal zone.[4]

[4] "…The proponent of a federal action shall consider whether the federal action and all its associated facilities affect any coastal use or resources and, if so, whether these interrelated activities satisfy the requirements of the applicable Subpart (Subparts C, D, E, F or I)." And: "The term 'associated facility' means all proposed facilities which are specifically designed, located, constructed, operated, adapted, or otherwise used, in full or in major part, to meet the needs of a federal action (*e.g.*, activity, development project, license, permit, or assistance), and without which the federal action, as proposed, could not be conducted…" 15 CFR 930.11(d)

2 PROJECT DESCRIPTION

BHP proposes to construct and operate a liquefied natural gas (LNG) receiving terminal (i.e., port) and regasification facility in federal waters approximately 14 miles south of the Ormond Beach Generating Station in Oxnard, California. BHP calls the project Cabrillo Port.

LNG is essentially no different from the natural gas used in homes and businesses everyday, except that it has been refrigerated to minus 259 degrees Fahrenheit at which point it becomes a clear, colorless and odorless liquid. As a liquid, natural gas occupies only one six-hundredth of its gaseous volume and can be transported long distances between continents in special tankers. LNG is a hazardous material due to its cryogenic temperature and dispersion and flammability characteristics. The safety concerns raised by LNG are addressed more fully in Section 5.3 (Siting Hazardous Development) of this report.

Main Project Components

Within the scope of this federal consistency review, Cabrillo Port would consist of three main components: 1) an offshore Floating Storage and Regasification Unit (FSRU) to receive and regasify imported LNG, 2) two pipelines to transport natural gas from the FSRU to shore, and 3) associated onshore components (e.g., pipelines and a metering station) to deliver the facility's natural gas to the natural gas distribution system owned and operated by Southern California Gas Company (SoCalGas).

BHP proposes to locate the FSRU 12.01 nautical miles, or 13.82 statute miles, south of the Ormond Beach Generating Station. From the FSRU, BHP proposes to install two 24-inch diameter natural gas pipelines in federal and State waters a length of 22.77 miles to the Ormond Beach Generating Station. From there, BHP would construct a new 36-inch diameter pipeline within the City of Oxnard and unincorporated areas of Ventura County where it would then connect with existing SoCalGas pipelines. The new proposed onshore pipeline is outside of the coastal zone. Exhibit PROJ-1 shows the proposed location of the FSRU in relation to a map of the general vicinity and shows the offshore pipeline route.

BHP anticipates importing LNG to Cabrillo Port from Western Australia's Scarborough offshore gas field, after a liquefaction facility and terminal are constructed. The field, located on the Exmouth Plateau about 174 miles off the Western Australia coast, reportedly contains about 8 trillion cubic feet of gas. The gas would consist of greater than 95% methane, contain very low carbon dioxide (0.34%) concentration, and is anticipated to meet California requirements for pipeline-quality gas with no additional treatment. However, if Cabrillo Port is ready to begin accepting LNG before gas from the Scarborough field is available, it intends to import natural gas that meets California requirements from other sources, such as Indonesia. In the event that an LNG carrier's cargo does not meet California specifications, the LNG carrier could not offload its LNG cargo in California.

The average daily output of the facility would be 800 million cubic feet per day (MMcfd) of natural gas. The maximum daily rate is 1.2 billion cubic feet per day.

Details of BHP's Cabrillo Port proposal are described in its October 6, 2006, consistency certification. Key elements of the project are described below.

The Floating Storage and Regasification Unit (FSRU)

The FSRU is a ship-shaped, double-hulled facility with three spherical storage tanks (see Exhibit PROJ-2) built specifically to transfer, store, and regasify LNG. The FSRU is a massive structure, larger than the Queen Mary II. It would measure approximately 971 feet long, not including the mooring turret, and 213 feet wide, and would displace approximately 190,000 deadweight tons. The freeboard (the distance from the waterline to the deck) would be approximately 59 feet while loaded with LNG, and approximately 62 feet when the FSRU is ballasted, i.e., when the ballast tanks are completely full. The tops of the LNG storage tanks would be approximately 102 feet above the main deck, placing them approximately 161 feet above the waterline when loaded, and 164 feet when ballasted. The cold stack height would be approximately 266 feet above the waterline, or 105 feet above the top of the LNG storage tanks. An artist's rendering of the FSRU and the berthing arrangement between the FSRU and an LNG carrier during offloading operations is shown in Exhibit PROJ-3. The FSRU's steel double hull will be designed with a bow and stern shape to minimize wave motion and provide a stable platform for operations.

The FSRU would attach to nine anchor cables and eight gas risers at its pivot point on the bow (see Exhibit PROJ-3). A turret-style mooring point at the bow allows the FSRU to weathervane, or rotate 360°, depending on wind and wave conditions, assisted by the stern thrusters.

The FSRU would be equipped with stern thrusters at the aft, or back end, of the hull for heading control only – the FSRU would not contain engines or other propulsion systems. It would therefore not be able to get underway under its own power; however, it could use its positioning thrusters to maintain a controlled forward speed of a few knots in light weather conditions. Because the FSRU would be a passive, fully-weathervaning facility (i.e., it would naturally find a position of least resistance to the weather), it would only need to use its thrusters when the LNG carriers are berthing. BHP has estimated that the FSRU thrusters would operate full-time and at full power an average of about 11.5 hours per week.

The FSRU would store LNG in three Moss tanks. Each Moss tank is 184 feet in diameter and has an LNG storage capacity of 24 million gallons. The total LNG storage capacity on the FSRU is approximately 72 million gallons, or 9.6 million cubic feet (MMcf).

The regasification facilities include up to six LNG centrifugal booster pumps and eight submerged combustion vaporizers (SCV). Onboard electric power generation equipment consists of four dual-fuel (natural gas and diesel fuel) generators, each with a power output of 8,250 kilowatts at 6.6 kilovolts. These generators would normally operate using natural gas (boil-off gas from the Moss tanks and/or the natural gas that has been regasified on the

FSRU). In addition, one emergency backup generator using diesel fuel would be onboard for emergency use only. The dual-fuel generators would operate using diesel fuel only under the following conditions: 1) for emergency fuel if both sources of natural gas are lost; 2) for monthly tests of the emergency generator and firefighting water pumps, and occasional tests of the dual-fuel generator; 3) during emergency training drills; and 4) during start-up activities before the first delivery of LNG (approximately 60 days).

BHP has designed the generators and SCVs to use a closed-loop tempered water heat exchange system. Water would be used in the SCVs to regasify the LNG. This water would be cooled as heat is transferred from the water to regasify the LNG. The now-cold water from the SCVs would be routed to the engine room, where it would be used to cool the generators. The generators would heat the water as the generators are cooled, and the now-warm water would be routed back to the SCVs, where it would be used to heat and regasify the LNG. This closed-loop tempered water system would, during normal operations, avoid the need for a once-through cooling system for the generators. A small amount of make-up water would be required each year, and would be obtained from the submerged combustion vaporizers. Each generator would also have a backup seawater cooling system that would be used during upset conditions when the SCVs are not operating.

Operations aboard the FSRU, including regasification, would occur 24 hours per day, 7 days per week. Berthing of LNG carriers next to the FSRU would only occur during daylight hours; however, the transfer of LNG from the carriers to the FSRU would occur at night.

Cabrillo Port Berth and Carriers

BHP's consistency certification calls for a single berth located on the starboard side of the FSRU. BHP's Deepwater Port Act license application includes an option to install at a later date a second berth on the port side. The second berth, if added, would provide operational flexibility under unusual conditions and would never be used simultaneously with the starboard berth because no more than one LNG carrier at a time would unload. At this time, MARAD is considering a single berth only. If, in the future, BHP wants to add a second berth, it would require an amendment to the license and further federal consistency review by the Coastal Commission.

To receive the LNG from a carrier, the FSRU would be equipped with on-deck loading arms, piping, and emergency shutdown systems to allow safe transfer of LNG from the LNG carrier to the FSRU. These emergency systems would release the LNG carrier if wave heights greater than specified operational limitations are encountered, even if timely weather warnings are not received (such as during a quickly developing squall). When activated, the emergency quick-release actions would take less than one minute to complete.

BHP proposes to use LNG carriers with a capacity of either 138,000 m^3 (4.8 MMcf of LNG) or 210,000 m^3 (7.4 MMcf of LNG). The FSRU would receive 99 of the smaller carriers per year, or 66 of the larger carriers per year. Based on an average daily throughput of 800 MMcfd of natural gas, this equates to an average of 1.25 to 1.91 shipments per week, depending on the size of the carrier, weather permitting, and given standard operating procedure restrictions of significant wave heights of 9.2 feet. The maximum number of carriers received at the FSRU in any weekly period could be two of the larger carriers or three of the smaller carriers; however, there would never be more than 99 carriers annually.

Berthing, unloading, and de-berthing would take 18 to 24 hours. Loaded LNG carriers would not anchor under any circumstance, nor would they be any closer to the mainland than adjacent to the FSRU.

The inbound and outbound routes of the LNG carriers, decided upon by the U.S. Coast Guard (USCG) and the U.S. Navy in consultation with BHP, are shown in Exhibit PROJ-4. These routes were chosen because they are away from areas used by most other vessel traffic, and because they would avoid the inshore traffic lanes.

The FSRU would be supported by two tug/supply vessels and a crewboat. BHP estimates that once per week, one of the tug/supply vessels would make the round-trip transit between the FSRU and Port Hueneme, resulting in approximately 52 round-trips per year. These trips would be made during daylight hours. The FSRU would have an operations crew of about 30 persons, rotated every seven days and transferred by crewboat from Port Hueneme. The small, fast crewboat would be based in Port Hueneme and would make approximately two round trips to the FSRU for each visiting LNG carrier. While the tug/supply vessels are assisting the carriers with berthing and deberthing activities, the crewboat would patrol the safety zone around the FSRU.

Offshore Pipelines

BHP proposes to lay the two 22.77 mile long pipelines on the seafloor approximately 100 feet apart, in waters from 2,900 feet to 42 feet in depth. The proposed pipeline route is depicted in Exhibit PROJ-1. The pipelines are made of carbon steel and coated on the outside with an anti-corrosion coating. In addition, sections of the pipeline would be concrete-coated, as necessary, to prevent waves from moving the pipeline. Aluminum anode rings (called "bracelets) would be attached at regular spacing along the pipeline to provide cathodic corrosion protection. At regular spacing, BHP would attach to the pipelines stiffening ring elements (called "buckle arrestors) to prevent the pipeline from collapsing under hydrostatic water pressure.

The near-shore segments of the pipelines would be buried under the surf zone and beach using horizontal directional boring (HDB). Two parallel bores, one for each pipeline, would be drilled approximately 4,265 feel long and 100 feet apart. The two bores would be drilled from a site within the Ormond Beach Generating Station and exit approximately 3,000 feet offshore at a water depth of approximately 42 feet.

Onshore Facilities within the Coastal Zone

Within the coastal zone at the Ormond Beach Generating Station would be a staging area, entry points for HDB pipeline installation activities, and construction of a new metering station. In addition, about 0.4 miles of a new 36-inch diameter natural gas pipeline would be installed in the coastal zone, in part within the boundary of the Ormond Beach Generating Station and in part adjacent to agricultural land. This section of the pipeline would be trenched and buried six-feet below ground. Slick bore technology would be used to go 90 feet under the Magu Lagoon Canal at the inland boundary of the Ormond Beach Generating Station. The 36-inch pipeline would then continue below ground outside the coastal zone for over 14 miles until it connects with an existing SoCalGas pipeline distribution system.

A temporary staging area measuring approximately 250 feet by 325 feet, or 1.9 acres, is required for equipment, supplies, parking, etc. At the entry point for each of the two offshore pipelines, a sloped HDB launching pit, measuring approximately 22 feet by 103 feet and 20 feet below grade at the deep end, would be excavated to align the drill rig with the entry angle of the borehole. The metering station consists of 3.5-foot tall aboveground valve actuators, eight-foot tall blow-down stacks, a small instrument building approximately nine feet tall, pig launchers and receivers, a gas odorant injection station, and concrete pads and foundation.

Construction and Installation

HDB activities require 108 days to complete. Offshore pipeline construction would take 35 days. Mooring of the FSRU would take about 20 days. Construction activities and their estimated time duration are shown in Table 2.2-1 below.

Port Decommissioning

The Deepwater Port license would have no expiration date, but BHP's projected in-service life for Cabrillo Port is a maximum of 40 years. MARAD's license for Cabrillo Port would require BHP to post a bond or other financial guarantee for the decommissioning of the facility. BHP has estimated the cost to decommission Cabrillo Port to be $31,500,000. MARAD will evaluate BHP's estimate and determine its acceptability. BHP's decommissioning cost is based on the following assumptions:

- All surface and subsea facilities would be removed from the vicinity of the FSRU. This includes the FSRU, moorings, riser systems, seabed anchors and seabed manifold system.
- Pipelines would be abandoned in place.

Within 90 days of termination or revocation of the lease, MARAD requires a licensee to submit a decommissioning plan. MARAD then reviews the decommissioning plan to determine compliance with regulations applicable at the time of proposed facility decommissioning. The review would include consideration of the potential environmental impacts of decommissioning (review under the National Environmental Policy Act). Also, the decommissioning plan will be reviewed for consistency with the enforceable policies of California's Coastal Management Program. Once a decommissioning plan is approved by MARAD, the licensee must complete removal of the facility within two years of approval of the decommissioning plan.

Table 2.2-1: Construction Vessels and Equipment

Vessel/Equipment	Use	Duration
FSRU Mooring		
2 tug supply vessels	Logistical support	20 days; 24 hrs/day standby each
1 crew boat	Transport of work crews	20 days; 2 hrs/day cruising, 14 hrs/day standby
1 construction barge	Installation of mooring system, PLET, and PLEM	20 days; 12 hrs/day operating, 12 hrs/day standby
1 tug	Barge positioning	20 days; 2 hrs/day assisting, 22 hrs/day standby
1 oceangoing tug	Logistical support	1 day; 2 hrs assisting, 22 hrs standby
Shore Crossing		
1 HDB pipelay barge	Fabrication and installation of HDB pipeline sections	60 days
1 exit borehole barge	Construction of transition trench	35 days
2 anchor-handling tow/supply vessels	Pipeline barge positioning, navigation during mooring	35 days
4 materials barges	Transport pipes and supplies	60 days
Offshore Pipelay Construction		
1 dynamically positioned pipelay vessel	Pipelaying	35 days; 12 hrs/day operating, 12 hrs/day standby
2 tug supply vessels	Logistical support	35 days; 24 hrs/day standby each
1 crew boat	Transport of work crews	35 days; 2 hrs/day cruising, 14 hrs/day standby
1 tug and pipe barge	Pipe handling	10 days; 4 hrs/day cruising, 12 hrs/day standby
1 dock crane	Pipe handling and loading	8 hrs total

2 APPLICANT'S CONSISTENCY CERTIFICATION

On October 6, 2006, the Coastal Commission received the applicant's *Coastal Consistency Certification, Deepwater Port Act License Application* (dated October 4, 2006). In it the applicant certifies that the proposed project complies with the enforceable policies of California's approved coastal zone management program, and will be conducted in a manner consistent with that program. Coastal Commission staff deemed the consistency certification complete on February 20, 2007.

3 STAFF RECOMMENDATION

3.1 Consistency Certification Motion

Staff recommends objection to the consistency certification.

Motion**:**

> *I move that the Commission* ***concur*** *with BHP Billiton LNG International, Inc.'s consistency certification CC-079-06, that the project described therein is consistent with the enforceable policies of the California Coastal Management Program.*

Staff Recommendation:

Staff recommends a **NO** vote on the motion. Failure of this motion will result in an objection to the certification and adoption of the following resolution and findings. An affirmative vote of a majority of the Commissioners present is required to pass the motion.

3.2 Consistency Certification Resolution

Resolution to Concur with Consistency Certification:

> *The Commission hereby* ***objects*** *to the consistency certification by BHP Billiton LNG International, Inc. on the grounds that the project described therein is not consistent with the enforceable policies of the California Coastal Management Program.*

4 FINDINGS AND DECLARATIONS

The Commission finds and declares as follows:

4.1 Marine Resources and Water Quality

CCMP § 30230 states:

> *Marine resources shall be maintained, enhanced, and where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance. Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes.*

CCMP § 30231 states:

> *The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means, minimizing adverse effects of waste water discharges and entrainment, controlling runoff, preventing depletion of ground water supplies and substantial interference with surface water flow, encouraging waste water reclamation, maintaining natural vegetation buffer areas that protect riparian habitats, and minimizing alteration of natural streams.*

CCMP § 30250 requires, in part, that new industrial development:

> *…be located within, contiguous with, or in close proximity to, existing developed areas able to accommodate it or, where such areas are not able to accommodate it… where it will not have significant adverse effects, either individually or cumulatively, on coastal resources.*

Sensitive Marine Resources of the Project Area

The Cabrillo Port project site is located in the area offshore Santa Barbara, Ventura and Los Angeles counties known as the Southern California Bight (SCB), one of the most complex, diverse and productive marine environments along the west coast of the United States. This area is marked by the confluence of two of the principal oceanic currents that transit the southern California coastline, the cold, southern-flowing California Current and the warm, northern-flowing Southern California Countercurrent. The passage and convergence of these two distinct currents within the northern portion of the SCB has enabled both cold and warm water species of marine plants, fish, plankton, birds and mammals to inhabit and proliferate in this unique location. Understanding of the significance and value of this area's marine resources inspired the National Oceanic and Atmospheric Administration's 1980 designation of the Channel Islands National Marine Sanctuary here and has led to its international recognition as a hotspot for scientific research, marine mammal and bird watching and recreational and commercial diving and fishing. The SCB's oceanographic and physical features support a great diversity of marine species, many of which are extremely rare and afforded special protection by federal and State law. A detailed description of this area's marine plant and animal communities is provided in Exhibit MAR-1 but briefly stated, the SCB is home to 41 marine mammal species, 195 seabird species, approximately 481 fish species, four species of sea turtles, over 5,000 species of marine invertebrates, a wide variety of planktonic and larval organisms and over two thirds of the 673 species of marine plants known to occur in California waters (including giant kelp). Among this highly diverse assemblage of species, there are numerous species recognized federally and/or by the State of California as endangered or threatened. These special status species include six seabirds: the California brown pelican (State and federal endangered), Xantus's murrelet (State threatened, federal candidate), marbled murrelet (State and federal threatened), California least tern (federal endangered), and western snowy plover (federal threatened). Also found within the project area are 42 species of marine mammals including federal endangered or threatened species such as the sei whale, fin whale, humpback whale, blue whale, North Pacific right whale, sperm whale, stellar sea lion, Guadalupe fur seal, and southern sea otter. All other marine mammal species such as the gray whale, bottlenose dolphin, harbor porpoise, California sea lion, harbor seal, and Northern elephant seal are afforded protection under the Marine Mammal Protection Act of 1972. In addition, federal threatened or endangered sea turtle species that may be found within the project area include the loggerhead, leatherback, green and olive ridley. As proposed, the Cabrillo Port project has the potential to result in a variety of impacts on both the marine biological resources and water quality of the project site and the larger Southern California Bight area.

Potential Marine Resource Impacts

Potential marine resource impacts will be discussed in detail below and include the following: (1) entrainment of planktonic and larval organisms due to the project's proposed use of seawater; (2) impingement of marine life on the intake screens used on the FSRU and LNG carrier vessels; (3) disturbance to nocturnal seabirds within the project area due to the FSRU's safety, operational, and construction lighting requirements; (4) disturbance and injury of marine mammals due to underwater noise associated with construction and operational activities; (5) disturbance and loss of benthic organisms and habitat due to the placement and installation of the FSRU's mooring system, the excavation of HDB exit pits on the seafloor, and the installation and placement of the two 24-inch diameter natural gas pipelines and their associated protective devices; (6) FSRU tankers and support vessel collisions with marine mammals and sea turtles; (7) disturbance and entanglement of migratory whales during pipeline installation; and (8) destruction of marine habitat and mortality to marine life associated with accidental interactions with unexploded ordnance during pipeline construction and installation.

4.1.1 Entrainment

Introduction and Background

The proposed project would result in the intake and use of approximately three billion gallons of seawater per year.[5] The FSRU would require about 1.4 billion gallons per year for ballast and other purposes, and the LNG carrier vessels would use about 1.6 billion gallons per year for ballast and for their seawater cooling systems.

This use of seawater would cause the entrainment of significant numbers of embryonic, larval and adult planktonic marine organisms. Entrainment occurs when seawater and the planktonic organisms it supports are drawn in to a seawater intake system. Many of these systems cause 100% mortality to the entrained organisms due to their being subjected to changes in temperature, pressure, and light, and in some cases due to the introduction of chemicals or the mechanical effects caused by pumps or other equipment. Even if some organisms initially survive entrainment and are released back to the ocean, it is believed that they die relatively quickly due to their delayed reaction to these stressors. Some intake systems, including some ballast water systems on ships, often cause less than 100% mortality; however, there is significant variability in ballast water survival rates based on factors such as the length of time organisms are within the ballast water, whether the ships use pumps or gravity to load and offload ballast, the rate of predation within the ballast water, whether chemicals are introduced, and other factors.[6]

Along with the direct loss of these organisms, entrainment caused by these systems can also cause indirect impacts to the marine environment by altering the food web and removing part of the marine community's productivity. The loss of eggs and larvae due to entrainment can additionally result in losses of future adult members of a given population as well as ecosystem losses or changes that cause alterations in community structure and viability.

BHP has modified the project as it was originally proposed to reduce its seawater use and entrainment impacts from about 5.2 billion gallons per year to the currently anticipated three billion gallons per year. One significant change is the FSRU's proposed use of a closed loop cooling system rather than a once-through system, which would reduce the project's overall seawater use by about two billion gallons per year. BHP assessed the feasibility of further reducing the facility's seawater use and its entrainment rates; however, the measures

---

[5] Three billion gallons is roughly equivalent to the water contained within an area one mile square and fourteen feet deep, or about 9,202 acre-feet.

[6] The survival of organisms within ballast water has resulted in a separate set of environmental concerns due to the introduction of non-native, invasive, or exotic species in coastal waters throughout the world. To avoid the potential impacts associated with these species introductions, BHP has committed that before the initial arrival of the FSRU from its overseas fabrication port, it would follow established ballast water exchange protocols in accordance with the International Convention of the Prevention of Pollution from Ships (MARPOL) and State of California and USCG requirements, including notification and exchange of ballast water outside the 200 NM (230 miles or 371 km) Exclusive Economic Zone limit. Similarly, BHP has committed to have the LNG carriers serving the FSRU perform ballast water exchanges in accordance with those same regulations.

considered appear to be infeasible or would not result in an appreciable difference in entrainment impacts. They include recycling the ballast water used by storing it in submerged tanks, increasing the depth of the intakes so that seawater is drawn in from a lower water depth with lower concentrations of entrainable organisms, and others. Therefore, while the currently proposed project would include a substantial decrease in entrainment compared to the project as originally proposed, the current proposal would still result in the unavoidable use of about three billion gallons of seawater per year.

To address the proposed project's entrainment impacts, BHP has committed to implement three main mitigation measures, as summarized below (see Appendix B for a full description):

- BHP will conduct an entrainment study starting within 60 days of Cabrillo Port's startup. The entrainment study will follow protocols similar to the "state of the art" power plant studies as described below. BHP will also convene an independent Technical Advisory Committee to help develop and implement the study and to review the study results.

- At least one year prior to project startup (anticipated to be in 2010), BHP will provide $5.4 million to the California Department of Fish and Game "Compensatory Hard Bottom Mitigation Fund." These funds will be used to design, permit, construct, and monitor at least seven acres of artificial reef in the Southern California Bight. As described in the discussion below, this amount of reef is believed to provide 2:1 mitigation for the lost planktonic productivity caused by Cabrillo Port's anticipated entrainment impacts.

- If results of the entrainment study show that the seven acres of artificial reef is insufficient mitigation (as determined by Technical Advisory Committee), BHP will within 60 days of study completion provide to the "Compensatory Hard Bottom Mitigation Fund" any additional funds needed to design, permit, construct, and monitor the additional acreage of artificial reefs needed to provide at least 2:1 mitigation for those impacts. The additional funds required will be determined by the Executive Director of the Coastal Commission in consultation with the Department of Fish and Game.

In sum, BHP is proposing to first provide funding to mitigate for anticipated project impacts, then study the actual project impacts, and then provide additional mitigation if the study shows it to be necessary. The discussions below provide more details about the extent of the proposed project's likely entrainment impacts and the adequacy of BHP's proposed mitigation. They first describe the type of entrainment study needed, which BHP has proposed to conduct, then describe how the Commission is using existing data and several conservative assumptions to determine, prior to performance of the needed study, the proposed project's probable impacts, and finally describe the adequacy of BHP's proposed mitigation.

Determining Adverse Entrainment Effects and Necessary Mitigation

As noted above, entrainment occurs when small organisms such as fish eggs, larvae, and plankton are drawn into a seawater intake. The rate and severity of entrainment impacts are related primarily to the volume of seawater used and to the location of the intake relative to the habitat used by species subject to entrainment. For example, intakes located in highly productive areas – in or near estuaries, on the ocean surface, etc. – are likely to draw in seawater containing relatively high concentrations of organisms. Entrainment impacts can also vary based on when seawater is drawn into an intake – for example, adverse effects may be more severe during spawning periods or plankton blooms.

The marine environment has a high level of spatial and temporal variability due to seasonal, daily and hourly changes in wind patterns, current speeds, current directions, and sunlight levels, all of which affect the presence and density of entrained organisms. Because of this variability, determining the entrainment impacts of a particular facility generally requires a site-specific study. This type of study has been done recently at several of California's coastal power plants, with the most recent of these studies considered "state of the art" for determining entrainment impacts along California's shoreline. BHP has proposed to conduct such a study, as described below.

Identifying the scope and severity of this proposed project's adverse entrainment effects is a significant challenge for several reasons. First, BHP has not yet conducted the type of study generally used to determine the entrainment impacts caused by a seawater intake. These studies are best completed before the impacts associated with the intake start. Additionally, there are currently no site-specific data available that describe the numbers, types, and densities of organisms that would be subject to entrainment at the proposed project site. The nearest data are from a long-term sampling station about 14 miles from the project site, which was established as part of the California Cooperative Fisheries Investigation (CalCOFI) program, described in further detail below. These data are likely suitable for establishing an initial assessment of the proposed project's likely impacts but do not provide the level of certainty provided by a study particular to this specific site. Despite these difficulties, the Commission has evaluated the best available data to determine the proposed project's likely impacts and has made several conservative assumptions about those impacts to determine whether BHP's proposed mitigation is adequate and appropriate.

Conducting an Entrainment Study

Several studies have been done recently to determine the type and extent of entrainment impacts caused by coastal power plants in California and to suggest recommended mitigation for those impacts.[7] These power plants use from several hundred to over two billion gallons of seawater per day, and each of these recent studies showed that the particular coastal power plant being studied caused significant adverse entrainment impacts to local or regional coastal waters. In some cases, the entrainment impacts affected dozens or hundreds of acres of the ocean environment by removing some of the productivity of nearby marine habitats. BHP's

---

[7] In the past decade, entrainment studies have been completed at several California coastal power plants, including Diablo Canyon, Huntington Beach, Morro Bay, Moss Landing, and South Bay.

use of about 8.2 million gallons of seawater per day would be far less than that used by these coastal power plants, so although Cabrillo Port's entrainment effects are likely to be similar, the scale of its impacts is likely to be smaller.

Although the proposed facility would use water from a different environmental setting than the coastal power plants – i.e., open ocean water rather than nearshore or estuarine waters – the study methods and protocols used for the power plant studies appear to be suitable or adaptable for determining Cabrillo Port's entrainment impacts. We note that each of the coastal power plant studies used similar protocols and techniques even though the power plants were located in areas with different habitat types – e.g., nearshore sandy bottom, rocky reef, enclosed bay, etc. – which suggests that the standard study protocols can be adapted to the open ocean habitat that would be affected by Cabrillo Port. The studies all share a basic approach – to collect seawater samples from near the intake for at least one year; to then identify, count, and measure the organisms in those samples; and finally, to use three different modeling techniques to determine what impact the loss of these organisms has on the affected marine environment. The BHP study would include this same general approach, methodology, and set of protocols, which are described below in more detail, to confirm the anticipated level of Cabrillo Port's entrainment impacts described later in these findings. The study would also be used to determine whether BHP would need to provide additional mitigation if the proposed project's entrainment effects are greater than anticipated. Additionally, by conducting the study after the facility starts operations, its results would reflect the site conditions with the facility rather than without. Once the facility is in place, some site conditions would change and may alter the anticipated level of entrainment – for example, both the lighting and the presence of hard substrate at the facility may change the numbers or types of entrained organisms in the area.

The entrainment studies recently completed at coastal power plants and the study BHP would complete require collecting and compiling several sets of data about the types and numbers of organisms subject to entrainment. BHP's study would include use of the Empirical Transport Model (ETM), which requires collecting additional data to provide an estimate of the amount of habitat that would be needed to replace the productivity lost due to entrainment.[8] That estimate, known as the Area of Production Foregone, serves as the basis for identifying the extent of an intake's entrainment impacts and for helping determine mitigation that may be needed to address those impacts. The description below is a highly simplified version of the steps needed in an entrainment study to generate that estimate.

[8] The other two models used in entrainment studies, Fecundity Hindcasting (FH) and Adult Equivalent Loss (AEL) model, require life history information that is not available for most species subject to entrainment on the West Coast, so these models of limited use. They are, however, often used in association with the ETM to provide confirmation of the ETM results.

An entrainment study first requires determining the volume of water drawn in to an intake. It also requires conducting sampling to determine the concentration of entrainable organisms of various species in that water. This generally entails weekly or biweekly plankton sampling that occurs over the course of a year, with each sampling event being 24 hours long.[9] The plankton samples are taken using established and consistent protocols regarding the type of sampling equipment used, how organisms are counted and measured, etc. Rather than keep track of each type of species captured during these sampling events, most studies identify a set of key target species that serve as a representative sample of the entire sampled population.

The two figures above – the volume of water drawn in to the intake and the average concentration of entrainable organisms of each target species per unit of water – are used to determine the number of organisms from each species that would be lost to entrainment. For coastal power plants, the assumption is that entrainment results in 100% mortality of all entrained organisms. For example, if there is an average of 100 larvae of a particular species in each million gallons of water, a 50 million gallon per day intake would entrain just less than about two million of these larvae annually (5,000 larvae per day X 365 days = 1,825,000 larvae per year).

These totals are then used in the ETM to calculate the proportion of organisms of each target species lost to entrainment to the total of those organisms in the source water. This is known as "Proportional Mortality" or P_m, and is used to estimate the effect of that entrainment on the local or regional marine ecosystem. To determine P_m, the ETM requires two main types of information in addition to that described in the step above. First, the study needs to determine the source water area for each species – that is, the area of water from which entrainable organisms from a particular species are drawn to the intake. This is done by reviewing hydrographic data to determine the average current speed of the seawater moving past the intake. Additionally, the study must identify the size and age at which organisms of the target species are no longer subject to entrainment – that is, the size or age at which a particular species is able to move away from an intake and thus avoid being entrained. This age generally ranges from several days to several weeks. Once this age is known, the source water for each species is determined by multiplying the age by the average water speed. For example, if the average current speed past an intake is 0.3 miles per hour and a particular species is susceptible to entrainment during the first week of its life, the source water area extends 50.4 miles upcurrent (i.e., 0.3 mph X 24 hours X 7 days = 50.4 miles). To obtain the overall volume of water within the source water area, the source water length is combined with the depth and width of the source water from which larvae of a particular species might originate. For nearshore facilities, this is usually based on an average depth out to a specific distance from the shoreline. However, the source water area for many species does not include the entire distance, but is based on the amount of suitable habitat within that distance.

---

[9] In recognition of the high degree of variability in ocean conditions, sampling sometimes needs to be done for more than a year. BHP has committed to conduct an additional year of sampling if the Technical Advisory Committee determines the initial year of sampling is occurring during a recognized period of high variability, such as an El Nino Southern Oscillation (ENSO).

With rockfish species, for example, if only 20% of the source water area includes rocky habitat used by adult rockfish, the larvae are assumed to come from only 20% of the area within the entire length of the source water and the source water areas for those species are adjusted accordingly. To provide additional certainty about concentrations of the various species within the overall source water area, studies using ETM conduct entrainment sampling relatively close to the intake along with source water samples taken at some distance from the intake. Continuing the example from above, if the larvae from a species come from an area 50.4 miles by one mile wide averaging 20 feet deep, their source water volume is just more than 210 billion gallons (assuming the entire source water area provides suitable habitat for that species). Determining the source water area will also vary based on whether the source water is constrained or unconstrained – that is, whether it is from an enclosed estuary or in open nearshore waters.

Once the source water is known for a particular species, calculating P_m requires identifying the percentage of organisms of that species in the source water that are lost to entrainment. If the concentration of those larvae is the same throughout the source water (e.g., 100 per million gallons), the 210 billion gallons of source water would contain about 21 million of that species' larvae, which means the roughly two million entrained each year would represent about 9% of the larvae in the source water. The P_m for that species would therefore be 9%.

The next measure to determine is the Area of Production Foregone, or APF, which describes the effects of entrainment in terms of the area of habitat needed to replace the lost productivity represented by the entrained organisms. The APF is determined by multiplying the area of habitat within the source water area by the proportional mortality. Continuing the example from above, the APF would cover 9% of the source water area, which would be roughly 3,000 acres (i.e., 9% of an area 50.4 miles long by one mile wide equals 2903 acres). An entrainment study determines separate APFs for each of the target species, which can then be averaged to represent an overall area of lost productivity. The overall APF can then be used to determine an appropriate type and amount of mitigation for the target species. APFs for those species known to use specific habitat types within the overall source water area can be kept separate to help identify more focused mitigation for those species.

The APF therefore provides a way to measure the effect entrainment has on the population of a species within a source water area. Even where a high number of organisms of a species are lost to entrainment, the APF for that species may be relatively small, depending on the size of the source water area of that species. Conversely, entrainment of a low number of organisms may result in a large APF if those organisms come from a small source water area. We note that the roughly 3,000-acre APF provided in the example above is based on an intake flow several times higher than those expected at Cabrillo Port (50 million gallons per day versus 8.2 million gallons per day), and that the source water areas for the organisms entrained at Cabrillo Port are likely larger than that used in the example. This would result in an overall smaller APF, as is shown in the findings below.

Although this type of entrainment study has been not been done for offshore facilities such as Cabrillo Port, the Commission believes it can be used and adapted as necessary to provide a reliable assessment of the proposed project's entrainment impacts. This is based in part on the study's adaptability to be used in different nearshore environments. Additionally, most of the power plant studies included formation of an independent Technical Advisory Committee that determined appropriate study protocols and reviewed study results. To provide further assurance that the study would be carried out in an effective manner, BHP has committed to include as part of its study formation of a Technical Advisory Committee, with its membership subject to review and approval by the Commission's Executive Director. The Commission therefore believes that a study conducted in a manner similar to the type described above would adequately describe Cabrillo Port's entrainment impacts. BHP's proposal to conduct such a study is therefore likely to provide the certainty needed to confirm the level of entrainment impacts anticipated for the Cabrillo Port facility, which are described in the following section.

Determining Likely Effects and Mitigation

As noted previously, it is difficult to identify the likely entrainment effects of the proposed facility without having results of the study described above. Normally, such a study would be needed as part of the permit review process; however, in this case, the Deep Water Port Act's anticipated regulatory timeline of 356 days did not allow for the approximately 18 months needed to develop and implement such a study. Although BHP has agreed to conduct the necessary study, it will not start until after the facility begins operating and the results would not be available for more than a year later. Additionally, absent such a study, it is difficult to evaluate what mitigation might be appropriate, since site-specific impacts on which to base a mitigation proposal are not yet known. The Commission must therefore apply the best data available and make a number of conservative assumptions to reach a reasonable conclusion about the project's likely effects and necessary mitigation.

There are several sources of data useful to describe Cabrillo Port's likely entrainment effects. The project site is within an area subject to extensive and long-term research about ocean conditions, with one of the main research efforts, and the one most suited to identifying the proposed project's likely entrainment impacts being CalCOFI, or the California Cooperative Oceanic Fisheries Investigations program. CalCOFI is a partnership between the California Department of Fish and Game, NOAA Fisheries, and the Scripps Institute of Oceanography. Since 1949, the program has conducted quarterly or annual sampling cruises in the Southern California Bight to collect data on the area's physical, chemical, and biological properties. The program has established 66 data sampling stations within several hundred square miles of the Bight and has amassed a substantial amount of data about ocean conditions during the past more than fifty years of research, including a long-term dataset describing the types and densities of marine organisms present in these waters.

Although CalCOFI was not designed to support the type of analysis needed to identify Cabrillo Port's likely entrainment effects, the program provides the best available data upon which to make a reasonable initial assessment of the types of organisms that would likely be subject to entrainment. The Commission must recognize several shortcomings in using these data, however, as CalCOFI does not provide the site-specific data needed to perform the entrainment modeling analyses that would be generated during the BHP entrainment study. The closest CalCOFI sampling station is about 14 miles from the proposed BHP facility site. Additionally, CalCOFI's schedule of collecting samples quarterly or annually are of less value for describing the project's probable effects than the weekly and monthly samples that would be taken during BHP's entrainment study. Further, CalCOFI samples the entire water column to a depth of about 900 feet below the surface, so the species identified in its samples are not necessarily those that would be subject to entrainment from an intake located about 40 feet below the surface. These characteristics limit the usefulness of those data to describe the species abundance, diversity, and variability in the plankton community that is likely present at the Cabrillo Port site. Nevertheless, the data collected during CalCOFI's more than fifty years of sampling provide a reasonable basis for identifying the types and numbers of organisms that would be subject to entrainment, particularly if the data are used in association with conservative assumptions about those likely impacts.

The EIS/EIR used CalCOFI data to describe the numbers and densities of planktonic organisms in nearby waters (see EIS/EIR Chapter 4.7 and Appendix H-1). The assessment in the EIS/EIR determined that the FSRU's use of about 1.4 billion gallons of seawater per year would result in the loss of anywhere from about 14 to 61 million fish eggs annually and about 2.6 to 11 million larvae annually, depending on its minimum or maximum operating conditions. The species identified included a mix of offshore pelagic species and nearshore species, including several species of rockfish. The EIS/EIR concluded that this loss of eggs and larvae was less than significant when compared to the numbers of eggs and larvae in the Southern California Bight.

However, that conclusion was based on a less rigorous approach than that used in the power plant entrainment studies described above. Without having the site-specific information needed to determine which species would be subject to entrainment and what the source water areas would be for those species, the EIS/EIR assumed that the area consisted of a roughly quadrangle-shaped area of several thousand square miles in the Southern California Bight. It then derived an average ichthyoplankton density from several nearby CalCOFI sampling stations to determine the likely number of eggs and larvae that would be lost to entrainment at Cabrillo Port. Finally, it compared this loss to the total number of eggs and larvae in the assumed source water area to conclude the entrainment losses would be less than significant.

This approach, however, does not include the species-specific and biologically-based source water determinations needed to calculate an Area of Production Foregone, as would be done in the BHP entrainment study. The EIS/EIR's use of the entire Southern California Bight as source water may result in a substantial underestimate of the proposed project's entrainment impacts. Further, the EIS/EIR did not include the seawater intake and entrainment that would be caused by the LNG carriers using about 1.6 billion gallons of seawater per year for ballast. The Commission is including this seawater use in its review of entrainment impacts, which is roughly double the amount of project-related entrainment described in the EIS/EIR.

Rather than rely solely on the CalCOFI data, the Commission is applying several conservative assumptions about the types and densities of organisms that would be subject to entrainment at Cabrillo Port and is applying some of the findings and techniques used in recent coastal power plant entrainment studies. One such assumption is that the average density of organisms in the seawater used by Cabrillo Port will be the same as in the seawater used by nearshore power plants – that is, the Commission is using the overall higher average densities found in nearshore waters. Although population densities in both nearshore and offshore waters are highly variable and there are times when the offshore concentrations are at or above the nearshore averages, the nearshore average density is likely to represent a reasonable high-end average concentration for the overall densities at the Cabrillo Port site. This assumption therefore helps minimize the risk of underestimating Cabrillo Port's likely entrainment impacts.

Another conservative assumption is that the species entrained at Cabrillo Port would be similar to those affected by entrainment at a nearshore facility. This is conservative in that nearshore entrainment often includes numerous rockfish species and other species that are the focus of intensive management and protection due to their importance to the State's fisheries. By emphasizing the effects on species from the various nearshore environments, this assumption avoids underestimating the proposed project's effects on species produced from habitats that are less common than the open ocean environment. This assumption also addresses in part the difficulty of mitigating for the loss of production in the open ocean. Data from the nearby CalCOFI sampling station suggest that it is also reasonable to make this assumption, since those data show the presence of several rockfish species along with the expected pelagic, or offshore, species.

To provide additional conservatism, the Commission is adding the use of ballast water by the LNG carrier vessels to its consideration of the various seawater intake requirements of the FSRU, which more than doubles the seawater use that the EIS/EIR evaluated. The Commission also assumes that the seawater intakes of both the FSRU and the LNG carriers will cause 100% mortality to the entrained organisms. Although the LNG carriers' use of seawater for ballast is likely to result in something less than 100% mortality, under exiting State and federal regulations, all ballast water that is taken on by LNG carriers at the project site must be discharged at least 50 nautical miles from land, which would effectively remove any and all marine organisms within that water from the local marine environment. In addition, the many variables affecting plankton survival within ballast water systems make it difficult to predict actual mortality rates. Therefore, the Commission is assuming the reasonable worst-case rate of 100% mortality for all planktonic organisms entrained by the LNG carrier vessels. By adding this seawater use to that considered in the EIS/EIR and by assuming 100% mortality, these assumptions would essentially double the potential adverse entrainment effects.

By applying these conservative assumptions – that the densities and types of organisms subject to entrainment at Cabrillo Point will be similar to those at nearshore facilities, and that all of the seawater use will cause 100% mortality – the Commission's approach provides a high level of assurance that Cabrillo Port's entrainment impacts are not being underestimated.

Additionally, to provide a better sense of Cabrillo Port's likely source water area needed to identify the extent of its entrainment impacts, the Commission is applying the conservative assumptions above to a recent nearby power plant study at Huntington Beach. The entrainment study done at the Huntington Beach Power Plant is likely the one most applicable to Cabrillo Port. Its source water is from an unconstrained open coastal area that is much shallower than the Cabrillo Port site, but the habitat types within its source water are largely open water and sandy bottom, which is more similar to Cabrillo Port than the source water areas for other recent power plant studies. For example, Diablo Canyon's source water includes substantial areas of hard bottom habitat and Moss Landing's source water is largely constrained within a coastal estuary.

The Huntington Beach study also included a rigorous determination of the power plant's source water area. Rather than use the entire geographic area from which the power plant draws its seawater, the study identified specific source water areas for a number of target species and then related the source water area to the level of seawater use by the power plant. The study determined that for a seawater intake flow of 254 million gallons per day, the average source water area was 104 acres – that is, the organisms entrained in a daily annual flow of 254 million gallons per day represented an annual loss of productivity in 104 acres of nearshore waters.[10]

By applying the conservative assumptions identified above, along with some findings from the Huntington Beach study, the Commission can generate a reasonable and conservative sense of Cabrillo Port's entrainment impacts. Because there are no site-specific data at Cabrillo Port, the best way to apply these assumptions and findings may be through a proportional comparison of the impacts noted at Huntington Beach with the anticipated impacts at Cabrillo Port. As noted above, the Huntington Beach entrainment study, completed by the California Energy Commission in 2006, showed that the entrainment caused by the power plant's use of 254 million gallons per day of seawater resulted in an APF equal to about 104 acres of nearshore waters. Applying that same proportional relationship between water use and lost productivity to the Cabrillo Port project results in an APF of about 3.4 acres:

$$\frac{254mgd}{104acres} = \frac{8.2mgd}{3.4acres}$$

The Commission recognizes that this approach has its limitations, in that the results from an entrainment study done at one location are not likely to be applicable at another location. However, with the use of the reasonable and conservative assumptions described above, the Commission believes this proportional approach can be applied to Cabrillo Port. Further,

[10] The Huntington Beach study also determined that the power plant caused an additional 15.35 acres of APF loss for goby species subject to entrainment. These species use an estuarine habitat type distinct from the habitat used by most other target species at Huntington Beach. However, the lack of site-specific data at the Cabrillo Port site does not allow this distinction to be made in this analysis.

when this same approach is applied to other recent power plant studies, the selection of Huntington Beach appears to provide substantial additional conservatism in identifying an appropriate APF. For example, the entrainment study done at Diablo Canyon found that the power plant's use of about 2 billion gallons per day would require about 1000 acres of rocky reef habitat to make up for the lost productivity. The study at the Moss Landing Power Plant showed that the 1.2 billion gallons per day used there required about 840 acres of wetland mitigation to make up for the organisms lost due to entrainment. These studies did not produce an APF in the way used at Huntington Beach – for example, the source water areas at Diablo Canyon include substantial areas of rocky habitat, and the Moss Landing source water areas were largely within a constrained estuarine system – but they allow a rough comparison to be made with the Huntington Beach study and they illustrate the conservatism of the Commission's assumptions. When the proportional relationship above is applied for these two facilities, the resulting APF is several factors less than that of the Huntington Beach facility, as shown below:

Moss Landing:

$$\frac{1.2bgd}{840acres} = \frac{8.2mgd}{0.0000057acres}$$

Diablo Canyon:

$$\frac{2bgd}{1000\ acres} = \frac{8.2mgd}{0.0000041\ acres}$$

That is, if the proportional relationships between water use and APF at these two facilities were applied to the water use at Cabrillo Port, they would result in a negligible APF of less than a square foot. It is clear from applying this approach to these three power plants that the figures derived from the Huntington Beach study are the most conservative for determining the extent of Cabrillo Port's likely entrainment effects.

Based on the above, the Commission believes it is both reasonable and conservative to assume that Cabrillo Port's entrainment impacts would result in an Area of Production Foregone no greater than about 3.5 acres.

Mitigation

The discussion above describes the anticipated entrainment losses caused by Cabrillo Port to be equal to about 3.5 acres of productivity from the open ocean. To address this impact, BHP has agreed to a two-pronged mitigation approach. It will first contribute $5.4 million to the Department of Fish and Game's (DFG's) "Compensatory Hard Bottom Mitigation Fund." Based on recent figures provided by DFG, this would provide about seven acres of artificial reef habitat within the Southern California Bight waters affected by the proposed project. This amount is based on recent DFG cost figures described below, and would result in 2:1 mitigation on an APF per-acre basis. BHP has also committed to providing additional funds for reef creation if the results of BHP entrainment study described above shows that Cabrillo Port results in an APF greater than 3.5 acres. In that case, BHP will provide the funds necessary to create additional reef habitat at the same 2:1 ratio – for example, if the APF is 5 acres instead of 3.5 acres, BHP would fund the creation of an additional 3 acres (i.e., the 2:1 ratio would result in 10 acres of mitigation for 5 acres of impact instead of 7 acres of mitigation for 3.5 acres of impact). For the reasons below, the Commission believes that BHP's proposed mitigation is adequate to address Cabrillo Port's likely entrainment impacts.

Regarding the type of mitigation offered, the Commission believes artificial reef habitat is suitable mitigation for this proposed project's entrainment effects on open ocean waters. It is infeasible to create direct mitigation in the form of open ocean waters, so BHP is proposing instead to fund a form of indirect mitigation, but one that is likely to be more productive than the lost open ocean habitat. Although a created reef would provide a different habitat type than that in which the entrainment occurs, it would support many of the same species that are likely to be found subject to entrainment during BHP's study. As noted previously, samples from the closest CalCOFI stations show a wide variety of nearshore species, including several rockfish species that are likely to benefit from the created habitat. Therefore, the constructed reefs would provide mitigation for species directly affected by the facility as well as provide indirect mitigation for other species.

Regarding the amount of mitigation, the previous discussion of likely project-related impacts showed that the APF of 3.5 acres is based on several conservative assumptions. Since the anticipated APF is based on those conservative assumptions, it would be reasonable to find at the completion of BHP's entrainment study that Cabrillo Port's actual APF is somewhat less than 3.5 acres. Providing 2:1 mitigation in the form of more productive habitat than that directly affected by the proposed project is therefore likely to result in a mitigation ratio somewhat higher than 2:1. For comparison, we note that the mitigation required as a result of the Huntington Beach power plant study was at a 1:1 ratio based on the APF. In that case, the Energy Commission determined that restoration of 104 acres of nearby wetlands would provide suitable mitigation for adverse entrainment effects at the power plant that resulted in an APF of 104 acres.[11] The use of a 1:1 mitigation ratio rather than the higher ratio usually applied to mitigation determinations was based in part on the likelihood that the 104 acres of restored wetlands would be at least as productive as the same area of open coastal waters.

As noted above, BHP's proposed $5.4 million contribution would go to the "Compensatory Hard Bottom Mitigation Fund," administered by the California Department of Fish and Game. As of 2005, the Program had constructed about 30 reefs in about a dozen different locations along the southern California shoreline. Program-related research has helped identify the most effective reef designs, materials, and placement to enhance various habitat characteristics. It has also shown that constructed reefs have developed self-sustaining fish populations and made significant contributions to larval populations in the Southern California Bight. One benefit, therefore, of BHP's proposed reef funding is that a properly constructed reef would likely result in ongoing mitigation benefits throughout the anticipated life of the LNG facility and beyond.

The most recent available cost figures for creating an artificial reef in the Southern California Bight are those developed in 2006 by the California Department of Fish and Game for a one-acre reef being built off of Point Pitas, in Ventura County. The total cost for that reef is estimated to be $523,311, which includes design, permitting, constructing, monitoring, and

[11] The eventual mitigation requirement was decreased based on the power plant using less than 254 million gallons per day for several years; however, the ratio of water use and wetland mitigation remained the same.

administrative costs. This would likely be a conservative figure when applied to BHP's proposed mitigation since reefs constructed with the BHP mitigation funding would likely have somewhat lower costs per acre due to some of the costs being spread across a larger project area. The $5.4 million is based on applying a conservative 10% per year cost increase and assuming that BHP would not provide the funds until 2010.[12] The per-acre costs in 2010 would therefore be approximately $766,180 per acre, and BHP's offer of $5.4 million would then be expected to result in about 7 acres of reef habitat as mitigation for the anticipated loss of production for about 3.5 acres of ocean habitat. Further, as noted above, BHP would provide additional funds if this funding amount is later determined to be inadequate based on the results of the upcoming entrainment study.

Conclusion

The Commission therefore finds that BHP's proposed mitigation is adequate to address Cabrillo Port's likely entrainment impacts.

4.1.2 Impingement

Impingement occurs when fish or other organisms are caught on an intake's screening system and are either killed or injured. The impingement rate for an intake is primarily a function of water velocity – that is, when an intake's water velocity is low enough for fish to swim from, its impingement rate is usually relatively low. U.S. EPA regulations implementing the design of cooling water intake structures pursuant to federal Clean Water Act section 316(b) establish as "Best Technology Available" a maximum intake velocity of 0.5 feet per second (fps). That velocity is also used as a design guideline for many intake structures not subject to that section of the Act. When velocities are below that rate, fish are usually able to swim away from the pull of the intake. Impingement rates may also vary seasonally or when schools of fish get close to the intake.

The proposed intake of about three billion gallons of seawater per year for the FSRU and LNG carrier vessels would require the use of a variety of intake pumps and screened "sea chest" type intake structures located below the water line on both the FSRU and the LNG carrier vessels. As currently proposed, the FSRU would have several sea chest intakes for its intake of seawater to be used for ballast water, fire system testing and operation, operating the inert gas generator, and for a back-up once through cooling system. Ballast water sea chests on the FSRU would have a minimum opening size of 15 square feet while the inert gas generator sea chests would have an opening size of 41 square feet. All of the FSRU intake structures would be fitted with an external grating consisting of a grate with one-inch clearance spacing to prevent the ingress of foreign matter that may damage the intake pumps or block the intake pipes. A secondary filter would also be fitted inside the sea chest with a screen size of 0.25 inches. To minimize impingement, BHP is designing the FSRU intakes and pumps to maintain intake flows at less than 0.5 fps, which would likely result in FSRU operations having very little impingement impacts.

---

[12] BHP has committed to increase this amount by 10% per year if funds are not provided until after 2010.

The LNG carrier vessel designs cannot ensure the same low velocities. The proposed carrier vessel designs include sea chest intake structures to allow the vessels to meet their ballast water intake requirements. Although there are no standard designs for these vessels, the intakes are generally covered by an approximately one-inch outer mesh screen at the hull as well as an inner mesh screen further inside the intake structure. The size and location of their ballast water intakes are limited due to structural constraints, the need to minimize hull friction as the vessels move through the water, and due to maintenance and safety concerns. While the carrier vessels' intake velocities would at times be less than 0.5 fps, the volumes of water needed during ballast intake and the limited size of those intakes would at times result in higher velocities that are likely to cause impingement.

Similar to the entrainment impacts discussed previously, it is a challenge for several reasons to quantify what level of impingement impacts would result from Cabrillo Port operations. Impingement rates will vary for a single vessel depending on how it is operated, and rates will vary among vessels depending on their design. Additionally, there are no data available that would describe the numbers or types of fish that may be subject to impingement and present at the proposed project site. Further, even if there were data available describing the fish present under existing conditions, the presence of the FSRU and carrier vessels is likely to change the number and type of species at the proposed project location. Finally, it would be infeasible to monitor impingement during Cabrillo Port's operations to determine the actual rates, due to the number and location of the various intakes and because fish that do become impinged are likely to fall away from the intake screens fairly quickly when the water velocity is reduced.

Because of these baseline and operational monitoring constraints, the Commission is unable to determine with accuracy the rate of impingement likely to occur at Cabrillo Port or the overall level of impact that the impingement would cause. Unlike the entrainment issue described above, the Commission has no credible data on which to base a determination of adverse effects or to determine appropriate mitigation. However, because of the conservative approach taken to identify the proposed project's probable entrainment impacts and the appropriateness of BHP's entrainment mitigation proposal, the Commission believes that the artificial reefs created through BHP's mitigation funding would also provide some level of mitigation for the impingement impacts likely to occur at Cabrillo Port. The created reefs would not only support productivity of numerous species in the Southern California Bight's planktonic community, but would provide habitat for a number of the same species of adult fish which may be subject to impingement at Cabrillo Port.

Conclusion

Based on the information above, the Commission therefore finds that the proposed project's impingement impacts, although unquantified, would be mitigated through BHP's funding of artificial reef creation, as described in the entrainment findings in the previous section.

4.1.3 Effects of Project-Related Lighting on Seabirds

The FSRU would require various types of lighting to facilitate nighttime activities, such as offloading LNG from LNG carrier vessels and ensuring safety and security by enhancing the visibility of the FSRU to reduce the potential occurrence of accidents and collisions. The FSRU would employ ten partially shielded halogen floodlights with a visible range of over eight miles to illuminate work spaces and deck areas, five additional partially shielded halogen floodlights with a similar visible range to illuminate the sides of the FSRU and adjacent waters as well as at least 60 fluorescent and incandescent lights with a visible range of over 5.8 miles to illuminate accommodations and equipment. Floodlights would be used approximately 156 days per year and would be installed at heights of between 65 feet and 100 feet above sea level, while fluorescent and incandescent lights would burn continuously 365 nights a year and would be installed at heights of between 65 feet and 120 feet above sea level. In addition, both fixed and rotating marine beacons would also be installed on the proposed FSRU. As allowed under the Deepwater Port Act, the brightest onboard light would be a rotating beacon located on the highest, unobstructed point on the vessel, approximately 266 feet above sea level. This beacon would be required to have an effective intensity of no less than 15,000 candelas[13] and would flash at least once every 20 seconds so that it would be visible from all points on the horizon. For comparison, a typical light-emitting diode (LED) marine beacon of between 1,500 and 2,800 candelas has a visible range of 6.9 to 11.5 miles. Six red fixed marine beacons with a range of over 11.5 miles would be installed at a height of 190 feet above sea level to provide warning to aircraft and four additional white fixed beacons with the same visible range would be installed at a height of 70 feet above sea level to provide warning to marine traffic.

Other lights would be used during night and evening hours by the Cabrillo Port's support and supply vessels and by the LNG carrier vessels that would dock at the FSRU to offload their cargoes. LNG carrier vessels would be illuminated for safety and would include floodlights at LNG transfer connection points and in transfer operations work areas. Typically, LNG carriers would be required to be illuminated continuously from one hour before sunset to one hour after sunrise and during any periods of reduced visibility while the vessel is moored to the FSRU. The two Cabrillo Port supply vessels would be equipped with two partially shielded halogen floodlights at heights of 16 to 60 feet above sea level. These lights would be similar in size and intensity to those installed on the FSRU and would be augmented by five navigational lights at 16 to 45 feet above sea level with a visible range of over 11.5 miles.

The proposed FSRU would rotate around its mooring turret as dictated by local wind and ocean current conditions, so changes in its position would be gradual and confined to a limited area around the turret. The FSRU and associated LNG carriers would therefore result in a continuous level of elevated artificial night lighting at the mooring location and the surrounding seas. This constant nocturnal illumination of the air and water would result in direct and indirect impacts to the marine organisms and seabirds that frequent the project site.

---

[13] A candela is a measure of light intensity. A candle emits about one candela, and a 100-watt light bulb emits about 120 candelas.

In addition, although proposed construction activities associated with the Cabrillo Port would be mobile and short-term in nature, the installation of the FSRU's mooring system, the construction and placement of undersea pipelines and the conduct of offshore HDB operations would require the use of substantial and sustained nighttime lighting that may result in impacts to seabirds and marine organisms similar to those anticipated from the night lighting at Cabrillo Port. Specifically, each of the four pipelaying barges that would be used during the installation of the Cabrillo Port's proposed offshore pipelines would make use of ten un-shielded halogen floodlights with an estimated illumination visibility of greater than 11.5 miles. Similar floodlights would also be equipped and used on the two construction tug/supply vessels, the two 100 ton cranes and the two 35 ton cranes that would be in constant operation during the construction phase of the proposed Cabrillo Port project. These vessels and cranes would be in operation for approximately 90 days, 24 hours per day, seven days per week. During approximately 54 of these days this construction equipment would be located at the same site less than one mile offshore of Ormond Beach.

Seabird Attraction

The lighting on the FSRU, LNG carrier vessels, and pipeline, HDB and mooring system construction equipment would result in substantial amounts of lighting on both the sea surface and above water areas surrounding these activities. A number of scientific studies[14] have established that artificial night lighting at sea attracts seabirds and disrupts their normal breeding and foraging activities. Seabirds have been observed to continually circle lights, falling prey to "light entrapment," whereby they remain trapped within the zone of illumination and are unable or unwilling to return to the darkness until overcome with exhaustion. Seabirds have also been observed to become disoriented in the presence of bright lighting at night, suffering injury or death after colliding with lights or nearby structures or stranding on lighted platforms where they can become vulnerable to injury, oiling or other feather contamination, exhaustion, and depredation by avian predators. Young or fledgling seabirds incur particularly high mortality from attraction to artificial light because in addition to light entrapment and disorientation they can also become separated from their parents, on whom they depend for food and guidance. Night lighting can also indirectly affect seabirds by illuminating areas at sea that would normally provide refuge and thereby increase their susceptibility to predation. Overall, nighttime light pollution increases the risk to seabirds from predation and injury and/or mortality from collisions, entanglement, and exhaustion.

Nocturnal and night foraging seabirds known to occur in the project area are known to be especially vulnerable to the adverse effects of night lighting. These include members of the alcid, storm-petrel and shearwater families such as the Xantus's murrelet, ashy storm-petrel, black storm-petrel, Leach's storm-petrel, Cassin's auklet, rhinoceros auklet, black-vented shearwater, sooty shearwater, and the pink-footed shearwater. These species are nocturnal feeders and may be particularly susceptible to the loss of protection from avian predators that darkness provides. Along with probable increases in predator-related mortality, the dangers posed to these species include light entrapment, disorientation and collisions caused by bright artificial nighttime lighting.

---

[14] Reed et al. (1985); Carter et al. (2000); Wiese et al. (2001); Rich, C. and Longcore, T. (2006).

Affected Species – Xantus's Murrelet

The Xantus's murrelet has been listed by the State as a threatened species due to its limited geographic range, small global population, extensive predation at its nesting sites from introduced feral cats, rats and natural predators and the significant threat of mortality from oil pollution. This species is also a priority two candidate for federal listing and is listed as endangered in Mexico. Currently, Xantus's murrelets are known to breed on only twelve islands along the southwest coast of North America from San Miguel Island, California to Islas San Benitos, Baja California. Three of the most robust and critical Xantus's murrelet breeding and nesting colonies are all located within the Southern California Bight, one each on Anacapa Island, Santa Barbara Island, and in northern Baja California at Islas Los Coronados. Recognition of the potential threats to the Xantus's murrelet including those posed by at-sea light pollution prompted the USFWS, in its May 11, 2005, Candidate Notice of Review, to increase the federal Endangered Species Act listing priority for this species from a five to a two. As this Notice of Candidate Review states:

> *Xantus's murrelets and other seabirds become exhausted from continual attraction and fluttering near lights or collide with lighted vessels, the impact resulting in injury or death. Chicks have been documented to separate from their parents due to vessel lights, often resulting in death as chicks are dependent on parents for survival.*

Similarly, in the November 2003 *Report to the California Fish and Game Commission: Status Review of Xantus's murrelet in California*, Burkett et al. listed artificial light pollution as a threat to the survival of the Xantus's murrelet. This report on the Xantus's murrelet cites numerous studies demonstrating that "this species is attracted to light and in particular to lighted vessels" and that even "small amounts of vessel lighting have been documented to cause parent-chick separation in the Channel Islands." Such separations often result in mortality to Xantus's murrelet chicks as "they are dependent on their parents for an extended period of time at sea." In addition to parent-chick separations, the report goes on to note that:

> *Artificial night-lighting has been shown to cause disorientation in birds of many species and has been documented to result in birds becoming exhausted due to continual attraction and fluttering near lights, or birds colliding with lighted structures, resulting in injury or immediate death.*

The report further notes that:

> *…artificial night-lighting, particularly close to the breeding sites of Xantus's murrelets in the Channel Islands, has a reasonable potential to cause… increased predation rates in adults as they leave/return to nests, and of chicks as they depart the nests for the sea by increasing the visual abilities and activity levels of predators.*

The proposed location of the FSRU is approximately midway between two of the largest known Xantus's murrelet colonies, those on Anacapa Island and Santa Barbara Island, amid an area in which the density of at-sea telemetry fixes on radio tagged Xantus's murrelets recorded by the USGS[15] and Humboldt State University[16] researchers between 1995 and 1997 were some of the highest in the Southern California Bight, 0.34 per square kilometer (see Exhibit MAR-2). These results are further supported by research conducted on the at-sea distribution of foraging Xantus's murrelets during the 2002-2003 breeding seasons[17] which found that "the majority of [Xantus's murrelet foraging] locations (88%) occurred within 40 km south of Anacapa Island, suggesting that there were abundant and predictable prey resources in that area." At 34.7 kilometers from Anacapa Island, the proposed FSRU location would be well within this range. In addition, other recent surveys of the at-sea density and distribution of Xantus's murrelets establish the project location as an important foraging site for Xantus's murrelets. Preliminary, unpublished radio telemetry data[18] on the at-sea locations of Xantus's murrelets during the 2002 and 2003 breeding seasons suggest that Xantus's murrelets from both Anacapa Island and Santa Barbara Island have a medium to high probability of occurring at the FSRU location.

Other Affected Species – Alcids, Storm-Petrels and Shearwaters

Other nocturnal seabird species are expected to experience the same types of effects as those described for the Xantus's murrelet. These include several California Department of Fish and Game Species of Special Concern such as the ashy storm-petrel, black storm-petrel, and rhinoceros auklet as well as other seabirds species such as the fork-tailed storm-petrel, Leach's storm petrel, Cassin's auklet, black-vented shearwater, pink-footed shearwater, sooty shearwater and several species of loons and grebes are also known to be susceptible to mortality, injury and disturbance from the use of artificial night lighting at sea.[19] Several of these species, including the Cassin's auklet, Leach's storm-petrel, ashy storm-petrel and rhinoceros auklet have been recognized by the Point Reyes Bird Observatory as "California Seabirds Most Affected by Night Lights" and, as noted in Reed et al. (1985), "the general problem of light attraction is worldwide among the Procellariiformes [the order of seabirds that includes shearwaters and petrels]; at least 21 species are known to be attracted to man made lights." Also, as noted in Carter et al. (2000), "ashy storm-petrels have been recovered dead on Platform Honda [in the Santa Barbara Channel] and from mainland locations with bright lights." All of these species are either permanent residents on the Channel Islands or are known to be seasonal visitors. Breeding colonies of several of these seabirds are located

---

[15] Carter et al. 2000. "At-sea threats to Xantus's murrelets (*Synthliboramphus hypoleucus*) in the Southern California Bight." Pages 435-447 in Proceedings of the fifth California Islands symposium (D.R. Browne, K.L. Mitchell, and H.W. Chaney, Eds.). U.S. Minerals Management Service, Camarillo, California.

[16] Whitworth et al. 2000. "Distribution of Xantus's murrelet (*Synthliboramphus hypoleucus*) at sea in the Southern California Bight, 1995-1997." Ibis 142, pp. 268-279.

[17] Hamilton, C.D. 2005. At-Sea Distribution, Habitat and Foraging Behavior of Xantus's Murrelets (*Synthliboramphus hypoleucus*) During the Breeding Season in the Southern California Bight. Master's Thesis. Humboldt State University.

[18] Hamilton. C.D., R.T. Golightly, and J.Y. Takekawa. (Unpublished) "Foraging habitats and at-sea distribution of Xantus's murrelets along small scale temperature front in the Southern California Bight."

[19] Reed et al. (1985); Carter et al. (2000); Wiese et al. (2001); Rich, C. and Longcore, T. (2006).

at various locations throughout the Channel Islands with Anacapa Island, Santa Barbara Island, Santa Cruz Island and their offshore rocks supporting populations of Cassin's auklets, ashy storm-petrels, black storm petrels and Leach's storm petrels.

The presence of these many seabird species in and around the proposed project area is demonstrated by the existence of their colonies on nearby islands as well as by both research and observational evidence.[20] The surveyed and modeled diversity of seabirds at and around the proposed project site is some of the highest in the region.[21] As noted in NOAA's Biogeographic Assessment of the Channel Islands National Marine Sanctuary,

> *Over 200,000 adult birds nest on the islands in April-May, which represents the height of the breeding season… Additionally, the Channel Islands contain the entire U.S. populations of black storm-petrel, California brown pelican, and Xantus's murrelets, plus over 33% of the world populations of ashy storm-petrels and Xantus's murrelets.*

Preliminary, unpublished data from the USGS Western Ecological Research Center and Mason et al. (in press) conservatively suggest that between May of 1999 and January of 2002 the maximum at-sea density of ashy storm-petrels, black storm-petrels, rhinoceros auklets, Cassin's auklets, pink-footed shearwaters, black-vented shearwaters, sooty shearwaters, Xantus's murrelets, loons and grebes (all of which are recognized as being susceptible to light attraction) within a 15 kilometer radius of the proposed FSRU site ranged from 2.16 to 51.85 birds per square kilometer. Recently, additional species specific radio telemetry studies[22] of both Cassin's auklets and ashy storm-petrels have demonstrated substantial variability in the at-sea foraging locations of these species, but unpublished data from 2004 and 2005 surveys[23] suggest that ashy storm-petrels may be found near the proposed FSRU location during the summer breeding season.

Mitigation

Given the high diversity and density of seabirds at the proposed FSRU location as well as the recognized vulnerability of many of these species to adverse impacts from night lighting such as that required by the Cabrillo Port, the Commission finds that the proposed project would adversely affect the federally-listed Xanthus's murrelet, several California Species of Special

---

[20] Whitworth et al. (1997); Carter et al. (2000); Whitworth et al. (2000); Mason et al. (in press).

[21] NOAA National Centers for Coastal Ocean Science (NCCOS). 2005. "A Biogeographic Assessment of the Channel Islands National Marine Sanctuary." Prepared by NCCOS's Biogeography Team in cooperation with the National Marine Sanctuary Program, Silver Spring, MD. and
Mason et al. (in press)

[22] Adams, J. and J.Y. Takekawa. (Unpublished). " At-sea distribution of radio marked ashy storm-petrel (*Oceanodroma homochroa*) captured on the California Channel Islands." and
Adams, J., J.Y. Takekawa, and H.R. Carter. 2004. "Foraging distance and home range of Cassin's auklets nesting at two colonies in the California Channel Islands." Condor 106, pp. 618–637.

[23] Adams, J. and J.Y. Takekawa. (Unpublished). "At-sea distribution of radio marked ashy storm-petrel (*Oceanodroma homochroa*) captured on the California Channel Islands."

Concern, and a variety of other seabird species. However, the magnitude of impacts to these species from the proposed project is largely unknown due to the high variability in oceanic conditions and prey availability in the area of the proposed project and because the potential short- and long-term effects on light-sensitive seabirds from a permanently moored lighted deepwater port within an area of known concentrations of these seabird has yet to receive adequate scientific scrutiny.

In its consistency certification, BHP has committed to develop a lighting plan in consultation with a marine bird expert which would include shielding lights[24] and limiting lighting to the minimum necessary to perform project activities and maintain compliance with safety and security requirements (these measures are detailed further in Appendix C). As described in Appendix B, BHP has also committed to providing $300,000 to the National Park Service to augment and extend existing seabird nesting habitat restoration and population enhancement projects within the Channel Islands National Park. A few of the projects currently being developed and implemented in the Channel Islands National Park include:

- Enhance the Cassin's auklet and Xantus's murrelet breeding populations on Santa Barbara Island by using social attraction techniques[25] and reduce erosion in and around nesting burrows by re-planting native vegetation;

- Restore Cassin's auklet, ashy storm-petrel, western gull, Xantus's murrelet, California brown pelican and double-crested cormorant nesting and roosting habitat on several of Santa Cruz Island's large offshore rocks; and

- Reduce seabird nest predation on San Miguel Island by reducing populations of introduced black rats.

Specifically, the funding provided by BHP would be used by the NPS for nest box installations, disturbance reduction efforts (e.g., the placement of signs, additional enforcement presence and the deployment of light meters at seabird colonies), erosion control and native plant restoration efforts, exotic plant removal activities, and the use of social attraction techniques to help augment and re-establish historic nesting colonies of Cassin's auklets, Xantus's murrelets and ashy storm-petrels on Santa Barbara Island, San Miguel Island, Anacapa Island and Scorpion and Orizaba Rocks offshore of Santa Cruz Island. This funding would also be directed towards activities designed to assess the efficacy and success of these restoration efforts. Commission staff would develop with the NPS a Memorandum of Agreement to establish how and when these funds would be used to conduct the necessary mitigation measures.

---

[24] Studies conducted by Reed et al. (1985) on the island of Kauai reported that the use of shielding to limit upward light radiation reduced the number of attracted shearwaters by between 30% and 50%.

[25] Social attraction techniques include the use of audio playback systems to play the calls of targeted seabird species to attract them to nesting and roosting sites.

BHP's funding would be used to provide additional high-quality breeding habitat, enhance and re-establish historic breeding colonies of Cassin's auklets and ashy storm-petrels, and aid in the recovery of the threatened Xantus's murrelet. The combination of habitat restoration and nest boxes would provide a favorable environment for storm petrels, auklets and murrelets on Santa Barbara Island, Anacapa Island, San Miguel Island and the rocks offshore of Santa Cruz Island. In Northern California, nest boxes have enhanced the population growth rate of several cavity-nesting alcid species at various sites by increasing recruitment of breeding-age birds, improving productivity, and decreasing mortality.[26] The use of playback systems would further facilitate the re-colonization of the Cassin's auklet on the island. These techniques would likely increase the number of breeding pairs of Cassin's auklets and Xantus's murrelets on the island, thereby increasing the number of offspring produced. By re-establishing the historical colony of Cassin's auklets and increasing the number of breeding pairs of Xantus's murrelets, this action would have long-term benefits to these species.

In addition, as detailed in Appendix B, BHP has also committed to providing $100,000 to the U.S. Geological Survey's Western Ecological Research Center to develop and implement site specific research at the FSRU to document and quantify the effects on seabirds from the Cabrillo Port's use of artificial lighting at night. Specifically, this study would include taking periodic representative samples of the number and type of seabirds that are attracted to the FSRU at night during both the spring breeding season and throughout the rest of the year. By providing information that can be used to estimate the total number of seabirds attracted to the Cabrillo Port during nighttime operations, this program would be invaluable in beginning to address the well recognized need for research on the impacts to seabirds from at-sea lighted facilities.

Conclusion

The Commission finds that with the implementation of the impact reduction and mitigation efforts described above, Cabrillo Port's potential adverse impacts to seabirds would be offset.

4.1.4 Underwater Noise

Marine mammals rely primarily on sound for communication, orientation, and detection of predators and prey. Anthropogenic noise is a recognized, but largely unregulated, form of ocean pollution that can disturb marine life including marine mammals, sea turtles and fish. A combination of noise sources, including shipping, oil and gas exploration and production, dredging, construction, and military activities, has resulted in steadily increasing noise levels throughout the world's oceans, including the southern California Bight, for the past 50 years. Over the last ten years, a growing body of evidence has established that some forms of ocean noise can kill, injure, and deafen whales and other marine mammals. Evidence has also established that high intensity impulse noise can cause fish mortalities.

[26] Sydeman et al. (2000).

At the same time, the project site is not a particularly sensitive one in terms of proximity to significant concentrations of marine mammals or to migration corridors (see marine mammal sighting figures, Exhibit MAR-3). Thus, the permanent project site is not located directly within gray whale migration paths, the construction period would occur outside the gray whale migration season, the project site is not among the more productive feeding grounds for marine mammals, and it is not a breeding grounds for any species of marine mammals other than a few species of dolphins and porpoises (i.e., long-beaked common dolphin, and Dall's porpoise), which breed throughout the Southern California Bight and which are fairly tolerant of human activity and vessel noise. The greatest concentrations in the region lie off the north shores of the Santa Barbara Channel, immediately south of the established vessel traffic lane and existing oil platforms, implying some degree of tolerance of existing levels of vessel and construction noise by marine mammals. Other concentrations sometimes occur to the southeast of San Miguel and Santa Rosa Islands, toward San Nicolas Island.

The project nevertheless raises several noise-related concerns: (1) temporary construction noise impacts; (2) long-term operational noise impacts; (3) additions to shipping noise, which have been consistently increasing in the southern California Bight; (4) the fact that project area water depths are sufficient to place some construction within the Sound Fixing and Ranging (SOFAR) channel (see footnote for link to an explanation of the SOFAR channel),[27] where sounds remain concentrated over large distances; and (5) cumulative/synergistic effects of adding noise to the host of other threats to marine resources (e.g., marine pollution, ship strikes, loss of food supply, etc.).

Although research is ongoing, to date little is known about the effects of loud impulse sound on marine mammals, and even less is known about the effects of ubiquitous shipping noise in the southern California Bight, or on the cumulative interactions of various different types of sound on marine mammals. Several studies that are available have linked vessel traffic noise to marine mammal abandonment of preferred habitats in some instances, and have noted that continuous construction/ operation noise has the potential to alter migration patterns. For example, NOAA Fisheries (2007) reports that:

> *Bryant et al. (1984; in Polefka 2004) recorded the abandonment by gray whales of a calving lagoon in Baja California, Mexico following the initiation of dredging and increase in small vessel traffic. Following the termination of the noise-producing operations, the cow-calf pairs returned to the lagoon. Underwater noise associated with extensive vessel traffic has been documented to have caused gray whales to abandon some of their habitat in California for several years (Gard 1974; Reeves 1977). Salden (1988) suggested that humpback whales avoid some nearshore waters in Hawaii for the same reason. Increasing levels of anthropogenic noise have been identified as a habitat concern for whales and other marine mammals because of its potential effect on their ability to communicate (Carretta et al. 2001; Jasny et al. 2005*).

[27] http://www.oceanexplorer.noaa.gov/explorations/sound01/background/acoustics/media/sofar.html

Concerning disturbance responses to noise in general, NOAA Fisheries (2007) notes:

> *Disturbance Responses: There is mounting evidence that wild animals respond to human disturbance in the same way that they respond to predators (Beale and Monaghan 2004; Frid 2003; Frid and Dill 2002; Gill et al. 2000; Gill and Sutherland 2001; Harrington and Veitch 1992; Lima 1998; Romero 2004). These responses manifest themselves as stress responses (in which an animal perceives human activity as a potential threat and undergoes physiological changes to prepare for a flight or fight response or more serious physiological changes with chronic exposure to stressors), interruptions of essential behavioral or physiological events, alteration of an animal's time budget, or some combinations of these responses (Frid and Dill 2002; Romero 2004; Sapolsky et al. 2000; Walker et al. 2005). These responses have been associated with abandonment of sites (Sutherland and Crockford 1993), reduced reproductive success (Giese 1996; Mullner et al. 2004), and the death of individual animals (Daan et al. 1996; Feare 1976).*

To address acoustic concerns BHP has conducted an acoustic study documenting the noise levels from the construction and operation equipment, estimated the expected underwater sound footprints and attenuation rates, and looked at available technology to reduce noise levels (such as by installing isolators to reduce vibration levels). The acoustic studies include June 30, 2004, and August 18, 2006, reports by CJ Engineering, and an August 2004 Report (Noise Analysis of Onshore and Offshore Construction Phase), by Entrix, Inc. (Entrix 2004).

Thresholds

While debate has arisen over the appropriate thresholds for impulse noise (e.g., increasing concerns over the potential for mid-frequency impulse sound to cause or be implicated in marine mammal strandings), the most commonly cited threshold for continuous noise, particularly for broadband noise, has been 120 decibels (dB).[28] For benchmarks, working with guidance from NOAA Fisheries, BHP's studies compared noise levels to background levels and noise thresholds of 120 dB, 160 dB, 180 dB, and 190 dB. BHP considered 120 dB to equate to NOAA Fisheries behavioral threshold/potential (i.e., Level B harassment) under the Marine Mammal Protection Act (MMPA), 180 dB to equate to an injury threshold (Level A harassment), and, at NOAA Fisheries' direction, BHP also noted the relatively few instances predictable noise levels could exceed 190 dB.

Background Levels

BHP states that the natural background underwater noise levels at the project site range from around 90-110 dB (rms), depending on ambient weather conditions, with the higher level (110 dB) predominating much of the time due to extensive shipping in the area.

Construction Noise

Exhibit MAR-4 from BHP's acoustic study (Entrix 2004) lists the various types of construction equipment and their corresponding underwater noise levels and rates of attenuation. Generators, compressors, deck machinery, and other sound sources would contribute to the numerous sounds of construction vessels, and all of which would add to the regionally high level of vessel traffic. For

[28] Underwater decibel references in this report are referenced to the water standard: re 1 μPa

both the offshore marine spread for the pipelines, and the FSRU, (the primary sources for each include drill rig, tugs, support boats, cranes, and helicopter), BHP states the maximum underwater noise levels would be 180 dB re 1 μPa – rms at 1 m.

Based on a behavioral threshold of 120 dB re 1 μPa – rms, BHP estimates that behavioral effects could occur within a radius of approximately 0.5 n.mi. (0.6 mi./1 km) from construction activities, which would correspond to an area of up to approximately 3.1 km^2 centered around pipeline construction activities. Because NOAA Fisheries requested analysis of MMPA "Level A" take (sounds $\geq$ 180 dB), BHP estimated this zone to be a radius of up to approximately 3.3 feet (1 m) from pipeline construction activities, with an ensonification area of up to 3.1 m^2. Absent unforeseen events, noise levels above 190 dB re 1 μPa – rms level would not occur during construction.

The State Lands Commission (SLC) (Mar. 2006, Revised Draft EIR) noted that previous monitoring efforts of construction noise for the Exxon Santa Ynez unit included observations that construction noise (a dynamic-positioning pipelaying vessel used west of Santa Barbara), could be heard underwater 15 miles from the construction site, and that hundreds of gray whales were observed during this project with no adverse impacts noted, including migration diversion or startle reactions, even when the whales passed through the construction area (Woodhouse and Howorth 1992). The SLC further noted:

> *[Exhibit MAR-4] provides a list of equipment that would be used offshore during construction and the levels of underwater noise generated for each. During pipeline construction, including the shore approaches, the underwater noise level and impacts would vary depending on the construction equipment required during each specific activity. Data on noise levels for the listed equipment allow the maximum noise that could occur on a particular day to be evaluated from the starting day of the construction of the pipelines in the nearshore and offshore areas. Helicopters would be used for certain periods of the day or certain days only. Construction vessels, including the exit hole barge tug and the survey vessel, would have maximum noise intensities (depending on the specific vessel used) between 159-171 dB. This additional noise factor was taken into account for the entire duration of construction. Based on the limited duration of the construction activities and the occurrence of these activities outside of grey whale migration season, significant acoustic impacts are not anticipated.*
>
> *Vessel noises are usually transitory and relatively short-lived. Construction vessels, however, may remain on site for extended periods. Although the noise of such vessels is not always loud, it is persistent. Generators, compressors, deck machinery, and other sound sources contribute to the cacophony of sounds produced by such vessels. Average peak pressure generated from vessels described in a noise analysis of construction activities for the proposed Project range from 156 to 181 dB (Entrix, Inc. 2004).*

Operation Noise

Operational noise would be generated by ships (including LNG carriers), helicopters, pipeline operation, and the FSRU. LNG carrier noise would be loudest at cruising speeds, while reduced in volume when moored at the FSRU. The carriers would not use propulsion systems while docked at the FSRU. FSRU noise for most operating scenarios would be 178.2 dB to 182.5 dB. Noise from LNG carrier docking (when tugs and the FSRU thrusters are in effect) could be up to 192 dB. Crew and supply vessel noise would be temporary and would generate a maximum of 181 dB. Helicopters at their loudest (during approach and takeoff) would generate noise at 162 dB. This noise level would continue only briefly while near the helipad, which in itself would reflect noise and attenuate the sound. Pipeline operational noise would be minimal.

To calculate expected noise levels and project effects, BHP compared seven working scenarios (Exhibit MAR-5) and their acoustic footprints, starting with a typical/average operation scenario (i.e., 800 MMscfd, FSRU plus standard operating equipment), which BHP states would be the situation approximately 90% of the time, as well as the same volumetric scenario but with vibration isolators installed to reduce noise, and several other "worst case" (i.e., maximum output) scenarios. The seven scenarios are show in Exhibit MAR-5.

Broadband noise under the "typical" scenario would be 181.6 dB, which would attenuate as follows:

Source: noise @ 1m – 181.6 dB
Distance to 180 dB – 3.9 ft.
Area of Disturbance at 180 dB – 47.8 sq. ft.
Distance to 120 dB – 0.9 mi.
Area of Distance at 120 dB – 2.4 sq. mi.
Distance to minimum background level (90 dB) – 24.9 mi.

With vibration isolators, these levels would be reduced as follows:

Source: noise @ 1m – 178.2 dB
Distance to 180 dB – would not exceed
Area of Disturbance at 180 dB – none
Distance to 120 dB – 0.4 miles.
Area of Distance at 120 dB – 0.4 sq. mi.
Distance to minimum background level (90 dB) – 16.2 mi.

For two of the "worst case" scenarios (e.g., using tugs, thrusters, and maximum throughput) which would occur 11.5 hrs./wk (6.8% of the time), these numbers could increase to:

Source: noise @ 1m – 192.6 dB
Distance to 190 dB – 4.6 ft.
Area of Disturbance at 190 dB – 66.7 sq. ft.
Distance to 180 dB – 14.1 ft.
Area of Disturbance at 180 dB – 625 sq. ft.
Distance to 120 dB – 11.1 mi.
Area of Distance at 120 dB – 389 sq. mi.
Distance to minimum background level (90 dB) – 80.8 mi.

BHP states:

> *The predicted noise levels from the FSRU are commensurate with similar floating platforms and are less than a large container ship, tankers, or supertankers. Generally the noise from the FSRU will be equal to the background levels at a distance of less than 7 km. The levels will fall to 120 dB at a distance of 1 km and will be equal to the background level, for a windy day, at a distance of less than 6 km.*
>
> …
>
> *The results of Case 3 show that the underwater-radiated noise levels may be reduced by at least 3 dB by resiliently mounting selected machinery items. The study included a minimum level of attenuation that could be easily achieved.*

Based on the assumption of a 120 dB behavioral threshold (i.e., NOAA Fisheries level B (behavioral harassment) threshold for continuous sound), and using the modeling assumptions shown in Exhibit MAR-6, animals affected would be those within a radius of up to approximately 0.9 mi. (1.4 km) from the FSRU for normal operational scenarios. With vibration isolators these distances would be reduced to 0.4 mi. (0.6 km). For the less common operational scenarios, the distance to 120 dB would be up to (worst case) 11.1 mi. (17.9 km). Using a 180 dB threshold (i.e., NOAA Fisheries level A (injury) threshold for continuous sound) would yield a radius of up to approximately 3.9 ft. (1.2 m) from the FSRU for normal operational scenarios, which would be reduced to zero with vibration isolators, and up to 14.1 ft. (4.3 m) from the FSRU for less likely or uncommon operational scenarios.

Mitigation

Because the underwater noise has the potential for marine mammal effects, BHP has incorporated a number of avoidance, monitoring, and mitigation measures (detailed in Appendix C), consisting of marine mammal monitoring, avoiding construction during the gray whale migration season, for construction activities, cessation of activities if marine mammals or sea turtles are within a designated safety range, and for operation activities, installation of noise reducing devices. While the monitoring plans have not been fully developed, the commitments include:

- Avoiding offshore construction during the gray whale migration season.
- Gathering baseline data, including obtaining: (a) pre-construction, site-specific data on the presence, species composition, abundance, frequency, and seasonality of marine mammals specific to the project site (twice-monthly aerial line transect surveys for one to two years); (b) physical oceanographic information (e.g. seasonal conductivity (density/salinity), temperature, and depth information); and (c) ambient sound at different depths and in different sea state conditions; and including measuring sounds of various vessels passing through the nearby shipping lane (sound pressure level recordings four times a year for one to two years).

- Preparing monitoring plans by independent, third-party monitors (to be reviewed by the USFWS, NOAA Fisheries, and CDFG). The monitoring plans would include:
  - Measuring: (a) operational sound at various depths, distances and directions from the Project site (sound pressure level recordings); (b) seasonal conductivity (density/salinity), temperature, and depth measurements at all sampling stations; (c) comparisons of cold and warm water influx periods; and (d) all operational modes with varying sound conditions;
  - Documenting behaviors of marine mammals exposed to operational noise (passive tracking and observations four times a year for one to two years), and measuring sound levels from project operations received by the marine mammals (sound pressure level recordings); and,
  - Evaluating mitigation monitoring results against NOAA Fisheries-accepted sound thresholds as results become available, and, in consultation with resource agencies, making recommendations as to whether noise levels can be reduced and whether continued or future monitoring is necessary.

- Maintaining two trained, NOAA Fisheries-approved marine mammal monitors on construction vessels, and one on operation vessels.
- Assuring that helicopters maintain a flight altitude of at least 2,500 feet (762 m), except during takeoff and landing.
- Installing vibration isolators and working with marine architects, acoustic experts and mechanical engineers and the USCG, among others, to design the FSRU and its equipment to reduce, to the maximum extent feasible, the output of cumulative noise from the facility.

BHP has additionally agreed to (as described in Appendix B):

- Establish a safety zone of 1,000 ft around construction activities. If a marine mammal/turtle enters or appears likely to enter the safety zone before construction activities begin, then construction should cease or be delayed until the marine mammal/turtle exits the safety zone. If the animal is seen at the surface and the dives, construction activities would be delayed for 15 minutes to allow time for the animal to exit the safety zone. If a marine mammal/turtle enters the safety zone during construction activities, the observer would closely monitor and record the animal's behavior. If it appears that the animal is at risk of injury, then construction activities, to the extent possible, will cease until the animal can safely exit the safety zone.
- Provide for passive acoustic monitoring during operations, including installing and operating an array of autonomous recording units to monitor and evaluate underwater sound output from the project before construction and for at least five years of operation;
- Include Commission staff in the development of the monitoring plans, for its review and approval prior to finalizing;
- Provide all monitoring plan results to Commission staff;
- Evaluate monitoring results against Commission-recommended thresholds as well as NOAA Fisheries-approved thresholds for effects determinations; and
- Seek Commission staff approval for any changes to or cessation of any monitoring efforts.

Effects on Fish

Concerns expressed during the last decade over effects of underwater noise on marine mammals and sea turtles have recently been extended to fish, which are highly sensitive to noise. Noise from construction and operation could affect fish and other marine biota, causing them to leave the project area. Nevertheless, given the extensive maritime use in the region, and the fact that the project site is, as is the case with marine mammals, not known to be a particularly biologically significant area for any fish species (e.g., there are no nearby Pacific Fishery Management Council [PFMC]-designated Habitat Areas of Particular Concern[29], pursuant to the Magnuson-Stevens Fisheries Conservation and Management Act).

Many commercial and recreational vessels transit the area annually. Noise generated by vessel traffic and other construction activities could cause avoidance behaviors in fish within the surrounding area. Many fish are highly sensitive to noise, particularly unusual impulse sounds causing "startle" reactions. Low-level, constant, and/or predictable noises, would allow those species disturbed to simply avoid the noise by swimming away. The types of high-pressure impulse sounds that cause startle reactions, or those having the potential to harm swim bladders in fish (which would be of concern because they can cause fish mortality), would not be associated with the proposed project.

Noise impacts on fish during construction activities would be temporary (and not highly impulsive), and operational noise impacts would consist of broadband noise of a type and intensity that has not, to date, been considered sufficiently loud to warrant mitigation measures based on effects on fish. In any event, the measures (e.g., vibration isolators) being used to reduce marine mammal and sea turtle effects would similarly benefit fish. If residual effects on fish are occurring, they would likely be mitigated by the fish enhancement benefits associated with the entrainment mitigation (i.e., through the creation of artificial reefs).

Discussion

Because the predominant broadband noise would occur at frequencies between 22 Hz and approximately 2.8 kHz, the species unlikely to be affect because they are high frequency specialists include: spotted dolphin, striped dolphin, pygmy sperm whale, northern fur seal and southern sea otter. Species possibly marginally (based on frequency sensitivity) affected include: Pacific white-sided dolphin, northern right whale dolphin, false killer whale, Blainville's beaked whale, harbor porpoise, and sei whale. Low frequency specialists most likely to be affected include: Risso's dolphin, bottlenose dolphin, Hubb's beaked whale, sperm whale, gray whale, minke whale, Bryde's whale, blue whale, fin whale, humpback whale, California sea lion and northern elephant seal.

The greatest concentrations of marine mammals in the region lie off the north shores of the Santa Barbara Channel, immediately south of the established vessel traffic lane and existing oil platforms, implying some degree of tolerance of existing levels of vessel and construction noise by marine mammals. Other concentrations sometimes occur to the southeast of San Miguel and Santa Rosa

[29] These are designations made by the Pacific Fishery Management Council (PFMC) as part of Fisheries Management Plans (FMPs), which define Essential Fish Habitat (EFH) (under the Magnuson Stevens Fisheries Conservation and Management Act.)

Islands, toward San Nicolas Island. Comparatively few marine mammal sightings have been reported at or near the project site, probably because it is not in an area characterized by vigorous upwelling and food production known to attract marine mammals.

BHP states:

> *The offshore noise levels are below the criterion of 120 dBA ref 1uPa at 1 kilometer from the source. Outside this zone no impacts to marine mammals would occur. Within this zone, the noise levels are similar to existing levels for shipping and drilling. These values may produce short-term avoidance behavior, but no long-term, biologically-significant responses are anticipated. No pinniped haul-out areas are close enough to be affected. Therefore, the impacts to marine mammals and fish from construction and operational noise will be less than significant.*

The SLC Draft EIS/EIR states:

> *Implementation of the …[above] mitigation measures would reduce the intensity and duration of anthropogenic noise introduced to the marine environment and would thus reduce impacts on marine mammals to a level below significance criteria. Additionally, avoiding the marine mammal migration season would reduce the numbers of certain marine mammals exposed to noise in the Project site during the construction activities. No impulse sounds are anticipated during normal construction and operational activities.*

Project opponents have expressed concerns over effects on gray whale migration, cumulative additions of anthropogenic noise (which are not well understood), and the project depths (which include the SOFAR channel where sounds travel long distances). They have also questioned whether marine mammal monitors would have the authority to stop construction activities. While, as noted in Exhibit MAR-7, the final monitoring plan has not been prepared, and NOAA Fisheries will need to review it before it can issue an incidental take permit, BHP has clarified, and Commission staff will assure, through its review of the plan, that the final monitoring plans provide for assuring the monitors will have this authority.

Most of the project's construction and operational sounds would be broadband noise, rather than frequency specific. Given the lack of studies or anecdotal evidence of these types of noises, it is difficult to arrive at definitive conclusions regarding broadband ocean noise. Marine mammal responses to underwater noise from vessels and platform and/or pipeline construction projects vary widely. In general, pinnipeds and small cetaceans appear to tolerate transitory or continuous noise and may become habituated to it. For example, California sea lions regularly haul out on mooring buoys and lower decks of oil platforms, and several species of dolphins regularly bow-ride vessels moving through the water. Acoustic deterrents, even to the point of injury, may not stop some marine mammals intent on seeking food sources. Baleen whales generally ignore stationary or distant sounds. If a vessel approaches slowly, with no aggressive moves, whales may shy away from such vessels in subtle ways (Howorth 2006).

While questions have been raised about cumulative impacts, given the project's location, current available evidence does not support the conclusion that broadband construction and shipping-type noise at the levels arising from the subject project warrants imposition of additional mitigation measures. In addition, the vast majority of the sound would occur at or near the top of the water column, which would avoid effects of sounds being emanated from within the deep (600+ m) SOFAR channel.

Moreover, while the Commission remains extremely concerned over the cumulative effects of overall noise in the marine environment, the project site is not a particularly sensitive one in terms of proximity to significant concentrations of marine mammals or to migration corridors, and it is not a breeding grounds for any species of marine mammal other than a few species of dolphins and porpoises (i.e., long-beaked common dolphin, and Dall's porpoise) which breed throughout the Southern California Bight and which are fairly tolerant of human activity and vessel noise. BHP has committed to reasonable and feasible mitigation measures to reduce to the extent feasible effects on marine mammals and sea turtles.

Conclusion

Based on available evidence from past offshore oil and gas construction activities in the Santa Barbara Channel, given the limited duration of the construction activities and the occurrence of these activities outside of gray whale migration season, and with measures to protect mammals within close proximity to the construction noise sources, and monitoring of baseline, construction and operation, the Commission concludes that, with respect to acoustic impacts, while uncertainty over cumulative impacts remains a concern, with the avoidance, monitoring, and mitigation measures, marine resources would be maintained, the acoustic aspects of the project would not adversely affect the biological productivity of coastal waters, and the project would not be located in an area of special biological significance or reduce populations of marine species.

4.1.5 Benthic Habitat Disturbance

Regional benthic habitat assessments of the Southern California Bight have been conducted several times since 1994 as part of the Southern California Coastal Water Research Project's Southern California Bight Regional Monitoring Program. Analysis of bottom trawl and grab samples taken in 1994, 1998 and 2003 throughout the SCB in depths ranging from 6 feet to 600 feet have revealed the presence of a diverse range of invertebrates and fish inhabiting these seafloor habitats. In the most recent 2003 survey, commonly encountered benthic fish species included pacific sanddab (*Citharichthys sordidus*), stripetail rockfish (*Sebastes saxicola*), dover sole (*Microstomus pacificus*), longspine combfish (*Zaniolepis latipinnis*), and shortspine combfish (*Zaniolepis frenata*) and the five most prevalent invertebrate species included white sea urchins (*Lytechinus pictus*), sea pens (*Acanthoptilum*), gray sand stars (*Luidia foliolata*), red octopus (*Octopus rubenscens*), and brokenspine brittlestars (*Ophiura luetkenii*).

Several aspects of the proposed project would result in disturbance, removal and/or permanent occupation of benthic habitat. The primary cause of benthic habitat loss and disturbance associated with this project is from the proposed installation and placement of 22.77 miles of subsea pipelines. These pipelines are anticipated to affect an area of seafloor approximately

22.77 miles long and 200 feet wide, or approximately 553 acres. During the proposed installation of the FSRU, mooring system, and riser pipeline-ending manifold system approximately 10 acres of seafloor at a depth of over 2800 feet would be disturbed. Additional benthic habitat loss and disturbance is also anticipated to be caused by the proposed dredging of two HDB exit holes on the seafloor and the proposed mooring of HDB barges and pipelay equipment. The total area of seafloor affected by proposed HDB activities would be approximately 149,400 square feet or 3.4 acres in depths of close to 40 feet. Overall, the combination of proposed activities described above is anticipated to result in the disturbance and/or loss of approximately 566.4 acres of benthic habitat at depths that range from over 2800 feet to around 40 feet.

Each of the individual activities resulting in seafloor habitat disturbance is analyzed below.

Pipeline Installation

The applicant has proposed to install twin 22.77 mile long natural gas pipelines on the seafloor from the proposed FSRU site to the proposed HDB borehole location, 3,000 feet offshore of Ormond Beach in Ventura County. These pipelines would be 24 inches in diameter and would be laid on the seafloor approximately 100 feet apart and 50 feet from the centerline of a proposed 200-foot wide pipeline right-of-way. The subsea pipeline route would not be trenched and the pipeline would not be buried. Three separate undersea telecommunications cables cross the proposed pipeline route: the Navy RELI cable, the Navy FOCUS cable and the Global West cable. At the intersection of these cables and the proposed pipeline, the applicant has proposed using sandbags, prefabricated concrete mats or prefabricated steel pipe supports to ensure that neither pipeline nor cable are damaged or compromised due to the proposed installation. The total footprint of this proposed pipeline-cable crossing equipment would not exceed the 200-foot pipeline right of way in any of the three crossing areas.

The proposed pipeline right of way encompasses approximately 553 acres of soft substrate benthic habitat, begins in waters approximately 2,850 feet deep and ends upon entering the proposed subsurface shore crossing boreholes in waters approximately 43 feet deep. The proposed route does not traverse any areas of hard substrate habitat or rocky reef. As such, fish or other marine organisms that rely on hard substrate habitats would not be affected by the proposed pipelines. Coastal pelagics and highly migratory species may, however, be disturbed or displaced during pipeline installation activities. These species are highly mobile and would likely avoid the project area during pipeline installation and return once installation activities were completed. Proposed pipeline construction activities are estimated to take up to 35 days, with an average of between one half mile and one mile of pipeline constructed and installed per day, so impacts on the sea floor due to installation activities are anticipated to be localized and temporary.

Some of these anticipated impacts include increased turbidity and suspension of benthic sediments resulting from offshore pipeline installation. These disturbances to benthic sediment would result in the burial of benthic organisms and would adversely affect the feeding ability of filter feeding marine organisms. In addition, some sessile or slow moving benthic organisms directly along the proposed linear pipeline footprint may be crushed or displaced from their habitat by the placement of the proposed pipelines. Considering the relatively small diameter of the proposed pipelines however, re-establishment of these areas from adjacent, undisturbed benthic habitat is anticipated to occur and impacts to the infaunal benthic communities along the proposed pipeline right-of-way are not likely to last more than six to twelve months. Similarly, those benthic species that are adversely affected by the increased turbidity and sedimentation associated with the proposed pipeline installation are likely to suffer only short-term impacts because of the mobile nature of pipeline installation and the fact that even the most fine grained clay sediments that would be disturbed and re-suspended during pipe laying would settle within one or two days at most.

FSRU Mooring and Pipeline Connection

The various mooring and anchor placement activities proposed for the FSRU site, as well as the proposed installation of the pipeline end manifold and riser system, are anticipated to adversely affect roughly ten acres of deepwater (around 2,850 feet in depth) benthic habitat around the proposed FSRU site. Proposed FSRU mooring placement and anchor embedment operations are anticipated to take approximately 20 days (with work occurring 24 hours per day) and would include the use of nine separate high-holding power drag-embedded anchors. During these operations, each anchor would be taken to the FSRU location by a construction vessel and placed on the seafloor at pre-determined mooring location. The anchors would then be dragged over a relatively short distance of seafloor by way of a cable attached to an anchor handling vessel. Dragging the anchors in this way would enable them to dig in their flukes and embed fully below ground until a pre-determined anchor load tension is achieved.

Because sediment around the proposed FSRU site is predominantly fine grained clay, the installation of the nine point mooring system would result in increases in turbidity that would likely last for several days. Clay sediments typically settle at a rate of less than four feet per day and depending upon the speed at which the proposed anchors contact the seafloor and the distance and rate at which they are dragged, sediments may be suspended more than ten feet above the seafloor. As described in the previous two sections, these types of turbidity increases may cause marine organisms to avoid the disturbed area, become displaced from their habitat or experience a decline in foraging and feeding success. These impacts are anticipated to be short-term and localized and confined primarily to those areas directly around proposed anchor placements. In addition, re-colonization of fish and invertebrate species is anticipated to occur from adjacent unaffected areas within a short time after installation activities cease. The disturbance of benthic habitat associated with FSRU mooring and pipeline connection activities is therefore not considered significant.

Offshore HDB Activity

To facilitate the passage of the two subsea natural gas pipelines to shore, horizontal directional boring is proposed to be used to create two 36-inch diameter boreholes beginning in 42 feet of water, 3,000 feet offshore and ending onshore at the Ormond Beach Generating Station. As part of this proposed shore crossing, a near-shore support barge and associated support vessels would be required at this proposed horizontal directional boring (HDB) exit point. A typical offshore HDB equipment layout is presented in Exhibit MAR-8. This equipment is proposed to be used to create a pit 150 feet wide by 200 feet long by 5 feet deep located at the point where the proposed pipelines enter the proposed boreholes that would allow them to transit to shore underground. This proposed pit, called a "transition excavation," would be used to extract and contain any drilling fluids that may be released when the HDB apparatus breaks the surface, to remove the HDB drill head and internal fluid supply and return pipes, and to prepare the ends of the two 36-inch diameter casings that would be used for the two 24-inch diameter pipelines. Upon completion of HDB activities and pipeline installations the transition excavation would remain and would be allowed to fill-in over time due to natural sand movement and current activity.

The proposed transition excavation would result in the excavation of 5,556 cubic yards of benthic sediment habitat and cause a substantial amount of turbidity and sediment suspension in the water column during dredging activities. This dredged material would be placed to the side of the trench and would be used as backfill material upon completion of HDB activities, a process that could again create substantial turbidity clouds and sedimentation in surrounding areas. In addition, the mooring of HDB barges, HDB removal equipment, and pipeline installation vessels during these dredging, pipeline casing and pipeline installation activities would result in the temporary disturbance of approximately 3.43 acres of nearshore benthic sediment around the transition excavation. The primarily sandy sediment in this location provides habitat for a variety of infaunal and epifaunal organisms including a wide variety of invertebrates such as annelid and polychaete worms, crabs, and mollusks and fish species such as halibut, rays, shovelnose guitarfish, and sharks. While the more mobile of these species would likely avoid the area during proposed activities, some sessile or slow moving species are likely to be buried or otherwise adversely impacted by the increases in turbidity and sedimentation from the disturbance of sediment. Reductions in light penetration caused by turbidity increases can reduce foraging and photosynthesis and filter feeding benthic organisms can experience substantial stress and mortality. Reductions in water clarity and ocean surface discoloration can also temporarily affect the ability of seabirds, such as pelicans, to find prey.

However, the impact on these species from the proposed dredging and pipeline installation should be minimal. The Commission has previously found that adult crabs should be able to unbury themselves if sand were placed on them, and that dredging is unlikely to affect seabirds, shorebirds, or marine mammals, including the threatened/endangered species noted above, because the sandy sediments in the project area would settle quickly and dredging and support vessels operate in open water and move slowly. Thus, while the proposed project would have temporary negative impacts on some species, due to turbidity and temporary smothering, it would not adversely affect particularly sensitive or either biologically or commercially important species, and the Commission has historically determined the temporary effects from dredging to be minimal.

Conclusion

The Commission finds that with the implementation of the impact reduction and mitigation efforts described above, Cabrillo Port's potential adverse impacts to benthic habitat would be minimized.

4.1.6 Vessel Strikes

Proposed support, crew and supply transport, and LNG carrier vessels have the potential to affect marine mammal and sea turtle species due to increases in the number and frequency of vessels and trips (compared to the existing level of vessel traffic in the project area) and differences in vessel traffic patterns. Specifically, vessel traffic associated with the Cabrillo Port has the potential to adversely affect federal and/or State listed species of marine mammals and sea turtles in nearshore and offshore waters by increasing the likelihood of vessel strikes and collisions.

Most collisions involving small cetaceans, pinnipeds, sea otters, and sea turtles involve small, fast vessels. In small craft, the noise source and dangerous parts of the vessel are essentially in the same place - the shaft, strut, rudder and propeller are at or near the stern, but the bow is not far away. The proposed operation of the Cabrillo Port would involve the operation of a variety of small tugs, crew vessels, and supply boats that would transit back and forth between the FSRU and Port Hueneme approximately 520 times per year on average. Operation of the port would also require two tugs to continuously patrol the seas around the FSRU to enforce the vessel exclusion area or safety zone that would radiate outward 2,683 feet (818 meters) from the FSRU's mooring point and 1,640 feet (500 meters) from the stern or outer edge of the FSRU itself. These tugs would be slow moving however and are not likely to collide with marine mammals, pinnipeds or sea turtles that could easily move out of the way if approached by Cabrillo Port's patrol tugs. Overall however, the level of proposed small vessel activity associated with the Cabrillo Port would result in an increase in small vessel transits in the project area of roughly 24%, from the current annual average estimated number of transits of 2,208 to the proposed annual average estimated number of transits of 2,728. Although this would be a substantial increase in small vessel transits, the existing level of small vessel traffic in this area has resulted in only one recorded collision between a vessel and a marine mammal, pinniped or sea turtle. This incident occurred in June 1999 when an oil supply vessel struck and presumably killed an adult elephant seal in the Santa Barbara Channel. No other collisions between any oil supply or crew vessels and any cetaceans or sea turtles have been reported in the region. As such, the small vessel traffic associated with the operation of the Cabrillo Port should not result in a significantly increased risk of marine mammal or sea turtle injury or mortality from vessel collisions.

Collisions with large whales usually involve ships rather than small craft. Modern merchant vessels, including LNG carriers, have a bulbous bow section that protrudes forward underwater. On a few occasions, merchant vessels have entered ports, including Los Angeles-Long Beach, with dead whales draped over the bulbous bow section. In other cases, dead whales showing slashes from large propellers have drifted ashore. The primary noise source of an approaching ship may not be close enough to the front of the ship to warn a whale of an approaching vessel and the bulbous bow virtually eliminates the bow wake, producing greater speed and efficiency. For instance, most LNG carriers have design speeds ranging from 19.5 to 21 knots (22.4 to 24.2 miles per hour). In addition, because the wake on these ships is almost nonexistent, noise is also reduced, rendering the bow of the ship very quiet, particularly if ambient sounds such as whitecaps mask sounds from the bow. In large ships, the propeller(s) and engines are located toward the stern, so the primary source of noise is far removed from the bow. Specifically, LNG carriers range up to 950 feet (290 m) in length (slightly longer than the FSRU) which means that the primary noise source is some distance from the bow. During normal operations, the FSRU would receive between 65 and 99 LNG carrier visits at the port annually.

Large ship strikes involving marine mammals and sea turtles, although uncommon, have been documented for the following listed species in the eastern North Pacific: blue whale, fin whale, humpback whale, sperm whale, southern sea otter, loggerhead sea turtle, green sea turtle, olive ridley sea turtle, and leatherback sea turtle. Ship strikes have also been documented involving gray, minke, and killer whales. Collisions with sei, Bryde's, and North Pacific right whales may have occurred in the eastern Pacific, but have not been reported. Despite the average annual passage of approximately 10,000 large (more than 300 gross registered tons) vessels within less than six miles of the project site, very few large ship strikes involving pinnipeds have been reported over the past 28 years by the Santa Barbara Marine Mammal Center (1976–2004) and no sea turtle-ship strikes have been reported in the area, although an olive ridley sea turtle stranded in Santa Barbara in 2003 showed signs of blunt force trauma consistent with a vessel strike. Considering the level of vessel traffic in the region, the lack of reported vessel strikes or other evidence of collisions, and the relatively low number of proposed annual LNG carrier vessel visits to the FSRU, it is possible but unlikely that a collision would occur between a Cabrillo Port LNG carrier vessel and a marine mammal or sea turtle.

Despite the low probability of vessel strikes occurring, to further reduce the likelihood of impacts to marine mammals or sea turtles from the Cabrillo Port's vessels, in its consistency certification BHP has committed to the mitigation measures included in the EIS/EIR (and detailed in Appendix C) which include the requirement to maintain marine mammal observers on all Cabrillo Port construction, crew, supply and support vessels during all construction activities, as each vessel travels to and from the construction site and as supply, support and crew vessels travel to and from the project site during operation. These observers would be authorized to stop the forward progress of the ship if marine mammals or sea turtles are sighted within 1000 yards of the ship and continuation of the ship's progress would be delayed until the animal leaves the area. Furthermore, because the offshore construction phases of the project may involve an increase in vessel traffic throughout the project area for several months, beyond the vessel traffic projections for normal operation of the Cabrillo Port, BHP has also committed, in its consistency certification, to conducting all offshore construction activities between June 1 and November 30, outside of the gray whale migration season (as described in Appendix C). In addition, prudent seamanship includes avoiding all large objects in the path of a vessel, including whales. In the unlikely event that such an impact occurred, it would be considered either a Level A harassment or a Level B harassment under the Marine Mammal Protection Act, depending on whether the animal was injured or not. Such events would require immediate reporting and consultation with NOAA.

Conclusion

The Commission finds that with the implementation of the measures described above, potential adverse impacts caused by vessel strikes would be minimized.

4.1.7 Marine Mammal Entanglement

Numerous marine mammal entanglements in synthetic materials have been documented on the West Coast. The most common entanglement is in various fishing nets or lines. Entanglements in moorings, crab and lobster trap float lines, and mariculture buoys also have been reported. Given the presence of marine mammals throughout the various proposed construction sites associated with the Cabrillo Port project, as well as the variety of mooring lines, anchor cables, pipelaying equipment, and diver support lines that are proposed to be used, the potential exists for marine mammals to become injured or entangled during construction.

During the HDB phase of offshore construction, divers would help align the HDB pipelines coming out from shore to the offshore pipelines so that they can be connected. In the course of such operations, dive support vessels and perhaps a dive barge would be moored over the HDB pipelines where they emerge from the seafloor in approximately 40 feet of water depth. Associated mooring lines, as well as down lines, divers' air hoses, marker buoy lines, and other lines pose a risk of entanglement for marine mammals and sea turtles. In addition, as many as 32 offshore mooring system anchor cables are proposed to be in place for approximately 108 days during HDB operations to facilitate the use of barges, cranes and other HDB equipment.

Although the proposed installation and placement of the two 22.77 mile long undersea natural gas pipeline is anticipated to take just over a month to complete, these activities would require a variety of cables, anchor lines, and underwater equipment which may present an entanglement hazard for marine mammals. In addition, as indicated in Exhibit MAR-9, the proposed pipeline route passes through typical gray whale migration corridors in several locations.

The installation of the FSRU mooring system and pipeline connections would require the use of a number of anchor cables and mooring lines for approximately 20 days and would also include the permanent placement of lines which would stretch approximately 3000 feet from the anchor points on the seafloor to the FSRU itself. Both temporary and permanent lines and cables present an entanglement hazard for marine mammals.

In numerous past projects in the region, monitors have been deployed to observe dive operations associated with pipelaying and repairs, HDB activities, and similar operations. The methodology has been successful, with no reported adverse impacts on marine mammals and sea turtles. As such, in its consistency certification BHP has committed to the mitigation measures included in the EIS/EIR (and detailed in Appendix C) by maintaining marine mammal observers on board all Cabrillo Port vessels during all HDB activities, pipeline installation activities and FSRU mooring activities; committing to conducting all offshore construction activities between June and November -outside of the recognized gray whale migration season; deploying potentially entangling material for only as long as necessary; removing as much slack as possible from lines; and immediately notifying the local NOAA Fisheries stranding coordinator and the Santa Barbara Marine Mammal Center if a marine mammal or sea turtle becomes entangled. Considering BHP's adherence to these measures as well as the relatively short time period in which proposed offshore construction activities would occur, it is unlikely that the project would result in significant risk to marine mammals from entanglement.

Conclusion

The Commission finds that with the implementation of the measures described above, potential adverse impacts due to entanglement would be minimized.

4.1.8 Unexploded Ordnance

The proposed pipeline route passes through an offshore area that has historically been used, and is currently being used, by the U.S. military for training and practice exercises. The use of ordnance and live ammunition within this area, the Point Mugu Sea Range, over the past several decades has increased the potential existence of unexploded ordnance on the seafloor. Disturbance and/or accidental contact with this potentially live ammunition during pipeline installation or FSRU mooring activities has the potential to result in undersea explosions, destruction of marine habitat, propagation of high levels of undersea sound and fatal or substantial injury to marine life. Although these potential occurrences are extremely unlikely, due to the relatively small amount of ordnance that potentially exists in this area and the decaying nature of seawater that would likely render this ordnance useless over time, the applicant has committed to conducting an unexploded ordnance survey along the portion of the pipeline route that passes within the Point Mugu Sea Range, approximately 12.2 miles. This survey would substantially reduce the potential for interactions between the proposed pipeline and/or pipe-laying equipment and unexploded ordnance within the Point Mugu Sea Range area.

Conclusion

The Commission finds that with the implementation of the measures described above, potential adverse impacts due to unexploded ordnance would be minimized.

4.1.9 Water Quality

The following sections discuss potential water quality impacts due to construction and operation of the Cabrillo Port project, including: (1) planned discharges from the FSRU, LNG carrier vessels and Cabrillo Port support vessels; (2) increases in turbidity during the installation of the FSRU mooring system and natural gas pipelines, and the excavation of the HDB exit pits; (3) re-suspension of contaminated sediments during these activities; (4) accidental and planned releases of drilling fluids during HDB operations; and, (5) potential erosion and sedimentation of the Mugu Lagoon Canal during planned slick bore operation.

Planned Discharges

Proposed daily operation of the Floating Storage and Re-gasification Unit, LNG carrier vessels and the various tugs and small support ships that would service the Cabrillo Port would necessitate the periodic planned discharge of sanitary wastes, graywater, ballast water, storm water and washdown water, desalination water, once-through-cooling water, bilge water, submerged combustion vaporizer wastewater and fire control system test water. All of these various proposed discharges would be regulated by the U.S. EPA under its proposed National Pollutant Discharge Elimination System (NPDES) permit which establishes and regulates effluent limitations guidelines and technology based controls for all of the Cabrillo Port's ocean discharges.

Floating Storage and Re-gasification Unit

The proposed operation of the FSRU would result in the planned release of the following discharges and volumes:

Ballast Water: Seawater would be added to and/or removed from the FSRU's ballast tanks to maintain proper draft and trim of the facility when LNG loads are being received or sent to shore. On average, approximately 4.3 million gallons of ballast water per day would be discharged into the ocean at the FSRU site. The proposed NPDES permit would prohibit the discharge of both oil and floating solids or foam in this water and would require visual observations of the receiving waters during daylight hours to determine compliance with these prohibitions. Despite these proposed regulations, the discharge of ballast water from the FSRU would still contain elevated levels of biomass as a result of the entrainment of organisms in the ballast intake system. This biomass discharge may provide a nutrient source for marine organisms in the proposed project location, resulting in locally elevated concentrations of marine life that would in turn be susceptible to entrainment. Given the depth of water and current circulation patterns and velocities at the project site, any potential accumulation of biomass in the water column would be quickly dispersed horizontally and vertically throughout the water column and would not be likely to result in adverse impacts to marine water quality or its biological productivity.

Submerged Combustion Vaporizer Wastewater: In addition to seawater, discharged ballast water would also include approximately 190,000 gallons per day of wastewater from the submerged combustion vaporizer units that are used to convert LNG back into non-liquid natural gas. The submerged combustion vaporizer process generates slightly acidic fresh water as a waste product. The applicant is proposing to treat this water with soda ash to offset its acidity and ensure a level of neutral pH prior to its discharge into the ballast tanks. Under the proposed NPDES permit, the pH of the submerged combustion vaporizer wastewater would be required to remain between six and nine standard units prior to mixing with seawater in the ballast tank and daily monitoring of the submerged combustion vaporizer wastewater would be required to demonstrate compliance with this limit. In addition to soda ash, submerged combustion vaporizer wastewater would also contain small concentrations of sodium, dissolved solids and nitrate. While the sodium and dissolved solids concentrations in the submerged combustion vaporizer wastewater would be inconsequential in comparison to the background concentrations of these materials in seawater, nitrate concentrations would be slightly elevated. Specifically, the proposed concentration of nitrate-N in the submerged combustion vaporizer water would be 1.13 mg/L, slightly higher than the ambient concentration of nitrate-N in seawater. This level of nitrate-N discharge would not result in a substantial or measurable degradation of marine water quality. To ensure that additional unanticipated pollutants are not also included in the submerged combustion vaporizer wastewater, EPA is requiring in its proposed NPDES permit that a sample of this discharge be taken and analyzed for the presence and concentration of priority toxic pollutants one month after initiation of submerged combustion vaporizer wastewater discharges. If these test results indicate that submerged combustion vaporizer wastewater discharges may cause or contribute to an exceedance of either EPA marine water quality criteria or California Ocean Plan objectives, EPA may reopen the proposed NPDES permit to establish additional effluent limitations or monitoring requirements.

Cooling Water: Despite the BHP's use of a closed-loop cooling system to cool the engine room onboard the FSRU during normal operations, the periodic use of a backup once-through cooling system during periodic maintenance activities would still be required. These activities would occur over the course of four days per year on average and the corresponding use of once-through cooling would result in the intake and discharge of approximately 17.4 million gallons of seawater. The thermal component of this cooling water discharge is discussed below. In addition to having an elevated temperature, the proposed cooling water discharge would be treated with hypochlorite and copper to inhibit the growth of marine life within the pipes and associated cooling system infrastructure. The proposed NPDES permit would require that both copper and chlorine discharges in cooling water adhere to the standards established under EPA's chronic marine water quality criteria or the California Ocean Plan six month median objectives (whichever is more stringent). The proposed NPDES permit stipulates that these standards would be enforced through once-daily monitoring for residual chlorine and copper concentrations in the discharge water. This monitoring data would be used to evaluate the reasonable potential for cooling water discharges to cause or contribute to the exceedances of applicable water quality criteria at the edge of the 100-meter mixing zone. Based on the results of this evaluation the proposed permit may be reopened and modified to establish additional effluent limitations and monitoring requirements. With the inclusion of these measures under the proposed NPDES permit, and because cooling water discharges would occur only four days per year, there would be no reasonable potential for cooling water discharges to contribute to the degradation of marine water quality or the loss of its biological productivity.

Inert Gas Generator Cooling Water: Proposed maintenance of the FSRU's natural gas and liquefied natural gas storage tanks, pipes and associated infrastructure involves the use of an inert gas generator system for approximately four days per year. This system allows the storage tanks and pipes to be emptied and re-filled with inert gas to allow maintenance and structural integrity inspections to occur. The use of the inert gas generator system requires the intake and discharge of approximately 41.8 million gallons of seawater per year for cooling purposes. This seawater would be discharged at an elevated temperature, as discussed below, and would be treated with chlorine and copper to prevent the accumulation of living marine organisms within the cooling and seawater intake system. The levels of chlorine and copper in this cooling water would be regulated under the proposed NPDES permit in the same manner as the cooling water associated with the backup engine room cooling system. Specifically, compliance monitoring would occur once per day during discharge and the concentrations of copper and residual chlorine in the discharged seawater would be required to adhere to the stricter of EPA's chronic marine water quality criteria or the California Ocean Plan's six month median objectives. Based on the fact that inert gas generator system cooling water would only be discharged on four days per year and would be regulated in compliance with EPA and California Ocean Plan water quality standards, the Commission finds that this discharge would not result in the degradation of marine water quality.

Bilge Water: Bilge water refers to the fluid that collects in the bottom of a ship as a result of leaks in the propulsion and ballast intake systems. The estimated volume of bilge water that would accumulate in the FSRU is approximately 240,000 gallons per year. Although bilge water is expected to be clean, this water would be treated prior to discharge into the ocean in an oil/water separator. Any oil collected in the separator would be placed in drums for subsequent disposal at an onshore licensed hazardous waste disposal facility in accordance with federal, State and local regulations. Under the proposed NPDES permit, the bilge water discharge would be subject to daily visual monitoring to ensure that neither visual sheens nor floating solids or foam appears on the receiving water . With this monitoring, the proposed bilge water discharges are not likely to degrade marine water quality.

Sanitary Wastes and Gray Water: The volume of gray water generated on board would be approximately 2,625 gallons per day, assuming that each of the permanent crew of 30 personnel would use 87.5 gallons per day, and the annual volume of gray water would be approximately 958,175 gallons. This gray water would be treated using filtration to separate particulate matter and UV oxidation to destroy dissolved organic materials. Treated gray water from the FSRU would be discharged to the ocean from a port in the stern, below the water line, in accordance with the proposed NPDES permit that would be issued by the EPA. This proposed permit would require daily visual monitoring of the discharge to ensure that no discharge of foam or floating solids occurs.

Sanitary wastes generated on board the FSRU are estimated at approximately 87 gallons per day or 31,755 gallons annually. These wastes would be treated aboard the FSRU using a U.S. Coast Guard certified Type II Marine Sanitation Device with a sewage digester to reduce the volume of sanitary wastes. The marine sanitation device would generate 87 gallons per day of treated water and 57 gallons of sludge per day. The liquid effluent from the treatment system would be discharged to the ocean in accordance with the facility's proposed NPDES permit and the sludge would be containerized and transported to shore for proper disposal at a local wastewater treatment facility once every three months in accordance with federal, State, and local regulations. The proposed NPDES permit for this discharge would require a total residual chlorine concentration in the discharge of at least one milligram per liter with a maximum total residual chlorine concentration of ten milligrams per liter. In accordance with the proposed NPDES permit, the concentration of residual chlorine within this waste stream would be measured daily to ensure that it remains between the required limits of one milligram per liter and ten milligrams per liter.

Because of the small volume of gray water and sanitary waste effluent that would be released daily, the treatment that these discharges would undergo, and the proposed monitoring and chlorine concentration limits required under the proposed NPDES permit, it is unlikely that the discharge of sanitary wastes and gray water would adversely affect coastal waters.

<u>Deck Drainage and Stormwater</u>: Deck drainage consists of stormwater runoff and washdown water from the FSRU. The total estimated deck surface of the proposed FSRU would be 199,853.5 square feet. The annual average rainfall in Oxnard from July 1948 to July 2003 was 14.77 inches. Therefore, the anticipated annual deck drainage from stormwater would be approximately 1.84 million gallons. The actual volume may vary because precipitation values for the FSRU location are not available at this time and the rainfall value used in this calculation is for an onshore location. In addition, weekly washdown activities on the FSRU would use approximately 5,077 gallons for a total estimated annual volume of deck washdown water of approximately 264,000 gallons.

For safety reasons, all rainwater and deck washdown water would be allowed to flow off the FSRU unimpeded along the length of the facility, except in secondary containment areas where the water could become contaminated with oil. Water within secondary containment areas would be processed through an oil/water separator before being discharged to the ocean. The separator would be designed to handle the maximum anticipated flows and meet the performance standards of the EPA and the facility's proposed NPDES permit, which stipulates that no free oil would be discharged in deck drainage. Oil collected in the oil/water separator would be containerized and transported to shore for proper disposal in accordance with federal, State, and local regulations. To ensure compliance with the requirements of the proposed NPDES permit, visual monitoring would be required during all deck drainage events during daylight hours and the presence of a visual sheen on the receiving water would be noted and reported in the required quarterly discharge monitoring report. With the inclusion of measures to reduce the discharge of oil in deck drainage water, including the monitoring requirement included in the proposed NPDES permit, the discharge of deck drainage water has no reasonable potential to result in the degradation of marine water quality.

<u>Fire Control System Test Water</u>: The main firefighting system would be tested annually using approximately 105,700 gallons of seawater, and then flushed with an equal volume of fresh water generated by the submerged combustion vaporizers. Each of the four firefighting pumps would be tested monthly (one pump each week for 48 weeks per year) for approximately 15 minutes and would require 5,725 gallons per minute, or 85,855 gallons per test. Consequently, the volume of seawater required for testing the firefighting pumps would be approximately 4.12 million gallons per year. In addition, each of the 25 deluge valves onboard the FSRU would be tested monthly using a total of approximately 49,575 gallons per month of fresh water, generated by the submerged combustion vaporizers. The total firefighting water demand for the FSRU, in the event of an actual fire, is estimated to be 634,000 gallons per hour. The discharge of this fire control system test water would result in deck drainage and, as discussed above, would not result in the degradation of marine water quality.

Marine Paint: The hulls of marine vessels are typically coated with a paint containing a biocide to prevent the growth of algae and the adherence of marine organisms such as barnacles. The EIS/EIR states that the International Convention of the Control of Harmful Anti-fouling Systems on Ships (the Convention) has been promulgated but has not yet been ratified (although ratification would likely occur in 2008). At that time, Annex I of the Convention is expected to include the following restrictions and requirements for vessels, including FSRUs, in excess of 400 gross tons:

- Vessels shall not bear anti-fouling/biocide compounds on their hulls or external parts or surfaces; or,
- Shall bear a coating that forms a barrier to such compounds leaching from the underlying non-compliant anti-fouling system.

The EIS/EIR further states that because the Convention would likely be ratified by the time that the project is estimated to begin construction, all new project vessels would be required to comply with the stipulations of the Convention. With the inclusion of these regulations that would prohibit the presence of leachable anti-fouling chemicals on the Cabrillo Port's vessels, there would be no reasonable potential for marine paint to result in the degradation of marine water quality.

Support and Construction Vessels

All Cabrillo Port support and construction vessels would meet applicable national and international design and operational standards. Vessels over 300 gross tons are prohibited by the California Clean Coast Act from discharging oily bilge water, gray water, or sewage within three nautical miles (3.5 miles) of any coastline, and vessels equipped with toilets are required to install a marine sanitation device. The International Convention for the Prevention of Pollution from Ships established regulations that apply in federal waters. Under Annex I of these regulations, no vessel can discharge oil residues in the project vicinity. Vessels operating more than three nautical miles from the coast must either grind up and disinfect their sewage, or use a marine sanitation device under Annex IV of the International Convention for the Prevention of Pollution from Ships. Gray water, including shower, bath, and laundry water, is not regulated in federal waters and therefore can be discharged untreated. Gray water and treated sanitary waste water can be discharged in federal waters as allowed by applicable federal law and international agreement. Construction vessels would be required to be underway and out of State waters before discharging gray and treated sanitary waste water.

Since no vessel could discharge gray water, black water, or bilge water within three nautical miles (3.5 miles) of shore and all potential discharges would be in the open ocean, it would be unlikely that any discharges from support or construction vessels would alter water quality within coastal waters. In addition, based on the low volumes of sanitary waste water and gray water that would be discharged in federal waters, it is highly unlikely that these discharges would result in the degradation of marine water quality.

The offshore pipeline pipelay vessel would have both a holding tank and a U.S. Coast Guard approved marine sanitation device for sanitary waste and gray water handling that would comply with applicable marine and environmental regulations. Sanitary waste water would be diverted to a holding tank, offloaded in port, and disposed of in a land based sewage treatment plant. Because the pipelay vessel would house up to 200 personnel, it could discharge between 10,000 and 15,000 gallons of combined waste water daily for 35 days when operating outside of State waters.

Gray water generated by other construction vessels would be anticipated to be minimal because few, if any, people would be housed on those vessels. The exact composition of the gray water would be unknown and could differ daily. The barge would be moving 1.87 nautical miles (2.2 miles) per day; therefore, the discharge would be dispersed by the current over the construction corridor and not discharged in a single location.

Project tugs would be equipped with a U.S. Coast Guard approved marine sanitation device for sanitary waste and gray water handling. Therefore, both would be treated before being discharged. Up to 10 people would be housed on the vessels and the volume of combined discharge would range from 385 to 560 gallons per day per tug. In general, this discharge would occur within the safety zone of the FSRU while the tugs are patrolling. The project crew vessel would only be used to transport crew and material; therefore, it would generate a minimal amount of gray water. It would not be equipped with a marine sanitation device, but would have a holding tank for sanitary wastes generated during its voyages. The contents of its holding tanks would be offloaded at Port Hueneme for proper disposal.

Given the existing State regulations prohibiting the discharge of sanitary wastes within State waters and the relatively low volumes of sanitary wastes and gray water that would be generated by the Cabrillo Port's support and construction vessels, discharges from these vessels are not likely to degrade marine water quality.

Conclusion

With the inclusion of discharge limitations, compliance monitoring requirements and discharge reporting provided under the FSRU's proposed NPDES permit, as well as the State water quality regulations prohibiting sanitary waste disposal and requiring the use of marine sanitation devices with State waters, the Commission finds that the marine discharges associated with the offshore components of the proposed project would not result in the degradation of marine water quality or the loss of its biological productivity.

Turbidity Increases and Disturbance of Contaminated Sediments

The proposed installation of offshore pipelines, the FSRU mooring system and pipeline connection as well as the anchoring of HDB support vessels and the conduct of offshore HDB activities would disturb seafloor sediments causing a short-term increase in turbidity or accidental disturbance and/or spread of contaminated sediments. This temporary increase in turbidity could reduce light penetration, discolor the ocean surface, alter the ambient pH and dissolved oxygen content of seawater, or interfere with filter-feeding benthic organisms sensitive to increased turbidity.

The proposed offshore pipelines would not be trenched or buried and therefore potentially contaminated sediments that may exist along the proposed pipeline route would not be excavated. Nevertheless, the pipelaying process could stir up contaminated materials that may be contained within the upper layers of benthic sediment along the 22.77 mile long pipeline route. Contaminants have not been documented within the benthic sediments along this route historically and are not assumed to exist at elevated concentrations. However, due to the depth at which the pipeline would be installed as well as the length of the proposed pipeline route, thorough sampling and contaminant testing of these sediments were not conducted and correspondingly there is no direct evidence supporting this assumption. Given that seafloor sediment disturbances would be of small quantities and for short durations, as these sediments would settle back to the seafloor within a matter of days, the potential disturbance and re-suspension of contaminants that may exist within the pipeline right of way would not result in a substantial long-term deterioration of marine water quality. Similarly, though increases in turbidity resulting from pipelaying activities would reduce local water quality at and around the pipeline and may adversely affect marine organisms such as filter feeding species and some species of fish that depend on visual cues to forage, these affects would also be short-term and insignificant.

As described above in Section 5.1.5, “Benthic Habitat Disturbance,” during installation of the FSRU mooring system and pipeline connection apparatus, approximately ten acres of soft-bottom seafloor would be temporarily disturbed and turbidity levels in the water column above the seafloor in this area would be elevated. This increase in local sediment suspension would result in direct reductions in water quality but these affects would decline over time as the seafloor disturbing activities were completed and sediments settled once again. The installation of the FSRU anchoring system would take place 24 hours per day for as many as 20 consecutive days, resulting in water quality impacts for this entire period as well as several days afterwards as sediments slowly settle out of the water column. The area of affected water quality is expected to be substantially larger than the ten acre area of seafloor disturbance due to below-surface currents and the expected dispersion of the sediment plume. Though lasting for close to a month and reducing the water quality in more than ten acres of open ocean, the installation of the FSRU mooring system would not permanently reduce water quality and the biological productivity of marine waters. Locally affected populations of marine organisms would be expected to return to the affected area once installation activities were completed and water quality levels were allowed to naturally recover.

Similar to the impacts to water quality that would be associated with the proposed installation of the FSRU mooring system and pipeline connection, the proposed mooring of construction vessels and sediment dredging during the operation of offshore HDB activities would also result in short term reductions in water quality. Because HDB activities are proposed to be conducted in a nearshore area of relatively shallow water depth and sandy substrate habitat, potential water quality affects would be of a different magnitude and duration and may result in distinct impacts to the biological productivity of these waters. Primarily because sediment grain sizes are substantially larger at the proposed HDB site in comparison to the FSRU site, the amount of time it would take for these sediments to settle would be significantly reduced.

As such, turbidity plumes resulting from the mooring of construction vessels and barges and the dredging of an HDB exit pit would be smaller in size and would persist in the water column for a shorter period of time. HDB activities are proposed to be conducted over the course of 108 days but sediment disturbing activities would only be conducted for a portion of that period. Marine water quality would not be substantially affected by HDB mooring activities.

BHP conducted sediment testing for heavy metals, organochlorines and polycyclic aromatic hydrocarbons at several locations around the HDB site and offshore of the Ormond Beach Generating Station. These tests failed to demonstrate contaminant levels of any material above the effects-range low (the lowest level of contaminant concentration that is known to result in adverse biological effects). In addition, no known ocean dumpsites that might contain hazardous waste materials are located within one-half mile of either the proposed FSRU location or the route of the subsea pipelines.

Conclusion

For the reasons cited above, the Commission finds that it is unlikely that hazardous materials or contaminants exist in the vicinity of any of the proposed activities, and that the proposed project does not pose a risk of adverse impact to marine water quality from disturbance or re-suspension of contaminated sediments.

HDB Drilling Fluid Releases

The proposed project would include the use of HDB technology to facilitate the proposed underground shore crossing of the two natural gas pipelines. The HDB boring process uses drilling fluid to run the bore motor in the bore head, to cut through underground sediment along the bore route, to seal off fractures along the bore route, and to lubricate the bore pipe during installation. Drilling fluid is pumped down the inside of the bore pipe and exits through the bore head. The fluid is drawn into the outer casing that is being installed simultaneously and is returned to the HDB entry site where it is recycled back to the bore head. At the beginning of the bore, a large percentage of the drilling fluid returns to the bore site. As the bore proceeds, fluid returns may gradually decrease because the porosity of the substrate along the bore route would cause fluids to be absorbed. In addition, the force of gravity acting on the fluids may overcome the pressures forcing the fluid back to the drilling site. Also, if cracks or fissures were encountered along the HDB route, drilling fluids could travel along them and eventually be released into ground water or surface water bodies. These releases of bentonite and sediment laden fluids would result in turbidity and sedimentation and would temporarily reduce water quality at the point of their release and surrounding waters. To address this potential impact to water quality and reduce the likelihood of a drilling fluid release, BHP has developed a Drilling Fluid Release Monitoring Plan (detailed in Appendix C) that includes the following measures:

- Adjusting the viscosity of the drilling fluid mixture to match the substrate conditions;
- Closely monitoring boring pressures and penetration rates so use of fluid pressure will be optimum to penetrate the sediments;

- o When loss of circulation occurs, spending very little time trying to regain returns once under the sea floor. This would reduce the potential for over-pressurization at a single point and the subsequent migration of drilling fluid to the surface;
- o Using best available engineering techniques to minimize the volume of lubricants applied to the cables within the bore pipe and bore head and discharged to the marine environment and to contain the lubricant within the bore pipe;
- o Maintaining containment equipment for drilling fluids on site;
- o Adding a non-toxic color dye to the drilling fluids to easily and quickly detect releases;
- o Ensuring that a qualified environmental monitor or suitably trained water quality specialist is on-site full time near sensitive habitat areas;
- o Stopping work immediately if there is any detection of bentonite seeps into surface water or sensitive habitats, for example by a loss in pressure or visual observations of changes in turbidity or surface sheen;
- o Reporting all bentonite seeps into waters of the State or sensitive habitat immediately to the project's resource coordinator, and the appropriate resource agencies; and
- o Cleaning up and properly disposing of any releases of drilling fluids to the satisfaction of the regulatory agencies.

Implementation of this Drilling Fluid Release Monitoring Plan would minimize the occurrence and volume of a potential accidental release of drilling fluids, and if such a release were to occur it would be quickly identified, reported, contained and removed to the extent feasible.

Despite these mitigation measures, the proposed exit of HDB boring heads on the seafloor could nevertheless result in the release of up to 10,000 gallons of drilling fluids and drilling mud into the surrounding waters. BHP would incorporate a variety of operational measures to minimize the volume of this release, including using a suction pump at the HDB bore head to withdraw as much drilling fluid from the bore hole as possible as it penetrates the seafloor, but a substantial quantity of drilling fluids would still be released. These drilling fluids would be warmer than surrounding seawater and studies have shown that drilling fluid forms lightweight flocs (or aggregate clouds) when it reacts with cold seawater. These warm drilling fluid flocs can extend upward into the cooler water column where turbulence and currents can cause the drilling fluids to disperse and spread over a large area. To address this issue, BHP has proposed constructing a transition excavation at the offshore HDB exit point to help contain drilling fluids and to station divers within this excavation that would use underwater vacuum hoses to remove drilling fluids as they are released. The vacuum hoses would be attached to a surface support barge and vacuumed HDB drilling fluids and seawater would be collected within holding tanks and disposed of as required. Although the use of these measures would not guarantee the capture all released drilling fluids, the amount of fluid released to the marine environment would be greatly reduced. Substantial turbidity clouds resulting from these activities would still occur but the resulting decrease in marine water quality would be short term and localized.

Conclusion

The Commission finds that the proposed HDB activities pose only minimal risks to marine water quality and that BHP is including all feasible measures to reduce that risk and minimize the volume of drilling fluids that may be released intentionally or accidentally.

Thermal Discharges

BHP has designed the FSRU's engine room cooling system to avoid the intake and discharge of seawater under normal operations. The proposed closed-loop, tempered water cooling system would transfer all heat generated by the engine room (by electrical generators, heating/air conditioning system, and freshwater maker) to two submerged combustion vaporizer water baths via plate heat exchangers. The use of seawater would only be required during occasional (four days per year) operation of the backup once-through cooling system and would equate to approximately 181,486 gallons per hour or 4,360,000 gallons per day for four days a year. Annual ocean discharges associated with this seawater intake by the backup system would be approximately 17.4 million gallons per year.

In addition, for an additional four days per year, seawater would also be used in the inert gas generator cooling system. The inert gas generator would never operate at the same time that the backup once-through cooling system is in operation but would use approximately 435,000 gallons of seawater per hour or 10.4 million gallons per day for four days. Estimated annual ocean discharges associated with the inert gas generator would be 41.8 million gallons.

Both discharges described above would be at elevated temperatures and would be considered to be thermal discharges. Thermal discharges within State waters are regulated under sections 3B(3) and 3B(4) of the California Thermal Plan which stipulates that discharges into marine waters may not be more than 20 degrees Fahrenheit above the ambient temperature of the receiving water body and that surface water temperatures must not be more than four degrees Fahrenheit above the ambient temperature of the receiving water at a distance of 1000 feet from the discharge point. Despite the fact that the proposed location of the FSRU is outside State waters, the U.S. EPA has recognized that the thermal limits of the California Thermal Plan represent a standard for the analysis of adverse effects due to changes in temperature in a receiving water body and has therefore incorporated these thermal requirements into the proposed NPDES permit. To ensure compliance with these thermal discharge limits, EPA would require, as part of the Cabrillo Port's NPDES permit, that monitoring of both the ambient ocean temperature as well as the cooling water discharge temperature (sampled at the outfall point) is conducted on each day of discharge. EPA has also included in the proposed NPDES permit a condition that states that modeling using EPA's PLUMES model (or receiving water sampling) would also be required on each day of thermal discharge to demonstrate compliance with the surface water temperature limit 1,000 feet from the discharge point. The result of both of these monitoring efforts would be compiled and reported to the EPA every three months in a quarterly discharge monitoring report.

To demonstrate the feasibility of compliance with the California Thermal Plan discharge limits, BHP has performed thermal plume dispersion modeling to simulate the fate and transport of heated discharge from the backup engine room once-through cooling system and the inert gas generator seawater cooling system and allowed the results to be independently verified. This modeling was performed using EPA's PLUMES model for the range of ambient seawater conditions expected in the vicinity of the deepwater port and assuming discharge temperatures of 20 degrees Fahrenheit above ambient ocean temperatures. Results showed that in all cases the plume temperature was predicted to dilute to less than four degrees Fahrenheit above ambient seawater temperature at distances of less than 1,000 feet from the point of discharge (compliant with the requirements of section 3B(4) of the California Thermal Plan). Plume temperatures diluted to less than one degree Fahrenheit above ambient in distances ranging from 50 to 2,000 feet, depending upon the volume of discharge, the velocity of the ocean currents, and seawater density.

Conclusion

With the inclusion of EPA's compliance monitoring requirements and the demonstrated feasibility of compliance with the California Thermal Plan discharge limits, the Commission finds that the FSRU's proposed thermal discharges would not substantially degrade marine water quality or its biological productivity.

Erosion and Sedimentation

The movement of equipment and materials during construction could destabilize the soil surface and increase erosion potential from water and wind along the pipeline route and in the staging areas. Construction activities and loss of vegetation could cause accelerated erosion on steep slopes and in erosion-susceptible soils. Also, construction activities could cause erosion before vegetation is re-established. Any of these scenarios could lead to potential sedimentation of nearby creeks, canals and/or drainages.

The most likely time for erosion to occur is after initial disturbance of the unpaved ground surface and before re-establishment of vegetative cover. A soil's susceptibility to erosion varies and is a function of characteristics such as texture and structure, topography (steepness of slope), surface roughness, amount of surface cover (vegetative or other); and climate. Erosion potential increases the longer soils are left bare. Erosion from water mainly occurs in loose soils on moderate to steep slopes, particularly during high-intensity storm events. Changes in drainage patterns as a result of the project's construction could result in erosion of the soil following construction.

The EIS/EIR states that substantial erosion is not anticipated in the Ormond Beach Generating Station area or in adjacent areas because of the relatively flat to gently sloping topography. However, soils along the pipeline route adjacent to the Mugu Lagoon Canal have slight to moderate erosion potential because they have a slight slope. Erosion in this area could lead to increased turbidity or sedimentation in the Mugu Lagoon Canal, especially during slick bore and trenching activities and the excavation of drilling pits.

To help protect surface water quality by minimizing the occurrence of erosion and reducing the amount of erosion that may enter the Magu Lagoon Canal, BHP would conduct a variety of erosion control and mitigation measures. These measures (detailed further in Appendix C) include commitments to:

- Locate the slick bore entry and exit pits sufficiently far from the Mugu Lagoon Canal to avoid migration of groundwater into the entry or exit pits;
- Isolate the slick bore pits with silt fencing to avoid sediment transport into the canal;
- Isolate the spoils storage areas with silt fencing to reduce sediment transport;
- Undertake and complete proper spoils disposal and re-vegetation upon completion of bore operations;
- Consult with regulatory agencies and water quality specialists to determine appropriate clean-up responses if erosion or sedimentation occurs;
- Transport and excess trench spoils that would not be used to backfill trenches or bore pits would be transported and disposed of offsite at an appropriate facility; and,
- Use a qualified environmental monitor or suitably trained water quality specialist would be present at the Mugu Lagoon Canal crossing site to ensure compliance with applicable permits and mitigation measures.

Conclusion

With the inclusion of these erosion control and onshore water quality protection measures, the Commission finds that the proposed onshore construction activities would not result in the degradation of water quality within the onshore portions of the coastal zone.

4.1.10 Summary of Anticipated Marine Resource Impacts and Mitigation

The project would result in adverse effects from entrainment and impingement of marine life, disturbance to nocturnal seabirds from night lighting, disturbance to marine mammals, sea turtles, and fish from underwater noise, disturbance and loss of benthic habitat from moorings, anchors, and pipelines, risks of vessel collisions with marine mammals and sea turtles, risks of disturbance and entanglement of marine mammals whales during pipeline installation, potential destruction of marine habitat, organisms and water quality from accidents, erosion and planned and accidental discharges. To avoid, where feasible, monitor, and mitigate these impacts, BHP has committed to:

Lighting

- Develop a lighting plan in consultation with a marine bird expert which will include shielding lights and limit lighting to the minimum necessary to perform project activities and maintain compliance with safety and security requirements;
- Provide $100,000 to the USGS's Western Ecological Research Center to develop and implement an onsite marine bird monitoring program that will include taking periodic representative samples of the density and diversity of the seabirds that are attracted to the FSRU at night; and,
- Provide $300,000 to augment and extend existing seabird nesting habitat restoration and population enhancement projects within the Channel Islands National Park.

Noise

- Marine mammal monitoring;
- Avoid construction during the gray whale migration season;
- Maintain high flight altitudes for helicopters;
- Install noise reducing devices to the extent feasible;
- Establish a safety zone of 1,000 ft around construction activities, with cessation of activities if marine mammals or sea turtles are within the designated safety range;
- Include passive acoustic monitoring during operations, including installing and operating an array of autonomous recording units to monitor and evaluate underwater sound output from the project before construction and for at least five years of operation;
- Include Commission staff in the development of the monitoring plans, for its review and approval prior to finalizing;
- Provide all monitoring plan results to Commission staff;
- Evaluate monitoring results against Commission-recommended thresholds as well as NOAA Fisheries-approved thresholds for effects determinations; and,
- Obtain Commission staff approval for any changes to or cessation of any monitoring efforts.

Entrainment

- Reduce seawater use and entrainment impacts from about 5.2 billion gallons per year to the currently anticipated three billion gallons per year, in part through use of a closed loop cooling system rather than a once-through system;
- Conduct an entrainment study starting within 60 days of startup, following protocols similar to "state of the art" power plant studies, and convene an independent Technical Advisory Committee to help develop and implement the study and to review the study results;
- Provide $5.4 million to the California Dept. of Fish and Game "Compensatory Hard Bottom Mitigation Fund," to be used to design, permit, construct, and monitor at least seven acres of artificial reef in the Southern California Bight; and,
- If results of the entrainment study show that the seven acres of artificial reef is insufficient mitigation (as determined by Technical Advisory Committee), within 60 days of study completion, provide any additional funds needed to design, permit, construct, and monitor the additional acreage of artificial reefs needed to provide at least 2:1 mitigation for those impacts.

Benthic Habitat

- Minimize disturbance to narrow construction corridors;
- Avoid construction in areas of hard bottom habitat or rocky reef;
- Minimize anchor disturbance during construction; and,
- Minimize turbidity and creating a transition excavation pit to extract and contain any drilling fluids that may be released at the end of HDB drilling.

Vessel Strikes

- Minimize potential for vessel strikes maintaining marine mammal observers on all Cabrillo Port vessels and stop the forward progress of a ship if marine mammals or sea turtles are within 1000 yards; and,
- Avoid construction during the gray whale migration season.

Entanglement

- Use monitors deployed to observe dive operations associated with pipelaying and repairs, HDB activities, and similar operations;
- Maintain marine mammal observers on board all Cabrillo Port vessels during all HDB activities, pipeline installation activities and FSRU mooring activities; and,
- Avoid construction during the gray whale migration season.

Unexploded Ordnance

- Minimize risk of damage through implementation of an unexploded ordnance survey along the portion of the pipeline route that passes through offshore militarily-used areas.

Ballast Water

- Follow internationally established ballast water exchange protocols in accordance with the International Convention of the Prevention of Pollution from Ships (MARPOL) and State of California and USCG requirements, including notification and exchange of ballast water outside the 200 n.mi. EEZ; and,
- Provide for LNG carriers serving the FSRU perform ballast water exchanges in accordance with those same requirements.

Water Quality

- Adhere to all discharge monitoring and limits required under the Cabrillo Port facility's proposed National Pollutant Discharge Elimination System permit;
- Develop and implement a Drilling Fluid Release Monitoring Plan;
- Maintain support divers at the offshore HDB exit site to capture and contain drilling fluid that may be released when the bore surfaces on the seafloor; and,
- Implement erosion minimization and control measures during all onshore activities within the coastal zone.

Conclusion

The Commission's evaluation of the proposed project's impacts to marine resources includes consideration that the types of impacts from proposed construction activities would be similar to impacts that have previously occurred in the region without serious adverse effects, and that operational impacts would be similar those caused by shipping and other vessels conducting extensive maritime operations in the region. While cumulative effects remain a concern, the project site is not especially sensitive in terms of proximity to significant concentrations of marine mammals, migration corridors, or breeding grounds. Moreover, to the degree feasible, BHP has committed to mitigation measures to avoid, monitor, minimize, and mitigate adverse impacts from entrainment, lighting, noise, benthic disturbance, vessel strikes, and accidents. To the degree an understanding of effects may be limited, BHP has further committed monitoring and providing additional mitigation in the event that future monitoring reveals that effects are greater than anticipated. With these measures to protect marine resources, the Commission concludes that the project would be carried out in a manner that protects marine resources, maintains the biological productivity of coastal waters and populations of marine species, would not threaten areas and species of special biological or economic significance, and that the project would therefore be consistent with the marine resources, water quality, and (with respect to marine resources) cumulative impact policies (sections 30230, 30231, and 30250) of the CCMP.

4.2 Air Quality

The CCMP contains several air quality requirements. CCMP section 30253(3) requires new development to:

> *Be consistent with requirements imposed by an air pollution control district or the State Air Resources Control Board as to each particular development.*

CCMP section 30414 provides:

> *(a) The State Air Resources Board and air pollution control districts established pursuant to state law and consistent with the requirements of federal law are the principal public agencies responsible for the establishment of ambient air quality and emission standards and air pollution control programs. The provisions of this division do not authorize the commission or any local government to establish any ambient air quality standard or emission standard, air pollution control program or facility, or to modify any ambient air quality standard, emission standard, or air pollution control program or facility which has been established by the state board or by an air pollution control district.*
>
> *(c) The State Air Resources Board and any air pollution control district may recommend ways in which actions of the commission or any local government can complement or assist in the implementation of established air quality programs.*

In addition, section 307(f) of the Coastal Zone Management Act (CZMA; 16 USC §1456(f)) includes as enforceable policies of California's Coastal Management Program (CCMP) requirements established by the Clean Air Act (CAA; 42 USC §7401 *et seq*.), and requirements established by the federal government or by any state or local government pursuant to the Clean Air Act. Therefore, to concur in BHP's consistency certification, the Commission must find that the Cabrillo Port project to which it pertains will meet federal Clean Air Act requirements.

Air Quality Requirements

Regulated Air Pollutants

The federal Clean Air Act designates seven criteria pollutants for which primary and secondary National Ambient Air Quality Standards (NAAQS) have been promulgated. Primary standards are designed to protect public health. Secondary standards are set to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation and buildings. The seven criteria pollutants are:

- Carbon monoxide (CO)
- Lead (Pb)
- Nitrogen dioxide (NO_2)

- Ozone (O_3)
- Particulate matter with an aerodynamic diameter less than or equal to 10 microns (PM_{10})
- Particulate matter with an aerodynamic diameter less than or equal to 2.5 microns ($PM_{2.5}$)
- Sulfur dioxide (SO_2)

The State of California has established additional and/or more stringent ambient air quality standards for some these criteria pollutants, as well as ambient air quality standards for sulfates, hydrogen sulfide (H_2S), vinyl chloride, and visibility-reducing particles.

Section 107(d) of the Clean Air Act requires that areas within a state be designated as either attainment, non-attainment, or unclassifiable with respect to the NAAQS on a pollutant-specific basis. Attainment designations are given to areas within a state that meet the NAAQS for a given pollutant. Nonattainment designations are given to areas within a state that either does not meet the NAAQS or that contribute to ambient air quality in a nearby area that does not meet the NAAQS. Unclassifiable areas are those areas within a state that cannot be classified on the basis of available information as meeting or not meeting the NAAQS. See 40 CFR § 81.305. The federal government may delegate its Clean Air Act authority to individual states when states demonstrate the ability to implement the federal program. California has such delegated authority, which is implemented through local air pollution control districts (APCDs). The U.S Environmental Protection Agency (EPA) has approved a State Implementation Plan (SIP) for the state of California.

California is divided into 15 air basins, which were established by grouping counties or portions of counties with similar geographic features. One or more local APCDs manage air quality within each basin. Each APCD establishes and enforces air pollution regulations that implement all federal and state air laws that are intended to attain and maintain ambient air quality standards. See California Health and Safety Code, Division 26, Part 3, commencing with section 40000. The APCDs permit and control emissions from stationary sources of air pollution.

Project-related construction activities (e.g., installation of mooring and tie-in of FSRU, installation of pipelines, and drilling of shoreline pipeline crossings) and ongoing Cabrillo Port operations would generate air pollutant emissions. Of primary concern is the creation of ozone caused by facility operations. Ozone is not emitted directly from emission sources, but is created at near-ground level by a chemical reaction between nitrogen oxides (NO_x) and reactive organic compounds (ROC) in the presence of sunlight. As a result, NO_x and ROC are often referred to as ozone precursors.

FSRU equipment would generate emissions of ozone precursors NO_x and ROC during both start-up conditions and normal operations. Ozone precursor emissions would also be emitted from LNG carrier engines, used to power the LNG transfer pumps during offloading of LNG from a carrier to the FSRU. LNG carriers, tugboats, and the crew/supply boat would also generate emissions of ozone precursors. Total annual Cabrillo Port air pollutant emissions from normal operations are listed below in Table 5.2-1.

Table 5.2-1: Total Project Air Pollutant Emissions

Description	Annual Emissions (tons per year)						
	CO	NH_3	NO_x	PM_{10}	$PM_{2.5}$	ROCs	SO_2
FSRU (stationary) [a]	178.5	6.1	75.5	12.6	12.6	31.4	0.4
Vessels (mobile) [a]	67.0	—	84.4	4.1	4.1	28.2	0.2
Total	**245.5**	**6.1**	**159.9**	**16.7**	**16.7**	**59.8**	**0.6**

Note:
[a] Emissions from LNG carriers due to LNG pumping are accounted for under FSRU.

Deepwater Port Act Requirements

Construction and operation of a deepwater port requires compliance with the Clean Air Act (33 CFR § 148.737). The EPA has jurisdiction under the Deepwater Port Act to administer air quality regulations and issue required air permits for deepwater port activities that occur outside of the seaward boundaries of the State of California. The Deepwater Port Act states that the applicable state laws of the nearest adjacent coastal state are to be administered and enforced to the extent such law is applicable and not inconsistent with any provision or regulation under the Deepwater Port Act or other federal laws and regulations (33 U.S.C. § 1518(b)). To apply the applicable law of California with respect to air pollution requires a determination of the appropriate air pollution control district.

The Ventura County Air Pollution Control District (VCAPCD) is the air pollution control district whose seaward boundaries, if extended beyond three miles, would encompass the site of Cabrillo Port. BHP also proposes that the pipelines from the FSRU land and connect to an onshore metering station within Ventura County. Accordingly, for this project, EPA has determined that the VCAPCD portion of EPA's approved California State Implementation Plan (SIP) contains the applicable air permitting regulations of the nearest adjacent coastal state.

VCAPCD Rule 10 requires a person to obtain an Authority to Construct permit for any new emissions unit, relocated emissions unit, or replacement emissions unit. Under the Deepwater Port Act, a deepwater port is considered a "new source" for purposes of the Clean Air Act (33 U.S.C. § 1502(9)(D)). As such, prior to commencement of construction, BHP must obtain from the EPA an "Authority to Construct" permit pursuant to Rule 10 for emissions generated from its stationary sources, the FSRU.

Within the VCAPCD, the onshore areas of Ventura County and areas within three miles of the mainland shoreline are classified as moderate non-attainment for the federal 8-hour ozone standard and as attainment for the federal CO, NO_2, PM_{10}, $PM_{2.5}$ and SO_2 standards. The area is classified as non-attainment for the state ozone, PM_{10}, and $PM_{2.5}$ standards, and as attainment/unclassified for the state CO, NO_2, SO_2, lead, sulfate, hydrogen sulfide vinyl chloride, and visibility reducing particles standards. Also under the jurisdiction of VCAPCD are two of the Channel Islands off the California coast that are part of the State of California and of Ventura County – Anacapa Island and San Nicolas Island. These islands, and a three-mile band around each of them, are designated as attainment/unclassifiable under the federal standards, and are classified the same as onshore areas with regards to the state standards.

The proposed location of Cabrillo Port, approximately 14 miles off the coast of mainland Ventura County, in federal waters and outside the boundaries of the state of California, does not have an air quality designation. After EPA determined that the VCAPCD portion of the California SIP contains the air permitting regulations applicable to the Cabrillo Port project, the next task was to decide whether the attainment or non-attainment area requirements of the VCAPCD should be applied to the FSRU.

Under Rule 26, VCAPCD's "New Source Review" or "NSR" rule, new emission sources in federal non-attainment areas that have the potential to emit ROC, NO_x, PM_{10}, or SO_x are required to 1) comply with current best available control technology (BACT) for such pollutants, and 2) obtain offsets of pollutant emissions, unless the source falls within certain enumerated exemptions identified in Rule 26.3.

VCAPCD Rule 26.2 requires that offsets be provided for any new emissions source with the potential to emit ROC or NO_x (in an amount equal to or greater than 5 tons per year), or to emit PM_{10} or SO_x (in an amount equal to or greater than 15 tons per year). An "offset" is an emission reduction credit (ERC) or community bank emission reduction credit that is used to mitigate an increase in emissions from any new, replacement, modified or relocated emissions unit. Rule 26.3.B requires any new or modified source with an emissions increase equal to or greater than 5.0 tons per year of NO_x or ROC to provide offsets at a ratio of 1.1 to 1.0. For any increase of NO_x or ROC equal to or greater than 25 tons per year, offsets are required at a ratio of 1.3 to 1.0. Offsets are calculated based on a source's "potential to emit."

VCAPCD informed the EPA[30] that if Rule 26.2 is applied to Cabrillo Port, the following marine vessel emissions would be considered as part of stationary source emissions for the purpose of calculating offsets under the requirements of Rule 26.2[31]:

- Emissions resulting from loading and unloading of LNG tankers or supply boats at the stationary source (FSRU).

[30] June 18, 2004, letter from Michael Villegas, Air Pollution Control Officer, VCAPCD, to Gerardo Rios, EPA.

[31] The following vessel emissions are not included in the emissions which are calculated when calculating offsets: hoteling emissions (i.e., in-port emissions while a vessel is moored and idling) and combustion emissions from supply boats or LNG tankers while outside Ventura District waters (i.e., outside three miles from the shoreline).

- Combustion emissions from the supply boats (or LNG tankers) while operating within three miles of the shoreline.
- Fugitive emissions or ROC emissions displaced into the atmosphere from the supply boats or LNG tankers while the vessel is (1) docked at the stationary source/FSRU or (2) operating in California Coastal Waters[32] adjacent to the Ventura District.

Given Cabrillo Port's estimated stationary emissions shown in Table 5.2-1 (75.5 tons per year of NO_x and 31.4 tons per year of ROC), under Rule 26, BHP would need to provide NO_x and ROC offsets at a 1.3 to 1.0 ratio. This means that the amount of emission reduction credits required for Cabrillo Port would be approximately 98.6 tons per year for NO_x and 40.9 tons per year for ROC.

Table 5.2-2: Offsets Required Under Rule 26.2

Description	NO_x offset required	ROC offset required
FSRU - stationary	98.2	40.8
Vessels-mobile	0.4	0.1

EPA's Draft Permit Decision

In an April 5, 2004, letter, the EPA informed BHP that it had reached a preliminary conclusion that the VCAPCD Rule 26.2 requirements apply to proposed Cabrillo Port. In other words, EPA decided that VCAPCD's nonattainment air rules that apply to the onshore area of VCAPCD apply to this project, not the rules applicable to the Channel Islands. Rule 26.2 requires offsets and BACT.

The EPA found support in the Clean Air Act for requiring offsets of a deepwater port located less than 15 miles from shore. It stated, "This conclusion is supported in part by the OCS [Outer Continental Shelf] sources offset requirements found in our regulations promulgated at 40 C.F.R. Part 55." Section 328(a)(1) of the Clean Air Act (42 USC § 7627), added in 1990, requires OCS sources (i.e., oil and gas producing platforms) located within 25 miles of a state's seaward boundary to meet the air rules of the corresponding onshore area. Section 328(a)(1) specifies that OCS sources located within 25 miles of the seaward boundary are required to obtain offsets because Congress recognized that offshore sources can contribute to onshore non-attainment problems. As a result, EPA concluded that the offset requirements of VCACPD Rule 26 apply to OCS sources located within 25 miles of California's seaward boundary. While EPA acknowledged that Cabrillo Port is not an OCS source, it reasoned that deepwater port sources and OCS sources should be treated identically.

---

[32] The California Air Resources Board (CARB) has defined California Coastal Waters as extending approximately 25 to 100 miles from the California coastline (17 CCR §70500). CARB has determined that pollutant emissions released over these waters are likely to remain close to the surface and be transported to the California coast and inland under prevailing summertime conditions. Pollutant emissions released somewhat to the west of these waters in summer are likely to be transported southward parallel to the coast.

In a letter dated June 10, 2004, to the US Coast Guard, EPA informed the Coast Guard that it considered BHP's application for an air permit incomplete until BHP submits an analysis of how the project would meet the offset requirements of Rule 26. BHP's offset package was to include offsets for emissions from the FSRU (the stationary source), including emissions resulting from loading and unloading of vessels at the FSRU, and combustion emissions from vessels while vessels are operating in VCAPCD waters (i.e., within three miles of the shoreline).

BHP disagreed with the EPA's determination that Rule 26.2 applies to this project, and on June 1, 2004, Hollister & Brace, on behalf of BHP, sent a letter to EPA opposing the application of Rule 26.2. BHP asserted that Cabrillo Port should be permitted under VCAPCD regulations applicable to the Channel Islands (the attainment area of Ventura County) and not the VCAPCD regulations applicable to the mainland (the nonattainment area of Ventura County). BHP's reasoning is described more fully below. If it were subject to the VCACPD rules applicable to the Channel Islands, BHP would be exempt both from acquiring offsets and meeting BACT requirements because neither of these requirements apply in attainment areas.

The EPA responded in a June 24, 2004, letter informing BHP that it has not changed its position regarding the applicability of VCAPCD Rule 26 to the Cabrillo Port project. However, a year later the EPA reversed its position in a letter to the U.S. Coast Guard, dated June 25, 2005. This letter states, "Based on further analysis of the Deepwater Port Act and the District rules, we have concluded offsets are not required for the sources constructed in the area" where BHP plans to site Cabrillo Port. EPA did not further elucidate the reasoning behind this reversal of its position.

In May 2006, the EPA released for public review its proposed draft air permit for the Cabrillo Port project. Consistent with its June 25, 2005, letter to the U.S. Coast Guard, the EPA proposed to permit Cabrillo Port in the same manner as sources in the federal attainment area (Channel Islands). By doing so, the EPA determined that emission units on board the FSRU are not subject to Rule 26.2 – that is, emissions must not be offset and BACT is not required. Exemptions from Rule 26.2 are provided in Rule 26.3. One exemption is for sources located in the attainment area of Ventura County on Anacapa Island or San Nicolas Island. The EPA proposed regulating Cabrillo Port in the same manner as sources on the Channel Islands, rather than a source located on the mainland.

In its "Statement of Basis for the Proposed Clean Air Act Permit to Construct Cabrillo Port," (May 2006), the EPA stated that it considered factors such as the location of the FSRU in relation to the Channel Islands and the mainland of Ventura County, the current uses of the Channel Islands, and the amount of emissions and the air quality impact to be expected from the stationary source (FSRU). The draft permit does not, however, contain either a quantified analysis of these factors, or an explanation of how these factors support the EPA's determination.

Coastal Commission staff wrote a comment letter to the EPA on August 3, 2006, about the proposed air permit. In it, staff disagreed with the EPA's conclusion that Cabrillo Port should be regulated as if it were located on one of the Channel Islands, rather than as a source located on the mainland. Staff cited the narrow exemption of Rule 26.3 (sources actually located *on* San Nicolas or Anacapa Islands), which does not apply to this project, and the estimated emissions and wind data in the record, that showed emissions from Cabrillo Port would exacerbate existing ozone standard violations on the mainland of Ventura County. It urged the EPA to return to its earlier determination that proposed air permit and regulate Cabrillo Port be regulated under VCACPD's nonattainment rule, Rule 26.2.

The VCAPCD's position on the applicability of Rule 26.2 has changed over the years as well. In 2005, the VCAPCD staff concurred with the EPA's position that Cabrillo Port should be considered not to be subject to the Rule 26.2 emission offset and BACT requirements. However, after reevaluation, the VCAPCD changed its position and it now disagrees with the EPA's interpretation of Rule 26. On November 14, 2006, VCAPCD staff issued a letter to EPA that objects to EPA's "Statement of Basis for the Proposed Clean Air Act Permit" as it relates to Rule 26.2. In part, VCAPCD staff believes the EPA has misinterpreted the narrow exemptions allowed by Rule 26.3. The letter states:

> *Specifically, the Rule 26.2 NSR exemption is based upon:*
>
> - *EPA's determination that these two islands, which are part of Ventura County and within the District's jurisdiction, are separate from the Ventura County ozone nonattainment area. (see 56 Fed. Reg. 56731 (Nov. 6, 1991) et seq.)*
> - *The small number of emission sources on either of these islands and the fact that such sources are owned and operated by the United States Navy and the National Park Service. Specifically, the Navy operates several existing "internal combustion engines used to generate electricity, a waste generator, and small gasoline dispensing facility" on San Nicolas Island.*
> - *The amount of emissions from this equipment or "approximately 11 tons per year ROC, 150 tons per year on NOx, 12 tons per year of Particulate Matter, 4 tons per year of SOx, and 34 tons per year of CO."*
> - *The construction of additional air pollution emitting sources and their concomitant emissions on either of these islands is unlikely.*
> - *The distance of these islands from the mainland portion of Ventura County which minimizes any impact these sources might have on the nonattainment portion of Ventura County. (See Final EIR for Proposed Revisions to the VCAPCD's New Source Review Rule (Rule 26), dated December 1997, pp. 31-32.)*
>
> *As Anacapa Island is part of a national park, future emission increases were expected to be minimal. San Nicolas Island is a U.S. Navy operation and again future emissions increases were expected to be minimal. While the emissions from San Nicolas Island area of the same magnitude as the proposed FSRU, San Nicolas Island is more than sixty (60) miles from the Ventura County coastline. The FSRU is*

> *approximately fourteen (14) miles from the Ventura County coastline. One of the key rationales for the Rule 26 exemption of the two islands is the fact future emission increases were expected to be minimal. This is a key difference between the FSRU and the sources located on the islands.*

The letter concludes, "…APCD is now of the opinion that Rule 26.2 (the requirements including best available control technology and emission offsets) applies to the Cabrillo Port project…" and "…on November 14, 2006, the Ventura County Air Pollution Control Board went on record as strongly supporting the current APCD staff interpretation that Rule 26.2 applies and Rule 26.3 does not apply to the Cabrillo Port project…"

Additionally, the House of Representatives' Committee on Oversight and Government Reform, chaired by Representative Henry Waxman, is currently investigating EPA's reversal of position. On January 6, 2007, the Committee requested that the EPA provide the analysis upon which its reversal was based. In a letter dated March 7, 2007, Representative Waxman, on behalf of the Committee, chides the EPA for not providing such an analysis and questions whether such an analysis even exists. He further states,

> *…some documents provided by the agency [EPA] raise additional questions about how this decision was reached. First, the documents reveal that EPA Assistant Administrator for Air and Radiation Jeff Holmstead personally intervened in the decision about the permit. According to the documents, Mr. Holmstead met with BHP on March 16, 2005. Mr. Holstead then telephoned EPA's Region 9 office to discuss the BHP project… Second, the documents show that at the time Mr. Holmstead was intervening in the decision, the career staff [at EPA] continued to insist that the project should be subject to Ventura District rules, including the offset requirements.*
>
> …
>
> *Based on the information provided to the Committee, it appears that (1) career officials at EPA opposed the permit decision reversal; (2) a senior EPA political official intervened in the permit decision after meeting with the company seeking the permit; and (3) the analysis that EPA cited to justify reversing the career officials does not appear to exist.*

As of the date of this report, the Committee's investigation is ongoing. Also, the EPA has not yet made a decision on a final air permit for Cabrillo Port.

CARB'S Position on Mobile Sources of Air Emissions

As discussed above, VCAPCD's position is that vessel emissions from hoteling (i.e., in-port emissions while moored and idling) and combustion emissions from LNG tankers, tugs, and supply boats operating outside of Ventura District waters (i.e., outside three miles from the shoreline) are not regulated by Rule 26.2. Therefore, 84.4 tons per year of mobile NO_x emissions generated by Cabrillo Port would not be regulated. The EIS/EIR states that CARB expressed concern that these mobile sources of air emissions can also reach the California coastline and add to the air pollution burden of downwind regions, e.g., the South Coast Air Basin. Therefore, through the California Environmental Quality Act (CEQA) process, CARB stated BHP should mitigate these mobile sources of emissions occurring within California Coastal Waters. The EIS/EIR includes mitigation measure AM AIR-4a (an Applicant-proposed mitigation measure), that would control NO_x emissions from two long-haul tugboats that frequently travel between the San Francisco Bay and the Ports of Los Angeles and Long Beach. CARB has been working with BHP to achieve NO_x emission reductions through implementation of the long-haul tug engine retrofit project. BHP's proposed "air mitigation package" is explained further below.

BHP's Position on Applicable Air Rules

BHP contends that potential air quality impacts associated with the Cabrillo Port project would be less than significant. Its contention is based on the air pollutant attainment status of Anacapa and San Nicolas Islands, the "de minimis" impacts on the coastline as shown by their air quality modeling analysis, the effectiveness of its proposed mitigation program, and the inapplicability of Rule 26.2 to the proposed project.

BHP's attorney Stoel Rives sent a February 23, 2005, letter to EPA, setting forth BHP's legal position as to why the offset requirements of VCAPCD Rule 26.2 should not apply to Cabrillo Port. It asserts that Cabrillo Port should be permitted under VCAPCD regulations applicable to the Channel Islands (the attainment area of Ventura County) and not the VCAPCD regulations applicable to the mainland (the nonattainment area of Ventura County). BHP argues:

- BHP has aggressively pursued emission reductions. The effort went beyond installing state-of-the-art controls; it engineered its processes around the idea of minimizing emissions. BHP also committed to CARB that it would run its LNG carriers on 99% natural gas (rather than diesel fuel) while transiting through California Coastal Waters. The project's worst case emissions are projected to be relatively small compared to other LNG terminals permitted by the EPA.

- BHP's emissions reduction efforts mean that the project would not have a material effect on ambient air quality. BHP's modeling of ambient air quality impacts shows that effects would be insignificant – both at sea and on shore.

- Associating the project with the portion of the County of Ventura that is in attainment is consistent with its physical location. The project is located the same distance as Anacapa Island from the mainland. The meteorology affecting the project is more similar to that affecting Anacapa Island than that affecting the mainland. Therefore, there is a logical and sound basis for the EPA to associate the project with Anacapa Island and exempt BHP from Rule 26.2 requirements.

Although it maintains that Cabrillo Port is exempt from the offset requirements of Rule 26.2, BHP told the EPA that it would achieve emissions reductions (in addition to emission reductions inherent to the project) to an amount equal to the FSRU's annual NO_x emissions.

Additionally, BHP told CARB that it would achieve NO_x emission reductions equal to its mobile sources (LNG carrier, tugboat and crew/supply boat) of its emissions within California Coastal Waters. BHP has executed contracts to retrofit two long haul tugs by replacing the propulsion engines of each vessel with modern low-emitting engines. The tugs' long haul routes run between southern Los Angeles County and the San Francisco Bay. At the request of the EPA and CARB, BHP conducted source testing to assist in determining the emission reductions expected as a result of the retrofits. BHP estimates that the re-powering of the two tugs could result in emission reductions of approximately 165.5 tons per year of NO_x. Since total annual NO_x emissions are estimated to be 159.9 tons per year, BHP maintains that the tug engine retrofits would fully mitigate its annual facility NO_x emissions. By BHP's own admission, the tug engine retrofit project would not mitigate fully for its estimated 59.8 total project annual ROC emissions. BHP estimates the tug engine retrofits would achieve a reduction of 29.7 tons per year of ROC. Further, as noted in the Coastal Commission Analysis below, there are other problems with BHP's tug retrofit proposal, since offsets from mobile sources such as tug boats are not equivalent to stationary source offsets.

Coastal Commission Analysis

Air Pollution Meteorology of the Southern California Bight

California lies within the zone of prevailing westerlies and on the east side of the semi-permanent high pressure area of the northeast Pacific Ocean. Air pollution meteorology in the Southern California Bight, the area between Point Conception and the Mexican Border, is dominated by the semi-permanent North Pacific Subtropical High pressure area (North Pacific High). This area of high pressure is a persistent feature and results in prevailing northwest winds along the California Coast (see Exhibit AIR-1) north of the Southern California Bight northwest winds blow southeastward along the coast and turn more westerly along the immediate coastline. South of Point Conception, the coastline trend changes from a predominantly westerly exposure, to a southerly exposure. The Santa Ynez Range, immediately east of Point Conception, block the prevailing northwest winds, and cause a change in the wind field to a more westerly direction and at lower wind speeds. This change in coastal orientation also creates eddy conditions in the Santa Barbara and Catalina Channels, known as the Channel and Catalina eddies, respectively. These eddy currents can result in easterly winds along the southern Santa Barbara coast, and southeasterly winds along the Ventura and Malibu coasts.

The NOAA National Data Buoy Center (NDBC) operates a meteorological data buoy in the vicinity of the proposed project. The relative location of this buoy to the proposed FSRU is shown in Exhibit AIR-2. An annual wind frequency distribution from the Santa Monica Basin Buoy (Buoy #46025) is presented in Exhibit AIR-3, while seasonal distributions are shown in Exhibit AIR-4. These figures all indicate that air pollutant emissions from the FSRU and associated vessels would be transported onshore approximately 80% of the time.

The potential for offshore air pollutant emissions in the Southern California Bight to be transported onshore has been the subject of several field studies and evaluated by numerous researchers. These studies generally conclude that emissions within the Southern California Bight, especially those that occur in areas east of the Channel Islands, would likely be transported onshore and thus adversely affect onshore air quality. These studies include:

- Early studies conducted by the California Institute of Technology evaluated tracer gas releases from offshore and nearshore locations to track onshore impacts and land/sea air recirculation[33,34]. Tracer gas studies included offshore releases along the coast from Long Beach to Ventura. The results of all tracer releases showed that offshore emissions were advected onshore.

- The South Central Coast Cooperative Aerometric Monitoring Program (SCCCAMP).[35,36] The SCCCAMP study was performed to develop modeling data for ozone attainment planning analyses in Santa Barbara and Ventura Counties. Mesoscale meteorological patterns observed during SCCCAMP demonstrate the strong onshore patterns in the project area, as well as the land-sea breeze interaction. The results of the study emphasize the importance of the land-sea breeze in evaluating multi-day high air pollution episodes where the pollutants move on and offshore and accumulate in the region. CARB specifically developed SCCCAMP datasets for use in the Urban Airshed Model to evaluate potential impact of emission sources in the Santa Barbara Channel on onshore air quality.

- The Southern California Air Quality Study (SCAQS).[37] This study collected and analyzed data on meteorological conditions, emissions, and pollutant formation (including ozone) from Ventura County through the South Coast Air Basin. The purpose of this study was to identify and evaluate factors that contribute to high ozone and particulate concentrations and clearly identified the contribution from offshore emission sources.

---

[33] Shair, F.H., E.J. Sasaki, D.E. Carland, G.R. Cass, W.R. Goodin, J.G. Edinger and G.E. Schacher. 1981. Application Transport and Dispersion of Airborne Pollutants Associated with the Land Breeze-Sea Breeze System, October 1981.

[34] Shair, F.H. 1982. Application of Atmospheric Tracer Techniques to Determine the Transport and Dispersion Associated with the Land-Breeze Movement of Air Over the Los Angeles Coastal Zone, California Institute of Technology, prepared for CARB, December 2, 1982. The entire report can be downloaded from CARB at: http://www.arb.ca..gov/research/apr/past/atmospheric.htm.

[35] Hanna, Steven R., May 1991. Characteristics of Ozone Episodes during SCCCAMP. *Journal of Applied Meteorology*, 30,5,534-550.

[36] Douglas, Sharon G. and Kessler, Robert C., May 1991. Analysis of Mesoscale Air Patterns in the South-Central Coast Air Basin during the SCCCAMP 1985 Intensive Measurement Periods. *Journal of Applied Meteorology*, 30:5:607-631.

[37] Blumenthal, D.L., Watson, J.G., and Roberts, P.T. 1987. Southern California Air Quality Study (SCAQS) Program Plan, Sonoma Technology Inc. Report to the California Air Resources Board, June 1987.

- The 1997 Southern California Ozone Study (SCOS97-NARSTRO).[38] The SCOS97 - NARSTO meteorological network collected data from June 16 through October 15, 1997. Air pollutant emissions, meteorological, and air quality data were assessed for five different types of multi-day ozone episodes. This study documents the strong interrelationship between offshore air pollutant emissions and onshore air quality.

- Analysis of Aerometric and Meteorological Data for the Ventura County Region.[39] This report describes the various trajectories that carry pollutants into Ventura County, including several emanating from offshore areas.

- Air Quality Impacts from NO_x Emissions of Two Potential Marine Vessel Control Strategies in the South Coast Air Basin.[40] As part of SCOS97, tracer gases were released near the Project area; one tracer event from the current shipping lanes and a second from proposed shipping lanes further offshore. The tracer gases were monitored onshore, with results showing that both shipping lane releases impacted onshore air quality.

- The Structure and Variability of the Marine Atmosphere around the Santa Barbara Channel.[41] This paper evaluates the mesoscale meteorological conditions between Point Arguello and the Santa Monica Bay, including the proposed FSRU location. The mean wind flow in the Santa Barbara Channel and across the project area was shown to be strongly onshore, and would support that project-related air pollutant emissions would predominantly be advected to adjacent onshore.

---

[38] Fujita, E.M., M. Green, R. Keislar, D. Koracin, H. Moosmuller and J. Watson. 1999. SCOS97-NARSTRO 1997 Southern California Ozone Study and Aerosol Study, Volume III, Summary of Field Study. Desert Research Institute, prepared for CARB. 1998 AWMA papers available online at: http://www.arb.ca.gov/research/scos/awma_98/awma_98.htm; Publications available online at: http://www.arb.ca.gov/research/scos/scospub.htm.

[39] Blumenthal, D.L., Smith T.B., Lehrman, D.E. et al. 1986. Analysis of Aerometric and Meteorological Data for the Ventura County Region, Sonoma Technology Inc. Report to the Western Oil and Gas Association, June 1986.

[40] CARB, 2000. Air Quality Impacts from NO_x, Emissions of Two Potential Marine Vessel Control Strategies in the South Coast Air Basin, Final Report, September 2000.

[41] Dorman, C.E. and C.D. Winant. 2000. The Structure and Variability of the Marine Atmosphere around the Santa Barbara Channel. Monthly Weather Review, 128:261-282.

- The Dynamics of Northwest Summer Winds over the Santa Barbara Channel.[42] This study evaluated wind fields characteristics over the Santa Barbara Channel and Southern California Bight under a variety of meteorological conditions. The analysis characterizes the divergent wind flow that occurs south of Point Conception and results in onshore wind flow patterns in the project area under prevailing regional wind flow conditions (see Exhibit AIR-5).

- Model Wind over the Central and Southern California Coastal Ocean.[43] This paper presents the results of a numerical modeling analysis of California West Coast wind flow patterns using the Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS). This study evaluated a three month period (March-May 1999) and estimated mean wind streamline characteristics. The model was validated against observations and illustrated several wind field features in the Southern California Bight, including large-scale (~100 km) wind turns onshore in the Southern California Bight where both wind speed and wind stress curl weaken southward along the coast.

Regulatory agencies have long recognized the need to address, reduce, and mitigate (offset) emissions from offshore sources, including marine vessels. In 1984, CARB specifically developed a definition of California Coastal Waters for this purpose, defined as "the area offshore of California within which pollutants are likely to be transported ashore and affect air quality in California's coastal air basins, particularly during the summer."[44] California Coastal Waters extend 25 to 100 miles from the California coastline (17 CCR §70500). Pollutant emissions released over these waters are likely to remain relatively close to the surface and be transported to the California coast and inland under prevailing summertime conditions (CARB, 1984). CARB has determined that pollutant emissions released somewhat to the west of these waters in summer are likely to be transported southward, parallel to the coast. Emissions released well west of these waters are likely to be transported southwestward, away from the coast.[45] CARB's conclusions are based on the field studies listed above and a dispersion modeling analysis conducted by CARB. Cabrillo Port is to be located approximately 14 miles from the shoreline, within California Coastal Waters.

---

[42] Skyllingstad, E.D., P. Barbour, and C.E. Dorman, 2001. The Dynamics of Northwest Summer Winds over the Santa Barbara Channel. Monthly Weather Review, 129: 1042–1061.

[43] Hsu, Hsiao-ming, Lie-Yauw Oey, W. Johnson, C. Dorman and R. Hodur, May 2006. Model Wind over the Central and Southern California Coastal Ocean Weather Review, in press.

[44] California Air Resources Board. 1984., Report to the California Legislature on Air Emissions from Marine Vessels, Volume I, June 1984, Page 78.

[45] California Air Resources Board, Staff Report: Initial Statement of Reasons for Proposed Rulemaking. Proposed Regulation for Auxiliary Diesel-Electric Engines Operated on Ocean-Going Vessels Within California Waters and 24 Nautical Miles of the California Baseline. October 2005. Appendix F: Offshore Emissions Impacts on Onshore Air Quality.

Additional evidence for onshore transport of project related emissions comes from an analysis of monthly average wind conditions over the Southern California Bight. Exhibit AIR-6 provides results of the National Center for Environmental Prediction, Office of Global Programs (2006) NCEP/OGP North American Regional Reanalysis. The NCEP/OGP is a hindcast (i.e., reconstruction of past weather events) of regional weather conditions based on the analysis of all available observations. The reanalysis was run for the most recent year available, 2002, to estimate monthly mean wind vectors. Exhibit AIR-6 presents four representative months, one for each season. In each case, the mean vector wind flow in the project area trended onshore, mainly towards the South Coast Air Basin. The reanalysis also shows the strong onshore flow that occurs along he California coast in summer. Therefore, the Commission analysis shows that air emissions from the project would be transported to the California South Coast Air Basin and would incrementally contribute to the non-attainment conditions for ozone, PM_{10} and $PM_{2.5}$.

Recent modeling analyses also demonstrate that air pollutant emissions from the project location likely impact onshore conditions because of prevailing winds. Exhibit AIR-7 shows an analysis from the Naval Air Warfare Center Weapons Division.[46] These analyses, from March 13th and 14th show wind flow from the proposed project site towards Ventura County and Los Angeles County, respectively. Archived analyses prepared at the Jet Propulsion Laboratory using the Mesoscale Meteorological Model (MM5) also show a similar, frequent trend of wind flow from the project site towards adjacent onshore areas.[47]

Based on the studies cited above, as well as the available wind flow analyses and model databases, there is an overwhelming consensus that air pollutants emitted in the vicinity of the proposed project would be transported onshore, mainly towards Los Angeles and Ventura counties.

BHP's Air Quality Modeling Analysis

BHP prepared an Air Quality Impact Analysis (AQIA)[48] for the proposed project. This analysis followed normally acceptable procedures for conducting an AQIA for non-reactive criteria air pollutants, or in other words, those pollutants for which there is a relevant federal or State air quality standard and the pollutant is only minimally reactive in the atmosphere. The list of pollutants would include: nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2) and particulate matter (both with aerodynamic diameters of less then 10 and 2.5 microns, or PM_{10} and $PM_{2.5}$, respectively). It does not include ROCs, which are pollutants that are the precursors to ozone, which are regulated by both the federal and state Clean Air Acts. The results of the AQIA show that the contribution of proposed project emissions to ambient levels of these pollutants would be well below applicable state and federal ambient air quality standards and the "Prevention of Significant Deterioration" significance thresholds that were

[46] http://www.nawcwpns.navy.mil/~weather/mugu/mesodata/analysis.html.

[47] http://ourocean.jpl.nasa.gov/cgi-bin/index.cgi.

[48] Sierra Research. 2006. Air Quality Impact Assessment of the Cabrillo Port Offshore LNG Import Terminal, prepared for: BHP Billiton. July 5.

used in the EIS/EIR. However, it should be noted that although Ventura County is in attainment for federal PM_{10} and $PM_{2.5}$, it is not in attainment for the *state* PM_{10} and $PM_{2.5}$ standards. The South Coast Air Basin is classified as nonattainment for both the state and federal PM_{10} and $PM_{2.5}$ standards. Project emissions would contribute to these existing standard violations. Complying with the requirements of VCAPCD Rule 26.2 would mitigate, although not entirely eliminate, these impacts.

As stated above, the main problem with the AQIA is that BHP's analysis does not adequately address potential photochemical reactions of project-related nitrogen oxide (NO_x) or reactive organic compound (ROC) emissions, and potential impacts to regional ozone (O_3) concentrations. The AQIA does make a cursory comparison of NO_2 impacts to potential ozone concentrations, but ignores the basic fundamentals of ozone formation, reactions with background air pollutants, and potential ozone formation offshore that would be advected onshore. Both the VCAPCD and the South Coast Air Quality Management District (SCAQMD) airsheds are classified as moderate and severe non-attainment for ozone, respectively. Rule 26.2 requires offsets of ROCs at a ratio of 1 to 1.3, resulting in total offsets for this project of 40.9.

Further, emissions of NO_x and sulfur oxides (SO_x) would also contribute to particulate formation in the form of nitrate and sulfate. Ammonia emissions associated with the proposed selective catalytic reduction system would also contribute to secondary particulate formation, which when combined with NO_x or SO_X emissions would form ammonium nitrate or ammonium sulfate. Given the humid offshore environment, high rates of secondary particulate formation would occur, with elevated nitrate and sulfate particulate formation occurring well before the pollutants reach landfall. These secondary particulates would exacerbate the onshore nonattainment situation in Ventura County and the South Coast Air Basin resulting in a significant unmitigated impact.

Applicability of Rule 26.2

As noted above, there are several factors that need to be considered in determining the applicability of Rule 26.2 to the proposed project. These factors include:

- The attainment status of the air basins that would be impacted by the proposed project emissions; and,
- The specific requirements and original intent of VCAPCD Rule 26.3, which exempts emission sources on San Nicolas and Anacapa Islands from Rule 26.2 requirements.

As discussed above, given the prevailing winds in the area, project-related emissions would frequently be transported to Ventura County and South Coast Air Basin non-attainment areas, thus hindering attainment efforts.

VCAPCD Rule 26.3 provides for an exemption from the requirements of Rule 26.2 for the following reasons:

1. *Any emissions unit which is required to obtain a Permit to Operate from the District due to a revision to Rule 23, provided the emissions unit was operated within Ventura County before the date on which a Permit to Operate is required by such revision to Rule 23 and the application for a Permit to Operate is submitted no later than one year after the date on which a Permit to Operate is required by such revision to Rule 23.*

Rule 23 provides an exemption to the applicability of Rule 10, Permits, for a wide variety of small emission sources. Generally, exemptions are construed narrowly by reading the exemption precisely. The proposed project facilities are not explicitly cited in Rule 23 and project-related equipment emissions exceed exemption limits. Thus, this part of Rule 26.3 does not provide an exemption because the project is not a small emissions source listed in Rule 23.

2. *Any emissions unit located on San Nicolas Island or Anacapa Island.*

None of the proposed project facilities are located <u>on</u> San Nicolas Island or Anacapa Island. The FSRU would be located a similar distance to the shoreline as Anacapa Island, but much closer to nonattainment areas in the South Coast Air Basin and Ventura County. In addition, wind patterns in the proposed project area are more conducive to pollutant transport to adjacent onshore nonattainment areas. Therefore, this part of Rule 26.3 does not provide an exemption for the project.

3. *A relocation of an emissions unit within Ventura County where the new location is no more than five miles from the previous location, provided the emissions unit is at a small or medium source as defined in Rule 11, and provided that there is no emission increase.*

The proposed project is not a relocation of an existing emission unit within Ventura County, and thus this part of Rule 26.3 does not provide an exemption to the project.

4. *Any stationary source which is required to obtain a Permit to Operate solely because of permit renewal or a transfer of ownership.*

The proposed project represents a new emission source, not an existing source as contemplated by the Rule, and there is no change of ownership, thus this exemption does not apply.

Also at issue is the original intent of Rule 26.3. The VCAPCD's Final Environmental Impact Report, which evaluated the potential environmental impacts of the Rule 26.3 exemption and other modifications to Rule 26, states:

> *It is possible in the future that the Navy might need to add or make modifications to its existing equipment. Therefore the proposed rule revision could allow additional emissions. However, any modifications to existing equipment are expected to be minimal increases in emissions, because most of the equipment is used to provide electricity for the limited number of personnel on San Nicolas Island. Given the location of the islands and their limited infrastructure, it is unlikely that any new source would locate on the islands while under Navy ownership. It is anticipated that any associated emission increase would be small and that it would not have a project specific impact or cumulatively significant impact on air quality.*

Potential emissions from the proposed project are not minor, and therefore it is clear that Cabrillo Port should not be subject to a Rule 26.3 exemption.

BHP's Air Mitigation Program

For the reasons described above, the Commission finds that BHP must meet the requirements of VCAPCD Rule 26.2 in order to comply with the Clean Air Act. Through negotiations with CARB, BHP has offered a proposed "voluntary" air mitigation package – to retrofit the engines of two long-haul tugs – to mitigate for all Cabrillo Port project-related air impacts. (See Exhibit AIR-8 for the tug/barge routes from Los Angeles to San Francisco.) BHP's proposed package fails to satisfy its obligations under VCAPCD Rule 26.2 because Rule 26 does not allow for the creation and "banking" of mobile offshore emission reductions to offset stationary air quality impacts such as the one from the Cabrillo Port project. Therefore, BHP's tug retrofit proposal is irrelevant in terms of satisfying the Clean Air Act's (i.e., VCAPCD's Rule 26.2) stationary emission offset requirements.

In addition to the emission offsets required under VCAPCD Rule 26.2, the project would also emit 48.9 and 18.0 tons/year of NO_x and ROC, respectively, in federal waters. While VCAPCD does not require ERCs for emissions from vessels in federal waters, emissions from these sources (FSRU support vessels and LNG tankers) would contribute to existing onshore violations of state and federal ambient air quality standards.

BHP argues that the quantity of the air emission reductions in which BHP's mitigation package would result is adequate to mitigate for all Cabrillo Port project-related air impacts. The Commission does not agree. As shown in Table 5.2-3, while the total NO_x offsets offered by BHP would slightly exceed the total from the project, the legal requirement of Rule 26.3 requires that stationary source emissions be offset by stationary source offsets, not mobile source offsets. The aggregate total project related emissions from the Cabrillo Port project includes 75.5 tons per year of NO_x emissions from *stationary* sources (i.e., emissions from the FSRU as well as vessel emissions that can be ascribed to the FSRU) that are subject to the offset requirements of Rule 26, plus 84.5 tons per year of NO_x emissions generated by BHP's *mobile* sources (i.e., vessel emissions that VCAPCD has determined not to be subject to the offset requirements of Rule 26). In Appendix D, the Commission provides an analysis that explains why mobile source offsets cannot mitigate the impact of stationary source emissions, and thus why BHP's air mitigation proposal to mitigate for the aggregate total of project-related air quality impacts of the Cabrillo Port project is inadequate. To summarize, because the benefits of mobile source offsets would accrue to other areas of California where there tug boats travel, the Ventura and South Coast air basins would absorb the impacts of the BHP stationary source, but would not accrue the full benefits of the offsets.

Table 5.2-3: Estimated Emission Reductions from BHP's Tug Engine Retrofit Proposal

Air District	**NOx Emissions Reduction Estimate (tons per year)**	**ROC Emissions Reduction Estimate (tons per year)**
SCAQMD	33.05	8.51
VCAPCD	11.47	3.01
SBCAPCD	25.11	6.39
SLOAPCD	10.84	2.73
Total	**80.47**	**20.64**
Project Emission Offset Liability (including 1.3:1 offset ratio)	**98.5**	**41**
Net Deficit	**-18.03**	**-20.36**

Satisfying the BACT Requirements of Rule 26.2: Although EPA's proposed draft air permit concludes that BACT is not required, BHP says it would control stationary emission sources using technologies that are consistent with Rule 26.2's BACT requirements. BACT is an emission limitation based on the maximum degree of emission reduction (considering energy, environmental, and economic impacts) achievable through application of production processes and available methods, systems, and techniques. For any stationary source, BACT is the more stringent of:

- The most effective emission control device, emission limit, or technique which has been required or used for the type of equipment comprising such stationary source unless the applicant demonstrates to the satisfaction of the Air Pollution Control Officer that such limitations are not achievable, or

- Any other emission control device or technique determined to be technologically feasible and cost-effective by the Air Pollution Control Officer.

VCAPCD Rule 2 specifically defines BACT as the most stringent emission limitation or control technology for an emissions unit which:

1. Has been achieved in practice for such emissions unit category, or

2. Is contained in any implementation plan approved by the EPA for such emissions unit category. A specific limitation or control shall not apply if the owner or operator of such emissions unit demonstrates to the satisfaction of the Air Pollution Control Officer that such limitation or control technology is not presently achievable, or

3. Any other emission limitation or control technology, including, but not limited to, replacement of such emissions unit with a lower emitting emissions unit, application of control equipment or process modifications, determined by the Air Pollution Control Officer to be technologically feasible for such emissions unit and cost effective as compared to the BACT cost effectiveness threshold adopted by the Ventura County Air Pollution Control Board.

The EPA's proposed draft air permit concluded that BHP's proposed project represented BACT at the time of the proposal. However, the EPA received a number of comments on the proposed draft air permit challenging EPA's determination that BHP has met BACT requirements. As of the date of this report, the EPA is evaluating the public comments and will not make a final decision on BACT until it issues a final air permit.[49]

Based on its review of the record, the Commission does not believe BHP is meeting BACT requirements, for the reasons described below.

<u>Internal Combustion Engine Electric Generators</u>: BHP identifies the use of Selective Catalytic Reduction (SCR) as BACT for the two onboard internal combustion engines that would provide electric power to the FSRU. In this case, SCR is universally accepted as BACT. BHP proposes a NO_x BACT limit of 9 ppm for the natural gas fired internal combustion engines. While BHP[50] contends that its proposed NO_x control level of 9 ppm[51] is considered BACT, the Environmental Defense Center (EDC)[52] has noted that BACT should be 5 ppm NO_x.

---

[49] Personal communication with Joe Lapka, EPA, Region 9, March 23, 2007.

[50] Wood, T.W. 2006. Letter from Thomas Wood to Peter Douglas, Executive Director of the California Coastal Commission regarding Environmental Defense Center Comments on Proposed Cabrillo Port Air Permit.

[51] EPA's draft air permit lists a NO_X emission limit of 9 ppm, but subsequent submittals by BHP have lowered the NOx limit to 7.5 ppm. The EIS/EIR also uses 7.5 ppm in its evaluation of potential air quality impacts.

[52] Powers Engineering, 2006. Assessment of BHP Billiton Best Available Control Technology for Air Emission Sources Associated with Cabrillo Port. Prepared for the Environmental Defense Center.

One factor that contributes to the dispute is the assumed conversion of emissions from units of g/bhp-hr (grams per brake horsepower hour) to ppm (parts per million). One of the references cited by Stoel Rives[53] notes that a table in the CARB 2001 guidelines on BACT[54] lists the conversion as 0.07 g/bhp-hr or 8 ppm. However, CARB concludes that the appropriate BACT level and conversion as: "The limits are 0.07 g/bhp-hr (5 ppm at 15% O2) for NO_x…"[55] Therefore, CARB has clearly identified BACT in both emission units and specifically references the 0.07 g/bhp-hr NOx level and identified 5 ppm as the appropriate BACT level.

There is ample information to support the emission limit of 5 ppm NO_x as BACT for the FSRU internal combustion engine electric generators. Two projects reviewed by the California Energy Commission have proposed a NO_x emission limit of 5 ppm; the NEO California Power LLC (Chowchilla) and Eastshore Energy Center.[56] Both of these facilities have identified BACT as 5 ppm NO_x. The San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) has also made a BACT determination for the NEO California Power LLC Chowchilla facility, which is 5 ppm @ 15% O_2 equivalent to 0.07 grams/bhp-hr using SCR as the control technology.[57]

A search of the EPA RACT/BACT/LAER Clearinghouse (RBLC)[58] database was conducted to identify NO_x BACT levels for large internal combustion engine electric generators. The EPA database identified numerous instances where NO_x emission limits of 0.07 grams/bhp-hr (5 ppm) were achieved including the NEO California Power Red Bluff facility[59].

In referring to the applicability of the CARB (2001) BACT guidance, BHP has argued that these BACT levels would not apply "[b]ecause Cabrillo Port's engines are neither onshore nor supplying energy to the grid, and so operate in a different fashion…."[60] This argument has

[53] Wood, T.W. 2006. Letter from Thomas Wood to Peter Douglas, Executive Director of the California Coastal Commission regarding Environmental Defense Center Comments on Proposed Cabrillo Port Air Permit.

[54] CARB. 2001. Guidance for the Permitting of Electrical Generation Technologies. Project Assessment Branch, Stationary Source Division, California Resources Board. November 2001.

[55] Ibid, p.31.

[56] Eastshore Energy, LLC, 2006. Application for Certification for the Eastshore Energy Center (Appendix 8.1F, Evaluation of Best Available Control Technology). Available online at: http://www.energy.ca.gov/sitingcases/eastshore/documents/index.html.

[57] San Joaquin Valley Unified Air Pollution Control District, 2001. BACT Clearinghouse, Chapter 3 – Internal Combustion Engines, Natural gas fired, lean burn IC engine powering an electrical generator, NEO California Power LLC, Chowchilla, CA (page 3.3.12). Available online at: http://www.valleyair.org/busind/pto/bact/bactchidx.htm or http://www.valleyair.org/busind/pto/bact/chapter3.pdf.

[58] http://cfpub.epa.gov/rblc/htm/bl02.cfm

[59] http://cfpub.epa.gov/rblc/cfm/PoltDetl.cfm?facnum=25194&Procnum=99462&poltnum=125492

[60] Wood, T.W. 2006, p. 14.

little merit in that in both cases the engines would be operated in an electrical generation capacity, and the fact that they are on or offshore, or hooked to a larger electrical distribution grid has no relevance to engine emissions performance. Therefore, the established SJVUAPCD BACT guideline of 5 ppm NOx @ 15% O_2 equivalent to 0.07 grams/bhp-hr using SCR should be applied to the Cabrillo Port project, consistent with the VCAPCD BACT definition.

Submerged Combustion Vaporizers: BHP has identified the use of low NO_x burners as NO_x BACT at 20 ppm for the eight submerged combustion vaporization (SCV) units on the FSRU. BHP also notes that SCR is in use on the SCVs at the Distrigas LNG terminal in Everett, MA, but dismisses SCR due to 1) technical problems with the Distrigas SCR system, and 2) an SCR the size of the Distrigas system would not be cost-effective due to space constraints on the FSRU.

In contrast, the EDC and Powers Engineering (2006) have indicated that SCR is feasible for the project and should be considered BACT. Their argument is based on the fact that the Distrigas facility has resolved many of the technical problems that they had experienced and project-specific problems could be overcome as well.

A search of the EPA RACT/BACT/LAER Clearinghouse (RBLC) database was conducted to identify BACT levels for SCVs located at LNG facilities. Two LNG facilities equipped with SCVs were identified, including the Southern LNG Elba Island LNG Terminal and the Sabine Pass LNG Import Terminal, with PSD permit dates of 2003 and 2004, respectively. The Elba Island facility achieves a NO_x emission limit of 0.08 lb/MMBtu[61], while the Sabine Pass SGV NO_x emissions are limited to 0.037 lb/MMBtu except during startup.[62] The EPA database does not contain information on the Distrigas NO_x level, but BHP has noted that this facility has an emission limit of 0.006 lb/MMBtu. By comparison, BHP is proposing a SCV NO_x control limit of 0.0243 lb/MMBtu. Thus, BHP has proposed a SCV NO_x emission limit that is lower than the two facilities that do not use SCR, but substantially higher than the lone facility that uses SCR on its SCV units.

The EPA has also raised concerns over the BACT analysis that was submitted as part of BHP's air permit application. In a letter to BHP, the EPA[63] notes:

> *Multiple commenters, including the South Coast AQMD and Santa Barbara APCD indicated that the established NO_x BACT limit for combustion units with heat inputs similar to the SCVs is 5 ppm, achieved with selective catalytic reduction. BHP's BACT analysis states that SCR has been achieved in practice for SCVs at the Distrigas*

[61] http://cfpub.epa.gov/rblc/cfm/PoltDetl.cfm?facnum=25649&Procnum=101896&poltnum=132831

[62] http://cfpub.epa.gov/rblc/cfm/PoltDetl.cfm?facnum=26433&Procnum=104760&poltnum=141183

[63] EPA, 2006a. Letter of October 13, 2006 from Amy Zimpfer (EPA) to Renee Klimczak (BHP), Request for information regarding Cabrillo Port Proposed Deepwater Port Clean Air Act Permit.

> *facility, which currently achieves a rate of 5 ppm. Despite this, BHP rules out the use of SCR for the Cabrillo Port project on the basis that its SCVs are in a separate emission unit category for which SCR has not been achieved in practice. BHP bases this conclusion on the following factors:*
>
> 1. *Concerns related to the dynamic environment of a floating vessel;*
> 2. *The large size of the units;*
> 3. *Catalyst blindinglfouling;*
> 4. *Difficulties heating the SCV exhaust gas to the necessary exhaust temperatures;*
> 5. *Worker safety concerns; and*
> 6. *Cost effectiveness.*
>
> *The December 2005 permit application does not adequately support the claim that SCR is not technically feasible or cost effective for these units.*

Subsequent to the EPA letter, BHP has indicated that it would take approximately five months (from October 17, 2006) to respond to all of the EPA's data requests regarding the feasibility of using SCR on the SCVs.[64] Given the time necessary to receive and evaluate the additional information requested from BHP, the EPA has not made a final determination of BACT for the Cabrillo Port SCVs, and whether or not SCR would feasibility represent BACT for SCV NO_x emissions. However, for the reasons described above and based on the information available to date, the Commission finds that BHP's project does not meet VCAPCD Rule 26 BACT requirements.

<u>Satisfying the Offset Requirements of Rule 26.2</u>: There are a number of ways BHP could satisfy the offset requirements of Rule 26.2: (a) purchase emission reduction credits (ERCs); (b) generate and "bank" new onshore emission reductions consistent with Rule 26; and (c) a combination of (a) and (b). In addition, BHP could seek a VCAPCD rule-making change to allow for the generation and "banking" of offshore mobile source emission reductions, like the retrofit of tug engines, to meet the offset requirements of Rule 26.

BHP says that it cannot acquire the necessary NO_x ERCs to meet Rule 26.2 requirements because the holders of NO_x ERCs within the Ventura District will not sell to them.[65] BHP also says it explored, but was unsuccessful in, identifying onshore emission reduction projects that would result in new "banked" NO_x ERCs. On March 22, 2007, BHP's attorney, Bryan LeRoy with Manatt, Phelps & Phillips, submitted documentation to the Commission illustrating BHP's unsuccessful efforts to purchase NO_x ERCs and create new onshore NO_x reduction opportunities (See Exhibits AIR-9, AIR-10, AIR-11, AIR-12, and AIR-13). As of

---

[64] EPA, 2006b. Memorandum to permit file to document meetings that took place between EPA and BHP Billiton on October 16 and 17, 2006. Available online at: http://www.epa.gov/region09/liq-natl-gas/docs2/10-19-06-memorandum-to-permit-file.pdf.

[65] Personal communication with Bryan Leroy, Manatt, Phelps & Phillips, and Tom Wood, Stoel Rives, January 12, 2007.

the date of this report, BHP's documentation has not been reviewed by VCAPCD staff. However, even if BHP's efforts to acquire ERCs have been exhaustive, there is no provision in law that allows avoidance of Clean Air Act requirements. In fact, BHP's information underscores the importance of this project going forward only if ERCs are provided. Most of the companies that gave reasons for refusing to sell ERCs said they want to retain the credits for their own future use. That means there is a reasonable and foreseeable possibility that these companies would (legally) increase their own emissions in the region in the future. Allowing BHP to proceed with this project without ERCs means that total emissions would increase beyond the legally acceptable limits. BHP's project thus creates not only a significant unmitigated impact individually, but also cumulatively when considered with these other projects.

In a letter dated March 8, 2007, to Coastal Commission staff from Michael Villegas, VCAPCD Air Pollution Control Officer, Mr. Villegas states that based on his understanding of BHP's projected emissions of NO_x and ROC from stationary sources, BHP would need approximately 97.5 tons per year NO_x ERCs and 32.5 tons per year ROC ERCs to satisfy Rule 26.2. He states further,

> *Simply looking at existing ERC balances for NO_x and ROC it appears that an adequate supply of ERCs is available. However, for NO_x only approximately 145 TPY [tons per year] of ERCs are available. For ROC approximately 165 TPY of ERCs are available. I have been informed by consultants working on behalf of BHP Billiton that the holder of the vast majority of NO_x ERCs is not willing to sell. ROC credits may be available for purchase for this project. VCAPCD staff has not been involved in any discussions regarding the purchase of these ERCs.*
>
> *If ERCs are not available for purchase, they would need to be generated and banked. By March of 2008, VCAPCD staff will be locating and registering diesel engines used in agricultural operations. To date, we have received varying estimates of the number of diesel engines used in agricultural operations in Ventura County. Many of these engines will need to be replaced to comply with new emission control requirements. If a significant number of these engines are located, it may create the opportunity for the creation of NO_x ERCs via electrification of these engines. At this time, VCAPCD cannot estimate the amount of ERCs that could be generated via this strategy.*

When BHP initiated this project years ago, it was aware of the potential difficulty in acquiring enough NO_x ERCs to offset its project emissions, which, at the time, the EPA said needed to be purchased to comply with the Clean Air Act. At that time, BHP could have worked with VCAPCD staff to seek out new opportunities onshore to create and "bank" new emission reductions and/or seek a rule-making change such that it could create and "bank" new offshore *mobile* emission reductions, like a tug engine retrofit-type project.

Unless and until BHP can demonstrate to the Commission's satisfaction full compliance with Rule 26.2, the Commission cannot find the project consistent with the requirement of CCMP section 30253(3).

Conclusion

For the reasons described above, the Commission finds that to bring the Cabrillo Port project into compliance with the requirements of the enforceable policies of California's Coastal Management Program (CCMP), BHP must provide both 1) offsets of stationary NO_x and ROC, and 2) BACT, as required by VCAPCD Rule 26.2. BHP has not complied with the offset and BACT requirements. As such, the project is inconsistent with VCAPCD Rule 26.2, as incorporated into the CCMP by section 307(f) of the CZMA, and therefore with CCMP section 30253(3). In order to bring the project into conformity with the CCMP, BHP must document to the Coastal Commission's satisfaction that it has met the offset and BACT requirements of VCAPCD Rule 26.2.

Note: Because Cabrillo Port would be a "coastal-dependent industrial facility," it is presumptively subject to analysis under CCMP section 30260 (see Section 5.11, "Coastal Dependent Industrial 'Override' Policy," of this report). In section 30260, the CCMP provides for special approval consideration of coastal-dependent industrial facilities, like Cabrillo Port, that are otherwise found inconsistent with the resource protection and use policies contained in Chapter 3 of the Coastal Act. The section 30260 industrial override policy applies only to Chapter 3 policies of the Coastal Act. Air quality rules that are incorporated into the CCMP by section 307(f) of the Coastal Zone Management Act are not Chapter 3 policies of the Coastal Act and therefore cannot be overridden by section 30260. If the Coastal Commission finds a project inconsistent with section 307(f) of the Coastal Zone Management Act, as it has here, it must object to the project, or condition the project to bring it into conformity with the enforceable policies of the CCMP.

4.3 Siting Hazardous Development

CCMP § 30250(b) states:

> *Where feasible, new hazardous industrial development shall be located away from existing developed areas.*

The proposed FSRU, subsea pipelines, and onshore facilities and pipelines constitute new hazardous industrial development. As discussed in more detail below, LNG and natural gas have the potential to cause injuries and fatalities in the event of an accidental or intentional release of LNG and/or natural gas. As part of the NEPA and CEQA environmental review process, State and federal regulatory agencies conducted an independent risk assessment of the proposed project, identifying project-specific release scenarios and potential adverse impacts to public health and safety. According to the project-specific, peer-reviewed Independent Risk Assessment, injuries from a worst credible case scenario occur at a distance of up to 7.3 miles from the FSRU. This distance reaches across the shipping lanes, but does not reach onshore. The FSRU and pipelines have been designed to include comprehensive safety systems, and BHP has agreed to implement mitigation measures to reduce the potential adverse impacts associated with a hazardous release of LNG or natural gas.

Risks Associated with LNG and Natural Gas

When natural gas is cooled to a temperature of -260 degrees Fahrenheit, it converts from a gas to a clear, colorless, and odorless liquid. Cooling natural gas to a liquid reduces the volume by a factor of 600, and makes it possible to efficiently store and transport large quantities of this fuel in specially designed spherical tanks and tanker ships. LNG is not stored under pressure; rather, the storage tanks are heavily insulated to keep the LNG cold.

LNG is composed primarily of 85 to 96% methane, with other light hydrocarbon components such as ethane, propane, and butane. LNG is flammable in its vapor state at a concentration range of 15% (i.e., 15% methane and 85% air) to 5%. The ignition temperature at its flammable concentration range is approximately 1,004 degrees Fahrenheit.

A cloud of natural gas may ignite and burn as a vapor cloud fire (see below); however, it will not explode (i.e., create damaging overpressure) unless it is confined. LNG itself, as a liquid, will not burn or explode – it must be warmed to its gaseous state and mixed with air in the proper concentration to allow combustion to occur.

Potential risks to health, safety, and the environment associated with natural gas and LNG include pool fires, jet fires, vapor cloud fires, vapor cloud explosions, rapid phase transitions, asphyxiation, and cryogenic effects. Each of these is discussed in more detail below.

Pool Fire

Spilled LNG may form a liquid pool from which it evaporates to natural gas. As the natural gas vapor disperses and reaches its flammability range and if an ignition source is encountered, the vapors will ignite and travel back to the origin, resulting in a pool fire. If the pool forms within a confined area, the fire will remain contained and will burn until the fuel is consumed. If the spill occurs outside a confined area, the burning pool is free to flow based on topography, current, and/or wind conditions.

Jet Fire

If LNG in a pressurized storage vessel is released, the material discharging from the hole in the vessel will form an aerosol or gas jet. If this material finds an ignition source while in its flammable range, a jet fire may occur. This type of fire is unlikely to occur with the LNG storage tanks on the FSRU, because the material is not stored under pressure. However, jet fires could occur in pressurized vaporizers or during LNG offloading or transfer operations when pressures are increased by pumping.

Vapor Cloud Fire

If LNG is spilled on the ground or on water, it will boil and evaporate rapidly. The resulting vapor cloud is cold, dense, and visible because it condenses water out of the air. If there is no ignition source, the vapor cloud will hug the ground and spread laterally. As the cloud becomes warmer, mixes with air, and continues to disperse, it may become invisible, and it will eventually become neutrally buoyant.

If LNG is released to the atmosphere and forms a vapor cloud, and the vapor cloud ignites before it is diluted below its lower flammable limit, a flash fire could occur. The entire cloud would not ignite at once; however, a flash fire might burn back to the release point resulting in either a pool fire or a jet fire. A vapor cloud fire will not generate damaging overpressure, i.e., an explosion, unless it is confined.

Table 5.3-1 below shows a range of values for thermal radiation that can be expected to cause damage or injury to exposed people or property. By way of comparison, at the Earth's surface on a clear, hot summer day the solar constant is one kilowatt per square meter (kW/m^2). Five kilowatts per square meter is commonly considered the heat flux level appropriate for protection of human health and safety, assuming evacuation or other evasive measures is possible. The National Fire Protection Association standard for the production, storage and handling of LNG recommends that this level not be exceeded at a property line or wherever people gather. Alternative lower criteria have been developed to address sensitive public exposure, and facilities that are difficult to evacuate (i.e., high density housing, hospitals, schools, theaters, stadiums, etc). The US Department of Housing and Urban Development required that thermal radiation levels do not exceed 1.4 kW/m^2, while the European Union has adopted a threshold of 1.5 kW/m^2). API 521, the American Petroleum Institute's recommended practice guide, sets a limit for continuous worker exposure at 1.58 kW/m^2, while the Society of Fire Protection Engineers recommends a level of 2.5 kW/m^2 as a public tolerance limit. The lower threshold of 1.5 kW/m^2, included in the table above, is essentially the "no adverse effect" level or the level of thermal radiation considered safe for all exposed individuals.

Table 5.3-1: Common Approximate Thermal Radiation Damage Levels

Incident Heat Flux (kW/m^2)	Type of Damage
1.5	Considered safe for continuous human exposure. No immediate evacuation necessary.
5	Permissible level for emergency operations lasting several minutes with appropriate clothing. Level appropriate for the protection of human health and safety.
12.5-15	Minimum energy to ignite wood with a flame; melts plastic tubing
18-20	Exposed plastic cable insulation degrades
25	Minimum energy to ignite wood at indefinitely long exposure without a flame
35-37.5	Damage to process equipment including steel tanks, chemical process equipment, and/or machinery

Vapor Cloud Explosion

If an LNG vapor cloud with concentrations in the flammable range occurs in a confined area, e.g., within the hold of the FSRU or an LNG carrier, and that cloud is ignited, damaging overpressure could occur. An explosion occurring under this scenario could cause severe damage onboard the vessel.

Rapid Phase Transition

A rapid phase transition (RPT) could occur when LNG is spilled on water, resulting in a nearly simultaneous transition from the liquid to vapor phase, with an associated rapid increase in pressure. RPTs may result in two types of effects: 1) a localized overpressure resulting from the rapid phase change, and 2) dispersion of the "puff" of LNG expelled to the atmosphere. RPTs at operating LNG facilities have occurred at the Canvey Island, UK terminal (1973) and an Indonesian liquefaction facility (1993). No injuries or fatalities were reported in either incident.

Asphyxiation

Although natural gas is not toxic, it can act as an asphyxiant when it displaces oxygen in a confined space.

Cryogenic Effects

LNG is a cryogenic material, and contact with it can cause severe damage to the skin and eyes. It can also make ordinary metals brittle, causing them to fracture. Cryogenic operations therefore require specialized containers and piping. LNG is typically stored in metal containers consisting of 9% nickel steel or aluminum, and is transported through stainless steel pipes that are capable of handling materials with very low temperatures.

LNG Release Scenario

If LNG is released due to a rupture or hole in a Moss storage tank on the FSRU, or a storage tank on an LNG carrier, some combination of the following scenarios might occur:

- Some of the LNG will immediately transition from the liquid phase to a gas on contact with warm marine air, causing RPT overpressure near the tank;
- Some of the LNG will flow out of the tank as a liquid stream and fall onto the water surface, spreading to form a liquid pool of LNG on the sea surface. Intermittent RPT overpressures will be expected below the surface, which will also generate underwater blast force sound waves. Additional damage to LNG facilities could also occur due to RPT blast overpressure, especially if water flows into a breached storage tank;
- Intermittent RPTs will occur as wave action exposes the cold LNG to pockets of warmer water, and underwater blast force sound waves will be generated;
- Evaporation of the liquid LNG pool will begin immediately, forming a cold, dense cloud of natural gas, like a low fog on the surface of the water.

If the cloud of natural gas is ignited soon after an LNG release begins, a pool fire will result. If the vapor cloud does not encounter an ignition source soon after the release begins (how soon depends on a number of factors, but would be measured in minutes, not hours or seconds), the vapor cloud will continue to expand and drift away from the point of release. Under these circumstances, the vapor cloud will move downwind at a rate determined by the speed and direction of the wind, and the LNG pool will spread, thin out, or eventually become fragmented due to wind, wave and current effects.

Specific worst-case release scenarios for the proposed project have been described in the EIS/EIR, and were independently evaluated by the Sandia National Laboratory. Potential scenarios causing a release, and potential impacts of a worst-case release, are detailed below.

LNG Carrier Accident History

A summary of major LNG carrier accidents is included in Exhibit HAZ-1 of this report. Exhibit HAZ-1 identifies five accidents since 1944 that have occurred while LNG ships were at sea. The rest occurred when ships were in port and during loading and offloading operations. None of these accidents resulted in injuries, fatalities, or a release of LNG, and only one was the result of a collision with another vessel. In 2002, the LNG carrier Norman Lady collided with a US Navy submarine, the USS Oklahoma City, east of the Strait of Gibraltar. The collision occurred after the LNG cargo had been unloaded, and although dents and cracking in the hull were reported, no damage was sustained by the nearly empty Moss-type spherical storage tanks.

Risk Assessment Process

A site-specific Independent Risk Assessment (IRA) was completed as part of the environmental review of the proposed project. Early in the review process, consultants and State and federal agencies sponsored a security and vulnerability assessment workshop and a hazard identification and analysis workshop. The purpose of the workshops was to identify and analyze potential hazards related to the proposed project.

Workshop participants discussed concerns identified through the public scoping process, including various terrorist scenarios. Issues and scenarios specifically discussed included the use of airplanes from local airports or shoulder-fired missiles to attack the facility; hijacking of LNG carriers; the potential for catastrophic and smaller LNG releases due to equipment failure and/or human error; the integrity of the offshore and onshore pipelines; accidents involving other vessels; earthquakes; emergency response; and the validity of computer modeling.

Based on the results of the workshops, five main scenarios and several variations were identified for consequence analysis of LNG spills. These five scenarios represented a range of both accidental and intentional events that could produce breaches of the LNG tanks, and ranged from several smaller but potentially more frequent events, to the simultaneous release of the entire contents of all three LNG storage tanks on the FSRU. In 2004, an initial Independent Risk Assessment was produced, and concluded that none of the release scenarios would cause adverse impacts to the public, either in the traffic lanes or onshore.

The 2004 IRA was prepared prior to the December 2004 publication of the Sandia National Laboratories report entitled *Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water.* The Coast Guard commissioned the authors of the Sandia guidance report to conduct a third-party technical review of the 2004 IRA. The results of the Sandia review, the additional analysis and evaluations conducted, and the resolutions of suggested changes were incorporated into a new, revised Independent Risk Assessment issued in January 2006. The 2006 IRA is incorporated by reference into this report, and is the basis of the discussion of FSRU risk scenarios below.

FSRU Risk Scenarios

The 2006 IRA studied several scenarios involving the release of LNG to the marine environment in the immediate vicinity of the FSRU, including vessel collisions and intentional events. Based on the technical review conducted by Sandia and on current knowledge and modeling techniques for collisions, breaches, and potential spills for double-hulled vessels, the following hazard scenarios were addressed in the IRA:

- Accidental or intentional marine collision;
- Accidental explosion in the hull void (i.e., within the void space between the FSRU's inner hull plate and the exterior of the Moss tank.);
- Accidental explosion in a Moss tank;
- Accidental explosion between vessels;
- Intentional two-Moss-tank breach; and
- Accidental or intentional cascading multiple (two or three) Moss tank release (escalation event).

From these six hazard scenarios, three general accident consequence scenarios were identified: 1) consequences from a marine collision; 2) consequences from an intentional breach; and 3) consequences of the escalation scenario. These three accident consequence scenarios encompass the worst possible consequences of the six hazard scenarios listed above.

Table 5.3-2 summarizes the three potential FSRU accident consequence scenarios discussed in the 2006 IRA.

Table 5.3-2: Summary of FSRU Accident Consequences

	Marine Collision	**Intentional Breach**	**Escalation**[a]	
Breach Size	1300 m^2	7 m^2 & 7 m^2	7 m^2 & 1300 m^2	7 m^2 & 2 x 1300 m^2
Number of tanks	50% volume of 1 tank	2	2	3
Release quantity (gallons)[b]	13 million	53 million	40 million	53 million
Pool Spread Distance				
Distance downrange (nm / miles)	0.40 / 0.45	0.35 / 0.40	0.33 / 0.38	0.43 / 0.50
Pool Fire				
Radiative flux distance > 5 kW/m2 (nm / miles)	1.60 / 1.85	1.42 / 1.64	1.35 / 1.56	1.74 / 2.01
Vapor Cloud Dispersion (No Ignition)			Immediate Ignition No Vapor Cloud Hazard	
Average flammable height (feet)	69.9	98		
Maximum distance to LFL[c] (nm / miles)	2.85 / 3.29	6.03 / 6.95		
Time for maximum distance (minutes)	50	89		
Vapor Cloud (Flash) Fire				
Radiative flux distance > 5 kW/m2 (nm / miles)	3.57 / 4.11	6.31 / 7.27		

Notes:
Pool fires and vapor cloud fires are mutually exclusive.
All radiative flux distances given from release location.
Wind speed = 4.5 mph, temperature = 69.8 °F.
[a]The escalation case was modeled as a pool fire resulting from a breach of secondary containment due to the effects of a fire. Since ignition is guaranteed due to the fire, no dispersion cloud develops.
[b] Tank volume of 100,000 m^3 is used for ease of calculations; actual tank volume is 90,800 m^3.
[c] LFL stands for Lower Flammability Limit.

The intentional two-Moss-tank breach (a simultaneous release of LNG from two tanks) has the potential to cause impacts at the greatest distance from the FSRU, by means of a vapor cloud (flash) fire resulting from dispersion. Under this scenario, injuries would occur at a distance of 7.3 miles from the FSRU. The escalation case involving failure of all three cargo tanks produces the greatest distance at which serious injuries from a pool fire would occur; i.e., approximately two miles from the FSRU. No vapor cloud dispersion or vapor cloud fire would result from the escalation case because immediate ignition is presumed for this scenario. The marine collision scenario is also discussed below because it has the potential to affect one of the vessel traffic lanes.

Worst Credible Case Scenario

The worst credible case scenario involves an accidental or intentional event resulting in the release of 53 million gallons of LNG to the ocean surface. As discussed above, subsequent to an LNG release three potential consequences might result: a pool fire, a vapor cloud dispersion with no ignition, and/or a vapor cloud (flash) fire.

Pool Fire: The escalation scenario addresses both an intentional event and an accident in which one tank is breached causing one or both of the others to fail. Under this scenario, a release of 53 million gallons of LNG would form a pool on the ocean surface approximately one-half mile in diameter. Beyond the limits of the pool, methane would be present in the atmosphere above the ocean surface. Assuming that ignition of the gas occurs at the time of release, computer modeling indicates that injuries from the fire would occur within two statute miles of the FSRU.

This distance is less than the proposed Area to be Avoided (ATBA) of two nautical miles, or 2.3 statute miles, around the FSRU. Therefore, under this scenario a pool fire would not affect either the nearest point on the mainland or the nearest marine vessel traffic lane, the closest of which is about two nautical miles from the FSRU.

Vapor Cloud Dispersion: Dispersion modeling was used to determine the distance from the FSRU at which a vapor cloud, having methane within the flammable range, would extend under three different wind speeds: 4.5, 8.9, and 13.4 miles per hour. These wind speeds represent the typical lower, average, and upper wind velocities experienced in the vicinity of the FSRU, based on available weather data from a nearby buoy. Under the dispersion scenario, a wind speed of 4.5 miles per hour causes the worst case, in which a flammable vapor cloud extends approximately 6.95 miles downwind from the FSRU. (Higher wind velocities cause the gas cloud to dissipate more quickly; therefore the reach of potential negative impacts is shorter.) The vapor cloud would not reach shore, but with southwest winds it would extend across both the southbound and northbound coastwise traffic lanes.

Vapor Cloud (Flash) Fire: The vapor cloud dispersion scenario discussed above assumes no ignition of the vapor cloud. The IRA also modeled an intentional event in which ignition of the vapor cloud is delayed. Under this scenario, the vapor cloud is allowed to disperse, and then is ignited causing a flash fire which burns back to the FSRU. Under the worst-case wind conditions of 4.5 miles per hour, injuries from the fire would occur within 7.3 miles of the FSRU, approximately one hour after the release.

The hazards from a vapor cloud fire reach to both shipping lanes, but extend no closer than 6.5 miles from the nearest mainland landfall. The hazard to the shipping lanes occurs about 30 minutes after the initiating event – this delay between the event which initiates the release and the exposure of the shipping lanes could allow for vessel notification and response. The exposure time within the shipping lane is for about another 30 minutes, until the vapor cloud disperses to below the lower flammability limit. An average of three vessels would be exposed to this vapor cloud hazard based on marine traffic frequency estimates.

Marine Vessel Collision

The 2006 IRA considered a scenario in which a large marine vessel, such as a container ship, oil tanker, or passenger ship, collides with the FSRU, resulting in the breach of a Moss tank aboard the FSRU. The analysis indicated that this scenario would result in the instantaneous release of 50% of the volume of one tank, approximately 13.2 million gallons of LNG. A spill of this volume would form a pool of LNG with a maximum diameter of 2,395 feet. If the pool encounters an ignition source before it has time to disperse, injuries would occur up to 1.8 miles from the FSRU. This distance extends beyond the proposed 1,640-foot safety zone, but does not reach past the ATBA or into the shipping lanes 2.3 miles away.

If the LNG released from a marine collision evaporates and forms a vapor cloud before encountering an ignition source, under worst-case conditions the outer boundary of the vapor cloud at its lower flammable limit would extend approximately 3.3 miles downwind. If the vapor cloud is ignited under these worst-case conditions, injuries would occur within the shipping lanes approximately 28 minutes after the initiating event, and the hazard would last another 27 minutes before the vapor cloud dissipated to below the lower flammability limit (LFL).

Not all marine collisions have the potential to cause a breach of an LNG storage tank on the FSRU – the colliding vessel must have the proper hull geometry, speed, trajectory, etc., to affect a breach of one of the Moss tanks. The potential frequency of a collision with the necessary characteristics to affect a breach is 2.4×10^{-6}, or once in every 417,000 years, based on the number and size of large vessels transiting near the FSRU.

FSRU Safety Systems

Operational accidents of varying levels of severity occur at all types of processing facilities, and at facilities where materials are transferred from one container to another. The FSRU would be equipped with the safety systems described in this section to reduce the risk of an accident and/or hazard scenario, and reduce the adverse impacts of any accident or hazard that might occur.

The FSRU would carry emergency systems and equipment for hazard detection, emergency shutdown, spill containment, fire protection, flooding control, crew escape, and all other systems and equipment required by the USCG and applicable laws and regulations.

Safety systems would include crew safety shelters located on the forward part of the FSRU and in the crew accommodation area, dedicated fire system pumps, unobstructed walkways, and life rafts. The regasification facility aboard the FSRU would be highly instrumented, and would be protected by extensive safety systems, including fire and gas detection, fire-fighting systems, a shutdown system, and a blowdown system.[66] The regasification facility, vessels, pumps, piping, and instruments would be inspected and maintained at regular intervals. All maintenance operations would be performed under guidelines designed to minimize releases and to ensure the safety of the system and personnel.

---

[66] Blowdown is a means of providing controlled venting of the contents of a pressurized pipeline to perform inspections, maintenance, or repairs.

Hazard Detection and Emergency Shutdown Systems

The FSRU would be equipped and designed to provide protection to personnel, the unit itself, and the environment against the effects of an uncontrolled release of hydrocarbons or other process gases.

Emergency Shutdown: The entire offshore facility, including the FSRU, offshore pipelines, and berthed LNG carrier, would be protected by comprehensive emergency shutdown systems. These would be electronic, high integrity, redundant systems that would initiate a range of shutdown actions, with the course of action depending on the nature and severity of the cause for shutdown. Shutdown systems would include electronic detection devices, thermal fusible plugs, and pneumatic pipe loops, which would automatically activate a range of shutdown procedures keyed to the cause for the shutdown. Manually activated shutdown initiators at various locations, including the facility's control room and crew safety shelters, would complement the automatic systems.

Emergency Depressurizing and Venting System: The FSRU would be equipped with a cold stack to vent natural gas vapors in the event of an emergency. The cold stack would be provided with an electric heating system to vaporize any emergency LNG releases and, if used, would discharge natural gas to the atmosphere. The cold stack height would be approximately 266 feet above the loaded draft waterline (269 feet if the FSRU is empty) and approximately 105 feet above the top of the storage tanks, elevated personnel walkway, and elevated piping along the tops of the tanks. These specifications would allow dispersal of the natural gas, considering the presence of the FSRU and an adjacent LNG carrier.

Two additional vent systems would be provided: one high-pressure vapor system that would handle releases from the LNG vaporizers and the high-pressure boil-off gas compressor, and a low pressure vent that would handle low pressure gas releases and liquid discharges from thermal relief valves and equipment drains. Any small liquid discharges would be caught in the low-pressure vent knock-out drum, where the liquid would be regasified using an electric heater. The natural gas would then be vented through the stack, with further electrical heating, if necessary, to ensure proper dispersal to the atmosphere. In the event of an emergency, processing operations would be shut down and the electric heater would be kept running through the use of the emergency generator. The vent outlet would be elevated to the top of a vent stack to ensure adequate dispersion of vapors below the flammable concentration limit. No gas will ever be flared.

Emergency Response: All vessels, facilities, and operational activities conducted by BHP would be covered by emergency response plans, which would address specific incidents such as oil spills, fires, collisions, and other identified potential incidents. BHP would provide personnel training to both its own employees and contractor personnel involved in the LNG and support operations, including the FSRU crew, LNG carrier crew, and tug/supply vessel crew. Periodic drills and emergency exercises would be conducted internally, for applicant and contractor personnel, and externally, for organizations and regulatory authorities that may be involved in emergency response activities associated with LNG operations.

The initial response to any emergency at the FSRU would be carried out by personnel aboard the FSRU and dedicated support vessels. The FSRU and support vessel personnel would be trained to respond to all identified emergencies and would be provided with the necessary equipment and outside support to respond according to the above plans. BHP would also contract with trained and experienced emergency response contractors and service providers. BHP's Incident Management Team, organized in the federal- and State-recognized Incident Command System, would support the offshore emergency responders and coordinate with federal, State, and local emergency management personnel. The USCG would be the lead agency to respond to any public safety emergency, and would coordinate efforts of other federal, State, and local agencies.

<u>Gas Detection Systems</u>: The FSRU would be equipped with a stationary gas detection system consisting of continuously operating catalytic-type detectors and infrared line-of-sight detectors connected to the FSRU's electronic fire and gas panel. The gas detection system would sound audible alarms as well as initiate the shutdown of appropriate equipment and systems. Gas detection would also be provided for the regasification plant, deck areas such as the Moss tank domes and loading arm areas, machinery spaces through which high pressure gas is piped, and the ventilation air inlets to safe spaces, including personnel accommodation areas.

Fire Protection Systems

The FSRU would be equipped with a variety of firefighting systems, depending upon the location and type of possible fire. Proposed fire systems include a main seawater deluge system to contain a gas fire and to avoid ignition in case of a gas release; a dry chemical powder system for LNG fires; a low expansion foam system for process deck areas, machinery, and oil storage spaces; a carbon dioxide fire suppression system for machinery spaces, paint lockers, and all flammable materials storage areas; a conventional sprinkler system for living quarters; and supplemental fire extinguishers stationed at multiple locations around the FSRU.

Spill Containment System

Secondary containment would be designed for areas with the greatest risk of LNG release, such as the loading arm area, and would have two main functions: 1) to safely contain any releases from the primary containment (tanks and loading manifold area); and 2) to protect the FSRU from potential damage from exposure to cryogenic temperatures. Spill containment would be designed in accordance with federal codes and standards applicable to LNG carriers and terminals (49 CFR 193 or NFPA 59a).

FSRU LNG Hazard-Related Mitigation Measures

Both the 2006 IRA and the Sandia report recommended specific measures to reduce the risk of potential hazards associated with handling and storing LNG at the FSRU. The EIS/EIR includes mitigation measures that were developed taking into account the recommendations contained in the 2006 IRA and Sandia report. BHP has agreed to comply with the safety-related mitigation measures required in the Mitigation Monitoring Program of the EIS/EIR as in Table ES-5.

Designated Safety Zone and Area to be Avoided requires BHP to monitor a safety zone, to be designated by the US Coast Guard, around the FSRU where public maritime traffic would be excluded. (The safety zone currently proposed covers a 1,640-feet radius around the FSRU; however final designation by the Coast Guard has not yet been made.) In addition, BHP would implement an "Area to be Avoided" with a radius of two nautical miles around the FSRU. Both zones would be marked on nautical charts and would serve as part of the Notice to Mariners. The safety zone would be patrolled at all times by at least one tug/supply vessel, except when both tugs are assisting LNG carriers with docking and undocking. The safety zone would also be continually monitored using radar tracking, which would provide advanced warning of approaching vessels. During docking and undocking procedures when tugs are unavailable, the safety zone would be patrolled by the crew boat.

Class Certification and a Safety Management Certificates are required under international agreements for vessels engaged in international voyages. Although this would not be required for the stationary FSRU, BHP would obtain class and safety management certification for other project components, including the subsea pipelines, the pipeline end manifold, and the risers. When operational, the FSRU will be certifiable under the International Safety Management, International Organization for Standardization (ISO) 9000 quality standards and ISO 14000 environmental standards.

Periodic Inspections and Surveys by Classification Societies requires BHP to allow periodic inspections of the FSRU by classification societies, including annual inspections and a full survey after five years of facility operation and every five years thereafter. This measure would ensure that shipboard procedures are regularly reviewed and updated, and that emergency equipment is maintained and updated as necessary.

Cargo Tank Fire Survivability requires BHP to provide safety engineering, hazard identification and analyses (HAZIDs), hazard and operability studies (HAZOPs), and quantitative risk analyses (QRAs) supporting the detailed engineering design, including cases where cargo tank insulation is presumed to fail in the event of a fire.

Structural Component Exposure to Temperature Extremes**.** BHP would provide safety engineering, HAZIDs, HAZOPs, and QRAs supporting the detailed engineering design, including cases where decking, hulls, and structural members are exposed to both cryogenic temperatures from spilled LNG and exposure to extreme heat from a fire.

Pre- and Post-Operational HAZOPs requires BHP to conduct HAZOPs that address all LNG operations prior to beginning operation, after one year of operation, and every two years thereafter unless there has been a change in equipment or other significant change. Results of these reviews would be used to improve and refine operations practices and emergency response procedures.

Automatic Identification System, Radar, and Marine VHF Radiotelephone**.** BHP would equip the FSRU with an Automatic Identification System and with real-time radar and marine VHF radiotelephone capabilities. This measure would reduce the likelihood of a ship collision or intentional event by providing multiple communication channels.

Subsea Pipeline Hazards

BHP proposes to regasify LNG onboard the FSRU, then transport natural gas from the FSRU to shore via two parallel 22.77-mile long, 24-inch diameter subsea pipelines. The pipelines would transport only natural gas, not LNG, and the natural gas would be odorized onboard the FSRU before it enters the pipelines.

Historical Natural Gas Pipeline Incidents

A substantial amount of historical data exists regarding the hazards and risks associated with pipeline transportation of natural gas. For decades, pipeline operators have been required to provide specific information regarding pipeline incidents to the US Department of Transportation's Pipeline and Hazardous Materials Safety Administration Office of Pipeline Safety. The California Public Utilities Commission also addresses risk management as part of its regulatory jurisdiction over 100,000 miles of utility-owned intrastate natural gas pipelines, which transported 85% of the total amount of natural gas delivered to California's gas consumers in 2003. Table 5.3-3 lists pipeline incidents by cause.

Table 5.3-3: Natural Gas Transmission Pipeline Incidents by Cause

Cause	1970 to 1984	1990-1999	2000-2003
Outside Forces (Excavation, Weather Damage, Vandalism, etc.)	54%	41%	32.8%
Corrosion (Internal and External)	17%	22.3%	27.0%
Construction or Material Defect	21%	15.3%	17.7%
Other (Fire/Explosion, Incorrect Operation, Malfunction of Control Equipment, etc.)	8%	21.4%	22.6%
Total Incidents and Annual Average	**Total: 5,862 Average: 404/yr**	**Total: 771 Average: 77/yr**	**Total: 345 Average: 86/yr**

Notes:
Source: Revised Draft EIR, Table 4.2-10
Data includes onshore and offshore pipelines in the United States.

As the last row of Table 5.3-3 shows, the total number of reportable incidents since 1990 has decreased. Although part of the decrease is due to a 1984 change in reporting requirements, the decrease is also the result of a number of pipeline safety initiatives implemented over the past few decades. These safety measures, such as better pipeline signage and one-call notification systems, have reduced the number of incidents attributable to outside forces. As older pipelines have been abandoned or upgraded to include cathodic protection systems, the number of incidents associated with corrosion events has also decreased.

The dominant incident cause since 1970 has been outside forces, which include: mechanical equipment such as bulldozers and backhoes; boat anchors; trawling equipment; earth movement due to soil settlement, washouts, and seismic events; weather effects such as wind, storms and extreme temperatures; and willful damage. Older pipelines have a higher frequency of outside force incidents, partly because their location may be less well known and less well marked than newer lines. In addition, older pipelines contain a disproportionate number of smaller-diameter pipelines, which have a greater rate of outside force incidents. Smaller-diameter pipelines are more easily crushed or broken by mechanical equipment or earth movement.

The frequency of service incidents is strongly dependent on pipeline age. While pipelines installed since 1950 exhibit a fairly constant level of service incident frequency, pipelines installed before that time have a significantly higher rate, particularly due to corrosion. More technologically advanced coatings and cathodic protection to reduce corrosion potential are generally used on newer pipelines.

Subsea Pipeline Safety Risks

Between the years 1986 to 2005, efforts to improve pipeline safety have had some success: although higher numbers of incidents have occurred in recent years, there is an overall decreasing trend in the numbers of fatalities and, especially, injuries associated with pipeline incidents. During this 20-year period, an average of 3.2 fatalities occurred per year during the operation of approximately 324,600 miles of onshore and offshore natural gas transmission pipelines. Using combined incident data for onshore and offshore pipelines represents a conservative approach for estimating the potential risks to the public from the twin subsea pipelines associated with the proposed project.

Table 5.3-4 below describes the estimated annual incident frequency for the offshore pipelines, based on historic pipeline incident data.

Table 5.3-4: Estimated Annual Incident Frequency

Event	Average Total Number per Year[a]	Estimated Frequency per Pipeline Mile[b]	Estimated Frequency for Proposed Subsea Pipelines[c]
Reportable Incident	89.2	2.7×10^{-4}	1.2×10^{-2} Once every 83 years
Injury requiring in-patient hospitalization	11.7	3.7×10^{-5}	1.7×10^{-3} Once every 588 years
Fatality	2.9	1×10^{-5}	4.6×10^{-4} Once every 2,174 years

Notes:
[a]From Revised Draft EIR Table 4.2-12. See also Table 4.2-17
[b]Based on operation of 324,800 miles of gas transmission line
[c]Based on two pipelines, each 22.77 miles long

The natural gas pipelines associated with the proposed project would carry odorized natural gas from the FSRU to shore. If a pipeline fails, natural gas would be released into the ocean, where it would bubble up to the surface and form a vapor cloud. This hazard is discussed in detail in the Section titled, "Risks Associated with LNG and Natural Gas," above.

Onshore Pipeline Hazards

BHP proposes to use Horizontal Directional Boring (HDB) technology to allow the two proposed 24 inch diameter subsea natural gas pipelines to pass beneath Ormond Beach and surface within the coastal zone at the Reliant Ormond Beach Generating Station site. Once the pipelines reach the surface they would be routed into a metering and backup odorant station where they would be consolidated into one 36 inch diameter pipeline. This proposed pipeline would then be trenched and buried between six and eight feet deep along a proposed pipeline right-of-way that extends inland from the generating station site and passes outside of the coastal zone boundary near the southern terminus of Edison Road.

Onshore Pipeline Safety Risks

One of the primary sources of potential subsurface pipeline rupture comes from seismic-induced damage to pipelines. Similar to the proposed subsea pipelines, the proposed onshore subsurface pipelines would also be designed to accommodate the anticipated maximum lateral/vertical motion from earthquakes. In addition, damage, fires and explosions may occur due to human error, equipment failure, or non-seismic natural phenomena (landslide, erosion, etc.). Natural gas pipelines could also be damaged intentionally, although they would not necessarily be considered a high value target (one where a single event would cause widespread destruction or loss of life).

Loss of pressure in either of the onshore pipelines would induce an automatic shut-down of the natural gas transport system, thereby limiting the amount of natural gas that would be released in the event of a pipeline rupture or leak. Automatic pipeline shutdown would result in the automatic, remote closure of station and mainline valves throughout the affected pipeline. To limit the potential release duration and the quantity of natural gas that may be released from a ruptured pipeline segment, federal regulations stipulate a maximum distance between pipeline closure valves. The approximate distance between valves on the proposed pipelines is 3.8 miles and given this valve spacing and the proper functioning of automatic, remote pipeline shut down procedures, the anticipated time for all natural gas to vent from a ruptured pipeline segment would be between five and six minutes (depending on the amount of damage suffered by the pipeline).

Potential damage that might occur as a result of unplanned releases of natural gas from high pressure transmission pipelines depends on: 1) how the pipeline fails (a leak versus a rupture), 2) the nature of the gas discharge (the angle of the jet and whether the jet is obstructed, 3) the time to ignition (immediate, delayed or no ignition), and 4) whether secondary fires are ignited as a result of a fire at the pipeline. Most of these potential scenarios would result in the release of an odorized natural gas cloud at concentrations that are likely to be in the flammable range. As such, federal pipeline safety regulations require the determination of a potential impact radius (PIR) for the proposed pipeline and its associated metering station.

The PIR for the proposed onshore pipelines are estimated at 820 feet or 250 meters. Pipeline safety regulations also use the concept of High Consequence Areas (HCAs) to identify specific locales and areas where a release could have the most significant adverse consequences. HCAs within the PIR for the proposed onshore pipelines are limited to the portions of the publicly accessible portion of Ormond Beach within 820 feet of the proposed Reliant Ormond Beach Generating Station Shore Crossing.

At the shore crossing where the public may congregate, the pipelines would remain at least 50 feet below the surface of the beach until they slope to the surface at the Ormond Beach Generating Station site, approximately 1000 feet inland from the mean high tide line. The soil content at the depth of the shore crossing is typically very fine silty sand to sandy silt with some clay deposits and the HDB technology would be expected to control the annular mud pressures to reduce or eliminate the risk of a fracture in the surrounding soil formation. The pipeline at this location would have a wall thickness of 0.875 inches and would be coated for protection against both external corrosion and abrasion. However, should a leak occur and natural gas reach the surface at this location, the odorant applied to the natural gas at the FSRU would be easily detectable.

Pipeline Mitigation Measures

BHP proposes to implement mitigation measures to reduce the risk of potential hazards associated with transporting natural gas through the subsea and onshore pipelines. Mitigation measures are summarized below, and described fully in Appendix C.

- BHP would treat as an HCA any onshore public beach area under which is located a pipeline carrying natural gas.
- BHP would develop and implement a pipeline integrity management program, including confirming all potential HCAs (including identification of potential sites from “licensed” facility information [day care, nursing care, or similar facilities] available at the city and county level) and ensuring that the public education program is fully implemented before beginning pipeline operations.
- BHP would treat as a HCA those areas where the potential impact radius includes part or all of a manufactured-home residential community, including outdoor gardens and areas with one or more normally occupied mobile homes or travel trailers used as temporary or semi-permanent housing, and outdoor gardens. BHP would enact for these areas the pipeline safety requirements contained in 49 CFR Part 192 Subpart O.
- Prior to the construction of the shore crossing, BHP would install signage indicating the presence of the buried natural gas pipeline at Ormond Beach. Signs would list the operator’s name and would include a toll free number to call for information in the event of plans to dig in the area or to report a leak or an emergency.
- BHP would provide to the USCG and other agencies all information necessary to place the subsea pipeline locations and warnings on navigational charts. This would include a Notice to Mariners for chart correction and inclusion on the next edition of applicable navigation charts. These data would be provided sufficiently early to allow these changes to be made on charts when FSRU mooring occurs. BHP would coordinate with the USCG to identify acceptable deadlines currently in place.

- BHP would implement emergency plans and procedures as specified in its operations plan and would immediately dispatch trained personnel to the area to investigate the emergency and to clear the area until the release has been stopped and pipeline integrity under the beach is assured as compliant with OPS Advisory Bulletin ADB-05-03, which requires preplanning with other utilities for coordinated response to pipeline emergencies.
- BHP would install five approximately equally spaced sectionalizing valves with approximately sited and sized blowdown stacks on the onshore pipeline route. The number of valves includes the station valves at each end of these pipelines. All valves would be equipped with either remote valve controls or automatic line break controls.
- BHP would design and install pipelines to meet seismic criteria, to ensure that pipeline integrity is maintained during severe seismic events that might be expected to bend or bow the pipelines.
- BHP would institute emergency plans and procedures that require immediate notification of vessels in any offshore area, and immediate notification of local police and fire services, whenever the monitoring system indicates that there might be a problem with subsea pipeline integrity.
- The proposed pipeline route minimizes geologic hazards to the greatest extent feasible, and crosses potential faults at as much of a right angle as possible. The pipelines would be installed directly on the seabed to help them withstand movement caused by fault rupture. Geological considerations related to the pipelines are discussed in more detail in Section 5.6, "Geology," below.
- The pipelines could be damaged during construction activities from the detonation of unexploded ordnance (UXO) in the Point Mugu Sea Range. BHP would conduct additional surveys over the offshore pipeline routes within and near the Point Mugu Sea Range to locate visible and shallowly buried UXO that might be disturbed by pipeline installation. If UXO are identified, they would be avoided, or BHP would develop procedures in consultation with the US Navy to eliminate the UXO.
- Pipelines laid on the seafloor in shallower water would be weight-coated with concrete or similar materials to provide additional pipeline mass and protect against rupture from contact with fishing gear and/or anchors.
- BHP will design, install, operate, maintain, and inspect pipelines to meet regulatory requirements, which include automatic monitoring of pipeline pressure and other conditions using a SCADA system and routine internal pipeline inspections.
- BHP would identify any offshore or onshore areas where the new transmission pipelines may be subjected to accelerated corrosion due to stray electrical currents, and implement precautions and mitigation measures as federally recommended. Cathodic protection systems would be installed and made fully operational as soon as possible during pipeline construction.

Conclusion

As described above, the proposed siting of Cabrillo Port would be located "away from existing developed areas" and is therefore consistent with CCMP section 30250(b) standard for locating new hazardous industrial development.

4.4 Oil and Hazardous Substance Spills

CCMP § 30232 states:

> *Protection against the spillage of crude oil, gas, petroleum products, or hazardous substances shall be provided in relation to any development or transportation of such materials. Effective containment and cleanup facilities and procedures shall be provided for accidental spills that do occur.*

This section addresses the potential release of refined petroleum products and other hazardous materials. The potential release of LNG is addressed in Section 5.3 (Siting Hazardous Development) of this report.

For the proposed project to meet the requirements of section 30232 it must satisfy two standards: (1) provide prevention measures to prevent or minimize the risk of a hazardous substance or oil spill; and (2), provide response equipment and procedures that can effectively contain and clean up the spill in the event of an accidental spill. The Commission defines "effective" as the ability to keep oil and hazardous substances from adversely affecting the shoreline resources of California.

The transportation, storage, use and disposal of petroleum products and hazardous materials are extensively regulated in order to prevent and reduce the risk of accidents and spills, and to provide response and clean-up in the event of a spill. The Cabrillo Port's FSRU, pipe-laying vessel, and tug/supply vessel must all be in compliance with numerous state, federal, and international safety and pollution control laws and regulations, including:

Pollution Control Laws and Regulations

- International Maritime Organization (IMO) Convention for the Prevention of Pollution from Ships as modified by Protocol of 1978 (MARPOL 73/78).
- USCG Shipboard Oil Pollution Emergency Plans (33CFR §151)
- USCG Vessel Response Plans for Vessels Carrying Oil as Secondary Cargo (33CFR §155.1030)
- USCG Navigation Vessel and Inspection Circular (NVIC)No.01-05: Interim Guidance for Non-Tank Vessel Response Plans
- National Oil and Hazardous Pollution Contingency Plans (NCP) (40CFR§300)
- US EPA Spill Prevention and Countermeasure Plans (SPCC) (40CFR §112)
- USCG Facility Response Plan Rules (30CFR§112.20)
- US EPA Clean Water Act
- US EPA Comprehensive Environmental Response, Compensation, and Liability Act
- California OSPR Non-Tank Vessel Oil Spill Contingency Plans (14CCR §825.01)
- California OSPR Vessels Carrying Oil as Secondary Cargo Oil Spill (VCOASC) Contingency Plans (14CCR §825.01)
- California EPA Hazardous Waste Control Act (Title 26 CCR)

Safety Laws and Regulations

- IMO International Convention on Standards of Training, Certification, and Watchkeeping 78
- IMO Convention on the International Regulations for Preventing Collisions at Sea (1972)
- US Occupational Safety and Health Administration Occupational Safety and Health Standards (29 CFR §§1910 and 1926)
- USCG Inspection and Regulation of Vessels (46 USC, Subtitle II Part B)
- CalOSHA Occupational and Industrial Safety (8CCR Chapters 3,4, and 7)

This assessment for petroleum and hazardous substance spill risk and impacts is organized as follows: (1) description of petroleum and hazardous substances; (2) potential project related spills; (3) potential coastal resource impacts; (4) prevention and response measures to avoid and minimize potential oil spill impacts; and (5) consistency with CCMP section 30232.

Description of the Project's Use of Petroleum and Hazardous Substances

BHP proposes to use low-sulfur diesel fuel, or biodiesel if it is available, to power the tugs/supply vessels and as emergency fuel for the FSRU generator. The low-sulfur diesel and biodiesel will comply with the specifications of the California Air Resources Board (CARB diesel). The biodiesel will be a mixture of 80% diesel and 20% vegetable oil.

The FSRU would also store up to 4,000 liters (1057 gallons) of mercaptan for the odorization of the natural gas being piped to shore. This material is a flammable liquid and would be stored on the FSRU in sealed containers within secondary containment. Other hazardous materials that would be stored and used on the FSRU include urea, lubricating oils, and small quantities of various paints, solvents, and other hazardous materials.

Diesel fuel, biodiesel fuel, and the lubricating oils are refined petroleum products and classified as Type 2 "light" oils. These are more acutely toxic to organisms but also dissipate more rapidly from the water and are less persistent in the environment than heavier crude and bunker oils. An accidental release of petroleum-based hazardous substances could cause acute and direct harm to marine species and habitats, and/or cause acute or chronic disturbances to the foraging patterns, migration patterns and spawning events of marine organisms. Mercaptan (used to odorize the LNG) is a sulfur hydrogen chemical compound that floats on water and is also acutely toxic to organisms that come in contact with or breathe it.

Risk of Potential Project Related Spills

The LNG carriers are double hulled vessels and would be equipped with a dual mode fuel system. Within California Coastal Waters, the carriers would run on 99% natural gas and 1% diesel, thereby reducing the risk of a diesel spill offshore California. However, there remains a risk of potential spills from diesel (or biodiesel) fuel and other hazardous substances during the construction and operation of Cabrillo Port from the following sources: (1) the fuel tanks of the pipe-laying vessel installing the subsea gas pipeline; (2) the storage tanks for the diesel (or biodiesel) fuel, lubricants, and mercaptan stored onboard the FSRU; and (4) the fuel tanks and cargo of the tug/supply vessels and crew boats servicing the FSRU.

Worst Case Spill from the Pipe-Laying Vessel

The pipe-laying vessel, because of its stationary position during pipeline installation, would be unable to avoid a collision with another vessel, which could result in the breach of its fuel tank and a release of diesel to the marine environment. The oil pollution contingency plan (OPCP) for the pipe-laying vessel identified a worst case scenario in which a vessel carrying 9,435 barrels (396,258 gallons) of fuel oil loses 25% , or 2,358 barrels (99,065 gallons), of its fuel.

Worst Case and Most Probable Spills from the FSRU

The FSRU would be towed to its mooring location with low-sulfur diesel fuel already stored onboard. BHP anticipates resupplying the FSRU with the Port of Hueneme supplies of low-sulfur diesel or biodiesel fuel to the extent that it is available. The FSRU would store 6,286 barrels (264,000 gallons) of fuel that would be used as a pilot fuel for the power generator engines, to fuel the tug/supply vessels, and as a backup fuel in the event of an emergency.

The Facility OPCP for the FSRU identifies the worst case scenario as the 100% loss of the diesel fuel storage tanks, resulting in a spill of 6,286 barrels (264,000 gallons) into the ocean over a one-hour period, under adverse weather conditions with no response or clean-up. The probability of this rapid, full-loss spill is very low because it would occur only if there was a total structural failure of the FSRU as a result of a catastrophic LNG incident.

A more probable accidental release of fuel oil at the FSRU could occur during the replenishment of the FSRU's diesel or biodiesel supply from the tug/supply vessels. The largest probable release from the FSRU that could occur during resupply activities would be 8.34 barrels (350 gallons) of fuel, which could, for example, occur as a result of a crane failure during transfer of a fuel tote container from the tug to the FSRU.[67]

Worst Case Spill from Tug/Supply Vessels

The tug/supply vessels and the crew boat would be powered by low-sulfur diesel, or biodiesel, from fuel supplies within the Port of Hueneme.[68] The single largest fuel tank on the tug/supply vessel would not exceed 523 barrels (22,000 gallons). The total volume of petroleum-based products onboard the tug/supply vessel, including diesel, lube oil, and the cargo, would not exceed 4,981 barrels (209,200 gallons). The Vessel OPCP for the tug/supply vessels provides a reasonable worst-case oil spill of 1,494 barrels (62,760 gallons).[69]

---

[67] February 19, 2007 letter from Bryan C. LeRoy, Manatt, Phelps & Phillips, LLP to Alison Dettmer, California Coastal Commission.

[68] *Ibid*

[69] In accordance with California contingency plan regulations for vessels carrying oil as secondary cargo, the reasonable worst case spill from the tug/supply vessel is calculated at 30% of the total volume of its petroleum based fuel and cargo.

Potential Impacts to Coastal and Marine Resources

Trajectory and Environmental Consequence Analyses

Oil spill trajectory analyses conducted for this project identified the resources at risk of impact from varying worst case spill scenarios under different seasonal wind, ocean current, and tide conditions. These analyses showed that an accidental release of oil or hazardous substances had the same range of potential impacts, whether the worst case spill originated from the pipe-laying vessel working along the pipeline route, or from the tug/support vessels transiting to and from the FSRU, or from the FSRU storage tanks.

For this project, BHP used the vector addition method to conduct separate oil spill trajectory analyses for the pipe-laying vessel, the tug/supply vessels, and the FSRU.[70] The OPCPs for the pipe-laying and tug/supply vessels and the FSRU provide detailed descriptions of the vector analysis methodology and trajectory results. In brief, the vector analyses considered the worst case spill scenarios (instantaneous release, 72 hour duration) under six different seasonal wind and current conditions (typically found in the project area):

1. Base case of northwesterly winds and north current of 0.3 meters per second (m/s). This base case would maximize the exposure for the mainland to oil.
2. A case with west current but all other input the same as the base case. When compared to the base case, this illustrates the effect of different wind direction on oil trajectory.
3. A case with a near shore southeast current at 0.2 m/s, with all other inputs the same as base case. This case is applicable to near shore positions for the pipe-laying vessel and tug/supply vessels and not to the offshore FSRU.
4. A Santa Ana case in December with strong westerly current at 0.3 m/s and easterly winds. This case would maximize oil travel in the direction of Anacapa Island and other Islands.
5. A case in which there is oil spill response and clean-up, with all other inputs the same as base case.
6. A harbor location case applicable to tugs and supply boats transiting Port Hueneme.

[70] NOAA has developed and maintains an oil spill trajectory analysis model (known as the General NOAA Oil Modeling Environment (GNOME)) for public use. GNOME (NOAA 2003b) is a sophisticated spill trajectory analysis tool that accounts for location-specific seasonal wind, current, and tide conditions. The Santa Barbara Channel data set for GNOME does not extend to the southeast beyond Anacapa Island, so it is not useful in supporting trajectory analyses originating in the FSRU vicinity (including the pipe-laying vessel locations and the tug/supply vessel transit routes). Development of a hydrodynamic data set for the FSRU location to support GNOME use was evaluated and found to be inappropriate for purposes of the Facility and Vessel Oil Spill Pollution and Contingency Plans. In addition to the GNOME model there are other private spill trajectory models such as OilMap©. However all private oil models that have the sophistication of GNOME also have the same shortfall for the proposed project – the lack of a developed hydrodynamic model for the Project location. Development of an applicable hydrodynamic model would have required an extensive modeling effort, including a validation process. The hydrodynamics would also have been dependent upon extensive extrapolations and interpolations from the limited available data. In lieu of using a complex model (such as GNOME), a vector analysis can be used to predict oil spill movement. In the event of a real spill, vector analysis using real time current and wind conditions is used to give ongoing predictions of oil movement. (Explanation taken from the trajectory analysis sections of the Facility OPCP, Tug/Supply Vessel OPCP, and Pipe laying Vessel OPCP.)

The results of the trajectory analyses indicate that diesel or biodiesel oil spilled at the project site would travel between 24 and 77 miles from the spill location, depending on ambient current and wind conditions. Under all spill scenarios (*i.e.*, pipe-laying vessel, tug/supply boats, and FSRU) the trajectory analyses show potential coastline oiling on the mainland from approximately Isla Vista and Santa Barbara down to Point Fermin near Los Angeles Harbor. Case #2, above, with a westerly current shows the potential for oiling the shorelines of Anacapa and Santa Cruz Islands. The Santa Ana case (Case #4) with reinforcing winds and currents to the west shows the potential for oiling the shorelines of Santa Rosa and San Miguel Islands. Due to lack of southerly flowing offshore currents, there were no forecasted trajectories that could transport oil to Santa Catalina or Santa Barbara Islands from the FSRU.

Under Case #5 when oil spill response with available skimming capacity is considered, the extent of shoreline that could be oiled from a worst case spill is significantly reduced. For a worst case spill from the FSRU, when available skimming capacity is considered, there are no cases that could deliver oil to any shoreline. When skimming is available in the event of a spill from the pipe-laying vessel or from the tug/supply vessels, the mainland shoreline that could be oiled is significantly reduced to extend from approximately Point Rincon south of Carpinteria to just beyond Point Dume.

Coastal Resources and Marine Resources at Risk

The coastal and marine resources at risk from a project-related spill include marine biota (*e.g*., sea birds, marine mammals, fishes, invertebrates) , water quality, environmentally sensitive habitat areas (*e.g*., rocky intertidal areas, sandy beaches, wetlands, and estuaries), commercial fishing, and access and recreation.

Marine Resources and Water Quality

Marine Birds: Seabirds, especially diving birds, are extremely vulnerable to diesel spills. Although diesel and biodiesel fuels evaporate from the ocean surface more quickly than the heavier oils, a diesel spill can still have significant adverse impacts on seabirds. The more volatile components of diesel fuel present an inhalation hazard to birds, in addition to ingestion and coating hazards. Direct contact of birds with any type of oil can cause matted plumage, reduced flying and swimming ability, loss of buoyancy, hypothermia, increased physiological stress, exhaustion and drowning. If the bird lives, oil ingestion may create physiological stress and lead to reproductive failure. Nesting adult birds can carry oil back to their nests, where eggs or young become exposed.

Oil-related mortality is highly dependent on the life histories of the bird species involved. Birds that spend much of their time feeding or resting on the surface of the water are more vulnerable to oil spills. Cleanup efforts to remove spilled oil may also cause impacts to coastal birds, nests and habitats. The presence of human beings during clean-up activities, and attempts to capture oiled wildlife for rehabilitation, may have the effect of flushing birds into oiled water, where they get exposed or re-exposed to oil.

<u>Sea Otters</u>: The southern sea otter is extremely sensitive to spilled oil, including diesel. Lacking a layer of fat, these animals are dependent on maintaining clean fur and an intact layer of insulating air next to their skin. Oil on just a portion of the fur can cause hypothermia and death. Otters can ingest oil when they attempt to groom their oiled fur, or when they consume filter-feeding prey that consumed oil. The volatile components of diesel fuels present an additional toxic inhalation hazard.

At the present time the southern sea other range does not extend into the southern Santa Barbara Channel or into the waters where the FSRU is proposed. Therefore it is highly unlikely that a diesel or biodiesel spill from the FSRU, the pipe-laying vessel, or the tug/supply and crew boats would significantly impact the sea otter population. However, if future sea otter range expansion brings a significant and persistent sea otter population into the Santa Barbara Channel, the risk of spill impacts to the sea otter population would increase.

<u>Whales</u>: Oil may affect marine mammals through various pathways: surface contact, inhalation, ingestion, and baleen fouling. Since whales rely on layers of body fat and vascular control rather than a coat of fur to retain body heat, they are generally resistant to the thermal stresses associated with oil contact. However, exposure to oil can cause damage to skin, mucous membranes and eye tissues. The eyes, mouth, and respiratory tract can be irritated and damaged by light oils (*e.g.,* diesel or biodiesel) and oil vapors. If oil compounds are absorbed into the circulatory system, they attack the liver, nervous system, and blood-forming tissues. Oil can collect in baleen plates, temporarily obstructing the flow of water between the plates and reducing feeding efficiency.

<u>Sea Lions and Seals</u>: Marine mammals that depend on hair or fur for insulation, instead of fat, are most likely to suffer sublethal or lethal impacts from oil exposure. Fur seals and newborn pinniped (*i.e.*, seal, sea lion) pups are the most vulnerable to oiling because they lack a fat layer. The marine mammals in the project area with the greatest seasonal vulnerability are harbor seals and seals at haul-out areas and pupping beaches in early spring.

<u>Sea Turtles</u>: Sea turtles would contact spilled diesel or biodiesel when they come to the surface to breath. Spilled oil can adversely affect sea turtles via external contact (primarily through mucous membranes), ingestion, blockage of the digestive tract, disruption of salt gland function, inhalation, asphyxiation, and displacement from preferred habitats. Sea turtles are known to ingest oil; this may occur during feeding or while attempting to clean oil from their flippers.

<u>Invertebrates, Fish and Plants</u>: Diesel fuel is acutely toxic to many water surface and water column species, and especially planktonic eggs and larvae in the upper water column. The toxic event is generally over fairly quickly. Adult fish, algae, and invertebrates that come in direct contact with a diesel spill may be killed.

Fish can directly ingest oil or eat oiled prey. They can take up dissolved petroleum compounds through the gills, lose their eggs or larvae to direct contact mortality, or face acute or chronic changes to the ecosystem that supports them. Many effects can be sublethal or transient, but any stress requires energy for recovery, which can ultimately lead to increased vulnerability to disease or to decreased growth or reproductive success. Diesel spills in shallow, nearshore areas would potentially have acute or chronic impacts on many species of invertebrate, fish, algae, plants and supporting habitats.

Rocky Intertidal, Sandy Beach, Estuary, and Wetland Habitats

The primary oil spill impacts to rocky intertidal and sandy beach areas include smothering or coating of individual plants, animals and broad habitat areas, acute (direct) mortality of organisms, chronic (indirect) impacts from uptake through plant and animal tissues, and contamination of sensitive and species-rich habitats (*e.g.*, rocky intertidal and shallow subtidal, marshes, estuaries, mudflats, river mouths, roosting/nesting/haulout islands, rocks and peninsulas) that may persist for months or years following the spill event.

Plant mortality from oil spills can be caused by smothering and toxic reactions to hydrocarbon exposure. Generally, oiled marsh vegetation dies above the soil surface, but roots and rhizomes survive when oiling is not too severe. The cleanup process could exacerbate the effects of an oil spill on threatened and endangered plants.

If oil from an offshore spill enters a wetland or estuary, impacts to the resource could include irreversible alteration of the habitat, mortality of endangered birds, plants and fish, and loss of plants and animals that may be unable to re-populate from adjacent areas.

Commercial Fishing

Commercially fished resources from an area impacted by a spill may be directly killed and thereby lost to a commercial market, or fish tissue may be “tainted” by oil. Fish can be sold for human consumption after taint tests indicate that no human health safety issues would result from eating fish from the oil spill area. However, a perception by the public that fish might be tainted by oil and unsafe to eat, even if they are not, may effectively limit or eliminate the commercial wholesale and retail markets for fish. The direct mortality from an oil spill of planktonic eggs, larvae and young commercially valuable invertebrates and fish can impair recruitment of individuals into the adult population for one or several seasons, leading to depression or loss of certain commercial markets

Access and Recreation

The mainland coast and islands in the project region include a number of beaches and parks that attract visitors throughout the year. Oil spills have the potential to affect access and recreation at the coast, or limit access to the National Parks at the Channel Islands, by causing beach and harbor closures. The multiple locations that could be affected in a large spill make it difficult to substitute nearby locations that are clean enough to support recreational activities. Closing a beach or recreation area would impact people who enjoy overnight camping, swimming, surfing, walking, jogging, and tidepooling at these coastal parks and beaches.

While the Channel Islands are restricted in the maximum number of visitors at any given time, and the hauling capacity of park concessionaires is limited by boat occupancy restrictions, Anacapa and Santa Cruz Islands nevertheless are valuable destinations that would lose visitors during an oil spill.

As discussed under commercial fishing, a large diesel spill can directly kill or "taint" fish, depending on where it spreads. This could have direct impacts on recreational fishing (*e.g*., for sports fishing boats, kayak fishers, scuba divers, dock and pier fishermen) by both reducing the available fishing stock for consumption, and by decreasing or eliminating recreational fishing opportunities in the area (during the spill itself or by changing the fish stock dynamics). In turn this could have some indirect economic effects on the recreational fishing businesses (*e.g*., charter boats, kayak rentals, bait and tackle shops).

Prevention and Response Measures to Reduce Risk of Spills

CCMP section 30232 requires the applicant to provide for "protection against the spillage of crude oil, gas, petroleum products, or hazardous substances." The proposed project could result in an accidental spill of diesel or biodiesel fuel, refined products (*e.g*., lubricant oils), or other hazardous materials (*e.g*., mercaptan). In compliance with state, federal, and international safety and pollution control laws and regulations, BHP would implement a number of prevention measures to avoid or minimize the risk of spills from the FSRU, the pipe-laying vessel, and the tug/supply vessels.

Spill Prevention Measures for Pipe-Laying Vessels

The pipe-laying vessel would operate in compliance with all applicable state, federal, and international safety and pollution regulations, as discussed above. The Oil Pollution Contingency Plan (OPCP) states that an accidental fuel tank spill could result from a collision with fishing vessels, recreational vessels, or commercial vessels that may be operating in the vicinity of the pipe-laying construction activities (the pipe- laying vessel is mostly stationary during pipe installation). To avoid the risk of vessel collision, BHP and the vessel contractor would publish local and international notices to mariners well in advance of the pipe-laying construction activities. These notices would give the general description and location of the construction activities, the pipeline route (including geographical waypoints), expected duration of construction activities, description of the marine equipment that would be in the area, light and sound signals, and marine radio frequencies that would be used for communications.

Personnel onboard the pipe-laying vessel would be trained in oil spill detection and response procedures. The vessel would carry oil spill response equipment, including absorbent pads to contain and clean-up any lubricant oils that may spill on the vessel itself. The vessel would also carry oil containment boom onboard to deploy immediately to contain any spill that may reach the ocean.

FSRU Spill Prevention Measures

As discussed previously, the FSRU would operate in compliance with all applicable state, federal, and international regulations prior to operation. According to the EIS/EIR, the FSRU would be designed and operated with systems, equipment, and training procedures in place to prevent or reduce the risk of accidental spills into the ocean.

The storage tanks and containers would be U.S. Department of Transportation (US DOT) approved and be located in areas that have secondary containment capable of containing up 100% of the storage volume. Refueling of storage tanks from the tank containers would be gravity fed. Fuel tank high-level indicators and alarms would be located in the central control room and in areas where fuel is located or stored, and fuel transfer lines would have a shutoff valve that can be operated by both manual and remote means.

A computer-based maintenance system (PMS) would be created for the FSRU, dedicated LNG carriers, associated pipelines and dedicated support vessels. Fuel oil storage tanks and daily use tanks and their associated pipeline, valves, actuators, low and high level detectors, hoses, pumps, and other equipment would be included in the inspection and maintenance routine. In addition to scheduled testing, maintenance, and calibration conducted by the facility personnel in accordance with PMS requirements, additional scheduled inspections, surveys, and testing of equipment and systems are carried out by USCG personnel and classification surveyors in accordance with applicable federal and international regulations, rules, codes and standards. High definition closed circuit television cameras would survey all areas of the FSRU during daylight hours. Infrared cameras would cover the same areas in low light conditions and at night. The dedicated standby vessel that patrols the facility exclusion zone would have high definition and infrared cameras and hydrocarbon detection equipment that can detect oil on the water. The entire main deck area of the FSRU would have hydrocarbon detectors capable of detecting diesel fuel vapor and alerting personnel.

Fuel oil transfers between the supply vessel and the facility would use US DOT approved tank containers or totes. All personnel involved in fuel transfers would be trained and certified in accordance with federal requirements. Copies of the fuel transfer procedures and a pipeline diagram would be posted at the fuel transfer location. Sufficient personnel would be assigned to visually and regularly inspect pipelines, valves, etc. for leaks during operation.

Dedicated spill response equipment would be stored in a sealed container on the vessel deck near the fuel transfer area and would be immediately available to contain and clean-up an accidental oil spill on the deck. An oil spill containment area surrounding the fuel transfer location would be designed to provide containment sufficient to hold 100% of the tank container capacity. A portable dedicated tank container would be available close by for storage of spilled oil. Additional equipment, such as brooms, sawdust, oil absorbent pads and granules would be part of the dedicated equipment for cleanup of a FSRU deck spill.

Tug/Supply Vessels

The tug/supply vessels would transport diesel or biodiesel fuel, lubricant oils, and mercaptan from Port Hueneme to the FSRU. In addition to federal and international vessel safety requirements, the tug/supply vessels must also be in compliance with both US Coast Guard and California oil spill contingency plan regulations for vessels carrying oil as secondary cargo (33CFR §155.1030 and 14CCR§818.03). The vessels' spill containment and response systems, and crew training for spill prevention and response, are both addressed in the submitted document, "*December 2006 Vessel Oil Pollution Contingency Plan – Tug/Supply Vessels*," which must be approved by California OSPR prior to vessel operation.

The petroleum-based liquids would be transported in US DOT approved 55 gallon metal drums, or 265 gallon or 350 gallon US DOT approved bulk containers (industry standard plastic containers within a steel protection frame). Spill containment during transport would be provided by storage pallets with integrated bonds. These containers are designed for handling by forklift and are commonly used offshore. They are transported within a lifting frame to provide adequate lift points for offshore lifts, spill containment and mechanical protection during transport.

In addition to the structural design and containment systems described above, the OPCP describes other oil spill prevention measures, including: personnel training requirements, fuel transfer procedures, communication protocols, and other employee risk reduction programs (*i.e*., drug testing) that would be implemented during the transit and transfer of the fuel containers to the FSRU to prevent or minimize the risk of a spill.

Consistency with Prevention Requirements

Based on the above information, the Commission finds that BHP's spill prevention measures for the pipe-laying vessel, FSRU, and the tug/supply vessels─ which have been or would be implemented in compliance with applicable state, federal, and international safety and pollution control regulations ─ would provide maximum feasible protection against the "spillage of crude oil, gas, petroleum products, and hazardous substances." The Commission therefore finds that the proposed project is consistent with the prevention requirements of CCMP section 30232.

Oil Spill Response Technologies and Capabilities

Notwithstanding the prevention measures and safety programs that BHP would implement in compliance with applicable state, federal, and international safety and pollution control laws and regulations, an accidental spill of diesel or biodiesel fuel, lubricating oils, or other hazardous chemicals (such as the mercaptan) could still occur.

CCMP section 30232 requires that "effective containment and cleanup facilities and procedures shall be provided for accidental spills that do occur." The Commission interprets the standard of "effective containment and clean up" as the ability to keep an offshore oil spill from adversely affecting the shoreline resources of California.

As discussed previously under trajectory analysis case #5, in the event of a spill from the pipe-laying vessel or from the tug/supply vessel, when skimming is available the mainland shoreline still has the potential for adverse oil impacts, although the area that could be oiled is significantly reduced to extend from approximately Point Rincon south of Carpinteria to just beyond Point Dume.

Immediate Containment and Response Systems Onboard the Vessels and the FSRU

In compliance with applicable state, federal, and international oil spill contingency plan regulations, the OPCPs for the pipe-laying vessel, tug/supply vessels, and the FSRU provide oil spill notification and response procedures, an inventory of the oil spill response and clean-up equipment that would be stored onboard for immediate deployment, and personnel training and drill programs for immediate oil spill containment and response.

The pipe-laying vessel would carry oil spill response equipment to contain and clean-up any lubricant oils that may spill on the vessel itself. The vessel would also carry oil containment boom onboard to deploy immediately to contain any spill that may reach the ocean. Each of the two tug/supply vessels would carry an oil dispersant system and an oil recovery system. The oil dispersant system would include two rigid arm booms each about 7 meters long (23 feet), and one dispersant pump with a capacity of at least 12 cubic meters (3,170 gallons) per hour.[71] The recovery systems would include skimmers, oil containment boom, and waste oil tanks. In the event of a spill, the oil containment boom and response equipment stored on the tug/supply vessels could be deployed immediately to contain the spill until the oil spill response vessel (OSRV) arrives.[72]

The FSRU would have spill response equipment stored onboard near the fuel transfer operation area. Equipment for the clean-up of on-deck spills includes 12 bales of sorbent pads, one 20-foot sorbent snake, 20 bags of sorbent granules, storage containers for recovered oily waste, and pneumatic pumps with suction and discharge hoses for recovery of on-deck spills. In the event that the spill enters the ocean, the FSRU also has 600 feet of oil containment boom which can be immediately deployed to help contain the spill until the tug/supply vessels arrive on scene with additional boom.

Primary and Secondary Oil Spill Response

BHP is a member of the Marine Spill Response Corporation (MSRC). The contract has been modified to include LNG operations, such as the Cabrillo Port, and associated activities such as pipeline construction. MSRC, and its authorized subcontractors, meet the US Coast Guard and the California OSPR highest level oil spill response contractor (OSRO) classification standard. MSRC is approved to provide oil spill response and clean-up in open ocean waters, shallow waters, and shoreline protection and clean-up. MSRC would be the primary responder for any petroleum spills from the FSRU or the project vessels.

[71] Note that chemical dispersants can only be applied in accordance with the California Dispersant Plan.

[72] February 19, 2007 letter from Bryan C. LeRoy, Manatt, Phelps & Phillips, LLP to Alison Dettmer, California Coastal Commission

MSRC's initial response to an oil spill from the vessels or from the FSRU would be from their sites at Port Hueneme, El Segundo, Redondo Beach, Terminal Island, Long Beach and Los Angeles.[73] MSRC estimates that oil spill response vessels containing containment boom and skimmers (California Responder, Clean Waters, Recovery 1, and Recovery 2 that are located at Terminal Island) could arrive on an oil spill scene near the FSRU within 4 hours. The boom boats (Recon 1, 2, 3, and 4, Response 1 and 3) could arrive on scene within 3 hours and the storage barge from Port Hueneme in about 3 hours.[74] In addition to providing on-water mechanical response and clean-up, MSRC also provides dedicated access to alternative response technologies such as *in situ* burn kits and aerial and vessel dispersant spraying.[75]

MSRC also has equipment at numerous other sites on the California coast that could provide additional assistance. The US Coast Guard could also authorize the immediate deployment of the response vessels and equipment from Clean Seas in Santa Barbara. MSRC could also station their OSRV from Terminal Island to Port Hueneme for the duration of the tugboat transit and transfer operations, thereby reducing response time to approximately 1.5 hours.[76]

Consistency with Oil Spill Response Provisions

The Commission interprets CCMP section 30232 standard of "effective containment and clean up" as the ability to keep an offshore oil spill from adversely affecting the shoreline resources of California. Although oil spill response equipment and cleanup methods have significantly improved in the past 20 years, research and experience shows that the response capability of current containment and clean-up equipment continue to be very limited during conditions of rough weather and sea conditions. Tests by the Environmental Protection Agency have demonstrated that oil skimmers can generally only recover about 50% of spilled oil in calm water conditions, with considerably decreased effectiveness if sea conditions are rougher.[77] Oil containment booms and skimmers are also limited in their effectiveness by wave height and wind speed. According to the NOAA Office of Response and Restoration, historical data indicates that only 10-30% of spilled oil can be recovered by mechanical means.[78]

---

[73] A complete list of MSRC's response vessels and support equipment are included in Appendix E of the Vessel Oil Pollution Contingency Plan – Tug/Supply Vessels dated 12/14/06.

[74] Email correspondence, dated December 21, 2006, from Ray Nottingham, MSRC, Southern California Area Response Manager to Robin Blanchfield, California Coastal Commission.

[75] A complete list of MSRC's response vessels and support equipment are included in Appendix E of the Vessel Oil Pollution Contingency Plan – Tug/Supply Vessels dated 12/14/06.

[76] February 19, 2007 letter from Bryan C. LeRoy, Manatt, Phelps & Phillips, LLP to Alison Dettmer, California Coastal Commission.

[77] Smith, Gary. *Summary of U.S. EPA OHMSETT Testing 1974-1979*. Municipal Environmental Research Laboratory, Office of Research and Development, US Environmental Protection Agency. 1981.

[78] Michel, J., S. Christopherson, & F. Whipple. *Mechanical Protection Guidelines*. Office of Response and Restoration, National Ocean Service, National Oceanic and Atmospheric Administration. June 1994. p. 26.

As discussed previously in the *Trajectory Analysis* section, a worst case oil spill from the pipe-laying vessel or the tug/supply vessel still has the potential to adversely affect the shoreline resources ─ from approximately Point Rincon south of Carpinteria to just beyond Point Dume ─ even when on-water response and skimming is available. Thus, in the event of an offshore oil spill, current spill response and clean-up equipment cannot effectively protect California's shoreline from oil spill impacts. The Commission therefore finds that CCMP section 30232 standard of "effective containment and clean up" cannot be met using the on-water containment and clean-up equipment currently available to respond to marine oil spills.

Conclusion

For the reasons described above, current mechanical response equipment and methods cannot effectively protect California's shoreline resources from oil spill impacts. The Commission therefore finds that the standard of "effective containment and clean up" in CCMP section 30232 cannot be met using the oil spill response strategies currently available. Accordingly, the Commission finds that the proposed project is inconsistent with the oil spill response requirement of CCMP section 30232. Because Cabrillo Port would be a "coastal-dependent industrial facility," it is presumptively subject to analysis under CCMP section 30260. See Section 5.11 (Coastal Dependent Industrial "Override" Policy) of this report.

4.5 Terrestrial Biology

CCMP § 30240 states:

(a) *Environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependant on those resources shall be allowed within those areas.*

(b) *Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designed to prevent impacts which would significantly degrade those areas, and shall be compatible with the continuance of those habitat and recreation areas.*

Sensitive Resources in Project Area

In addition to its various offshore components, the Cabrillo Port project also includes construction and placement of onshore infrastructure as well. Although most of the proposed infrastructure would be installed outside of the coastal zone, pipelines and several structures would be built within the coastal zone, beneath and adjacent to Ormond Beach in the City of Oxnard.

Ormond Beach is an approximately 1,500 acre area consisting of agricultural lands, industrial and military facilities, beaches, dunes and wetlands. A two mile long beach, it stretches from Port Hueneme to the northwestern boundary of the Point Mugu Naval Air Station, which encompasses Mugu lagoon. Historically, the coast of Ventura and Ormond Beach consisted of a vast complex of dunes, lakes, lagoons, and salt and freshwater marshes. Approximately 1,000 acres of wetlands once extended from the Port Hueneme Harbor to Mugu Lagoon. In the early 1900s Port Hueneme was constructed in one of the larger lagoons, agriculture fields intruded into the wetlands in the 1920s and extensive drainage canals were constructed in the 1930s. In the 1950s and 60s heavy industrial facilities were sited within the wetlands. Today, only 217 acres of fragmented wetlands are found along one mile of coastline at Ormond Beach, and the area is comprised mostly of a variety of disturbed and undisturbed dune complexes, remnant and filled wetlands, energy production facilities, military facilities, a wastewater treatment plant, heavy manufacturing facilities, roads, railroad tracks, flood control channels and drainage ditches. The wetlands that remain in this area are located on several parcels ranging in size from less than one acre to over 134 acres.

The dunes, wetlands, riparian and shoreline areas that still exist at Ormond Beach represent one of the few intact dune-transition zone-marsh systems in Southern California and provide habitat for a variety of species of plants and wildlife. Over 200 migratory bird species have been observed in the Ormond Beach area and more shorebird species are known to use Ormond Beach than any other site in Ventura County. Many of the plant and wildlife species known to inhabit the Ormond Beach area have received special status designations from the U.S. Fish and Wildlife Service (USFWS) and/or the California Department of Fish and Game

(CDFG). Special status species are those flora and fauna species listed as endangered, threatened, or species of concern by the USFWS and/or the CDFG. In the Ormond Beach area the list of these species includes birds such as the California least tern, western snowy plover, California brown pelican, Belding's savannah sparrow, elegant tern, and peregrine falcon; insects such as the globose dune beetle and salt marsh skipper butterfly; plants such as the salt marsh bird's beak, Coulter's goldfields and red sand-verbena; and freshwater fish such as the tidewater goby and unarmored three-spined stickleback. Environmentally sensitive habitat areas in the proposed project vicinity include Ormond Beach and the Ormond Beach dunes and a variety of remnant salt marshes, riparian channels and other wetlands. In addition, the USFWS has designated critical habitat for the Pacific coast population of the western snowy plover in Ventura County that includes the coastal area between Port Hueneme and Naval Base Ventura County Point Mugu. As described in 50 CFR Part 17:

> *This [subunit CA 19B] is an important snowy plover nesting area for this region of the coast, as the next concentration of nesting snowy plovers to the south (other than the adjacent subunit CA 19C) is located on Camp Pendleton Marine Corps Base about 100 mi (160 km) away. The number of birds nesting within this subunit has varied from about 20 to 34 per year (Stenzel in litt. 2004). CA 19B is also an important wintering area for the plover, with up to 123 birds each winter (Page in litt. 2004). This subunit is capable of supporting 50 breeding birds under proper management. It includes the following features essential to the species: Wind-blown sand dunes, areas of sandy beach above and below the high tide line with occasional surf-cast wrack supporting small invertebrates (for nesting and foraging) and generally barren to sparsely vegetated terrain (for foraging and predator avoidance). Disturbance from humans and pets is the primary threat that may require special management for snowy plovers in this subunit.*

Much of the inland extent of the Ormond Beach area has historically been used for agriculture, industry, and military and energy generating activities but in recent years, as the value and scarcity of coastal wetlands has been increasingly recognized, the Ormond Beach area has been targeted for a variety of habitat restoration projects. Since the 1990's, the California State Coastal Conservancy (SCC) has been working with the City of Oxnard, the local community, and the landowners of Ormond Beach to extinguish lots on the beach, prepare a plan for restoration of remnant wetlands, and develop a consensus plan for development and wetland restoration on private lands. With the support of the City of Oxnard, the County of Ventura and all the federal and State resource agencies that participate in the Southern California Wetlands Recovery Project, the SCC is developing a comprehensive Ormond Beach Wetlands Restoration Plan and has begun acquiring property at Ormond Beach. The SCC's goal is to acquire at least 750 acres to accommodate wetland and other habitat needs and at the same time complement the City's goal to complete development of the south Oxnard community. As of January of 2006, the SCC, in partnership with the Nature Conservancy, had secured over 540 acres of dunes and existing and historic wetlands throughout the Ormond Beach area and surrounding the Ormond Beach Generating Station site (or "the power plant).

Proposed Onshore Activities

Within the onshore portion of the coastal zone, most of Cabrillo Port's project-related activities would take place with the boundary of the 37 acre filled wetland Ormond Beach Generating Station site. These activities are:

- Staging area and entry points for horizontal directional boring (HDB) shore crossing.
- Construct metering station.
- Construct, install and trench 1800 feet of 36 inch diameter natural gas pipeline.
- Staging area and entry point for slick bore riparian canal crossing.

Project-related activities proposed outside of the power plant site, but within the coastal zone, include:

- Temporarily deploy and subsequently remove a half-mile long above-ground 10 millimeter shielded copper cable.
- Exit point for slick bore apparatus and 36 inch diameter natural gas pipeline.

These various activities have the potential to affect the terrestrial biological resources of the Ormond Beach area in a several ways including through (1) habitat loss and/or displacement, (2) accidental spills of HDB drilling fluids and mud and (3) the disturbance of plants and wildlife during construction, excavation, maintenance operations and their associated lights, noise, and soil disturbance.

Habitat Loss/ Displacement

Ormond Beach Generating Station Site

BHP proposes to use an approximately 3.7 acre portion of the Ormond Beach Generating Station site 1) as a staging area for HDB equipment, materials and operations, 2) as an entry point for the two proposed 24 inch pipelines that would pass beneath Ormond Beach and surface on the seafloor approximately 3,000 feet offshore, 3) as a construction site and permanent location for a natural gas metering station and backup odorant system, 4) as the beginning of an 1800-foot long 36-inch diameter natural gas pipeline route and its associated 80-foot wide construction right of way, and 5) as the staging area and entry pit for a slick bore operation that would be used to place the 36-inch diameter pipeline beneath the Mugu Lagoon Canal on the inland side of the power plant site.

The portion of the power plant site proposed for HDB staging, pipeline entry and the gas metering and backup odorant station is on the down-coast side of the power plant, adjacent to the facility's transmission lines. This area consists entirely of cleared, disturbed land and would encompass approximately 250 feet by 325 feet, or roughly two acres.

The proposed natural gas metering and backup odorant station would require the construction of a nine-foot high structure and the installation of a variety of equipment and containment pads with an estimated total footprint of 40,000 square feet. This structure is proposed to be constructed entirely within the approximately two-acre HDB area and would be surrounded by an eight-foot high security fence that would encompass roughly one acre.

The proposed installation of a 36 inch diameter natural gas pipeline from the metering station to the Magu Lagoon Canal would involve a variety of excavation, trenching and pipeline installation equipment. The proposed construction right-of-way would be 80 feet wide and would stretch roughly 1,800 feet. Upon completion of pipeline installation, the proposed pipeline trench would be backfilled and leveled, and no aboveground structures would remain to block or impede wildlife movement or migration.

The Mugu Lagoon Canal passes along the east and north sides of the Ormond Beach Generating Station and is connected hydrologically with Mugu Lagoon to the southeast. This drainage canal is tidally influenced in its southern reaches, but is brackish in its upper reaches due to freshwater agricultural run-off. The drain carries mostly agricultural and storm runoff to the west arm of Mugu lagoon. During heavy storms, the lower ends of the agricultural fields flood, causing the drain to overflow into adjacent wetlands. Tidal swing gates located on Naval Base Ventura County control the flow of salt and brackish water from the lagoon into the canal. In addition, tidal influence is muted because the mouth of Mugu lagoon is not always open to the ocean, and the drain connection to the lagoon is several miles from the project site.

Due to its connection to Mugu Lagoon, the canal has the potential to support populations of two federal endangered species of fish, the tidewater goby and the unarmored threespine stickleback. To avoid disturbances to this channel and the habitat and species it may support, BHP proposes to excavate entry and exit pits on either side of the channel and use slick bore technology to allow the natural gas pipeline to pass beneath the channel and exit on the other side without disturbing the channel itself. The proposed slick bore method involves the use of an air driven pipe rammer to install a bore pipe beneath the riparian channel. This method does not require the use of drilling fluids and would thereby avoid potential sedimentation and turbidity impacts associated with accidental releases of drilling fluids and mud.

Additionally, BHP has committed to implementing the following mitigation measures (detailed further in Appendix C):

- Excavate the slick bore entry and exit pits at least 15 feet (or any other distance mandated by the CDFG or the USFWS) from the edge of vegetation at the riparian channel;
- Install silt fences and straw bale sediment barriers around these bore pits to minimize erosion;
- Contain all construction debris to prevent erosion;
- Store and maintain all construction equipment at least 50 feet from the canal as well to follow all other measures detailed in the project's Stormwater Pollution Prevention and Containment Plan to control sediment runoff;
- During excavation and boring operations have a qualified biologist on-site to ensure that State and federal wetland protection guidelines are followed and adequate stream edge setbacks are established.

Invasive Plants and Weeds

Proposed construction related soil and vegetation disturbance could provide an opportunity for invasive plant species and weeds to become established or spread. The introduction of new noxious species from other areas can occur from the transportation of seeds on construction equipment and other vehicles. These noxious and invasive plant species are often aggressive pioneers that have a competitive advantage over other species and once they are established in an area. Negative impacts associated with invasive plants can include loss of wildlife habitat, alteration of wetland and riparian functions, displacement of native plant species, reduction in plant diversity, changes in plant community functions and increased soil erosion and sedimentation.

To address these issues, in its consistency certification BHP has committed to developing and implementing the weed management program included in the EIS/EIR (and detailed in Appendix C) that includes procedures to:

- Perform noxious weed surveys to identify known locations of noxious weeds;
- Remove invasive exotic plants from the work area;
- Clean all vehicles and construction equipment when mobilized from an area infested with exotic plant species;
- Obtain all fill material, soil and gravel from weed free sources;
- Clear existing vegetation from areas only to the width needed for direct construction activities;
- Salvage and replace the upper twelve inches of topsoil;
- Re-vegetate disturbed soils with an appropriate seed mix that does not contain introduced or noxious weeds.

Shorebirds

Although the proposed HDB and slick bore staging areas, metering station and pipeline right-of-way are entirely within the heavily disturbed power plant site, recently conducted habitat surveys have identified this site as potential habitat for California least tern and Belding's savannah sparrow, both of which are State and federal endangered species, and western snowy plover, listed federally as a threatened species and by the State as a species of concern. In addition, designated nesting habitat for both snowy plover and least tern exists adjacent to the power plant on Ormond Beach.

The proposed construction activities would be conducted over the course of 108 days and would result in only temporary use of the two acre HDB area. The proposed construction of the natural gas metering and backup odorant station, however, would result in the long-term use of roughly one acre of undeveloped land within the power plant. Despite this area's identification as potential special status bird species habitat, its location and proximity to the existing power plant and the continuous disturbance that this area undergoes during routine power plant operation suggest that it would provide only marginal and low quality habitat for these bird species.

Nevertheless, in its consistency certification BHP has committed to conducting all onshore construction activities between the months of October and February, outside of the recognized western snowy plover and California least tern nesting season.

Conclusion

In addition to the measures to reduce and control erosion, minimize the establishment and spread of exotic invasive plant species and reduce the potential for disturbances to listed shorebird species, BHP has also committed to implementing all of the mitigation measures included in the EIS/EIR (and detailed in Appendix C) to ensure that project activities do not result in adverse impacts to sensitive biological habitat resources. These measures include implementation of an Employee Environmental Awareness Program to educate project personnel and subcontractors about the sensitive resources that may be found in the project area, the laws, regulations and measures dedicated to protecting these resources and the importance of adhering to the guidelines, restrictions, site safety and traffic management policies developed to avoid adverse impacts to sensitive species and habitats. Biological monitoring would also be conducted during all construction activities, and pre-construction biological surveys would be carried out in any area potentially affected by project activities where sensitive plant species may potentially occur. Any sensitive plant species identified would be fenced. BHP would also prepare and implement a Biological Resources Mitigation Implementation and Monitoring Plan to ensure that all sensitive resource areas are identified and marked, all relevant mitigation, monitoring and compliance conditions are specified and all appropriate resource protection measures are identified and enforced. With the inclusion of these measures, the Commission finds that proposed use of the power plant site would avoid affecting sensitive habitat in the Mugu Lagoon Canal and would result in only temporary and negligible loss and/or disturbance of other sensitive habitat.

Ormond Beach and Dunes

To facilitate the high level of directional precision needed to successfully complete HDB operations, BHP is proposing to use a surface monitoring system that would allow the boring apparatus to be tracked and monitored. This proposed monitoring system requires the temporary installation of approximately 2,000 feet of shielded ten millimeter copper cable on the beach and dunes at Ormond Beach. Given the small size of the cables involved, the footprint for this proposed surface monitoring system is approximately 2,000 square feet. It would extend shoreward of the HDB staging area, across the beach and dunes to the high tide line at Ormond Beach and then back to the HDB site. To minimize disturbance, the surface monitoring system would be installed and removed by hand and would be in place for no more than 108 days, the length of time required for the completion of proposed HDB shore crossing activities.

The installation, use and removal of the proposed HDB monitoring system on Ormond Beach and the adjacent dune complex, areas reportedly used by the California least tern and federally designated as critical habitat for nesting and wintering western snowy plovers, has the potential to result in adverse impacts to these special status species by causing them to be disturbed or temporarily displaced from vital forage, resting and breeding areas. To ensure that western snowy plovers and California least terns are not adversely affected by the proposed use of this equipment on Ormond Beach, BHP has committed in its consistency certification to conducting all construction activities outside the snowy plover nesting season (March 1 through September 30) as well as to conducting pre-construction wildlife surveys to identify the location of special status species so that their habitat can be avoided, and to using biological monitors during all project activities.

In addition to potential impacts to the special status species described above, several other species of plants and animals with State and/or federal designations have the potential to occur within the Ormond Beach dune and shore complex and may be adversely affected by the installation and removal of the HDB monitoring cable. Globose dune beetles, sandy beach tiger beetles and salt marsh skipper butterflies, all listed as State or federal species of concern, may occur within the proposed HDB monitoring system route. Botanical surveys conducted in the spring and summer of 2005 along the proposed route did not reveal the presence of salt marsh bird's beak, Coulter's goldfields or red sand-verbena, the three species of federal, State and/or California Native Plant Society listed plant species with the highest potential to occur in this area. However, given the length of time that would elapse between the completion of these surveys and the initiation of proposed project activities, the results of these surveys do not guarantee the continuing absence of these species from the area of potential disturbance surrounding the proposed HDB monitoring cable. Therefore, to address potential impacts to special status plants and wildlife that may be found within the Ormond Beach dunes, BHP has committed to carrying out the mitigation measures included in the EIS/EIR (and detailed in Appendix C) by implementing an Employee Environmental Awareness Program and Biological Resources Mitigation Implementation and Monitoring Plan, as detailed below, conducting pre-construction plant surveys of the proposed monitoring system route and all other project areas to further define the location of special status plants identified during the 2005 surveys, and to flag, fence and map sensitive areas and sensitive species for avoidance during construction, delineate habitat for special status species and comply with all the terms and conditions of the project's USFWS/CDFG Biological Opinion if listed plants were identified in construction areas. These measures would be further enhanced by BHP's commitment, also included in its consistency certification, to use qualified biological monitors during all work in areas where sensitive plants have been identified to ensure that potential impacts to special status plant species are minimized or avoided and to consult with the appropriate resource agencies (CCC, USFWS and/or CDFG) to determine the best course of action if sensitive resources cannot be avoided.

Because the HDB monitoring system would be installed at or near the high tide line at Ormond Beach, a recognized grunion spawning beach, in its consistency certification BHP has committed to incorporating the precautions against the potential disturbance of spawning grunion that are included in the EIS/EIR. Per this commitment, all construction activities within the inter-tidal area of Ormond Beach would be conducted after September 15th and before March 15th, outside the typical grunion spawning season.

Conclusion

With the inclusion of these measures to protect sensitive species and resources, the Commission finds that BHP's proposed temporary use of 2000 square feet of Ormond Beach and dunes would not adversely affect environmentally sensitive habitat areas.

Slick Bore Exit Site

The only other area within the coastal zone and outside of the power plant site that is proposed to be used for Cabrillo Port activities is the slick bore and natural gas pipeline exit site on the inland side of the Mugu Lagoon Canal. BHP is proposing to conduct all slick bore and pipeline exit activities within a 50-foot by 50-foot area of cleared, disturbed soil that is currently being used as an access road for an adjacent sod farm and is within existing right-of-ways for an overhead electrical transmission line and a natural gas pipeline. The exit site is also adjacent to an area that currently being used for existing natural gas pipeline infrastructure. Because this area is already disturbed, the proposed project would not result in adverse impacts to sensitive resource areas or resources. However, due to the proximity of the exit site to the Mugu Lagoon Canal, BHP has committed to implementing a variety of erosion control and sediment containment measures to ensure that the canal is not affected or degraded due to erosion or sedimentation. These measures (detailed in Appendix C) include 1) the commitment to contain construction debris to prevent any erosion into the canal; 2) stabilize and surround disturbed soils with erosion control fencing upon completion of construction activities and until the area is re-vegetated and disturbed soils are properly stabilized; 3) excavate, remove and appropriately dispose of all contaminated soils to prevent sensitive plant and animal species from becoming exposed; 4) conduct work in a manner that minimizes erosion; and 5) install erosion control fencing or other devices such as hay bales, straw bales, matting or mulch. Also, as mentioned previously, BHP's use of slick bore technology would not require drilling fluids or mud and therefore involves no risk of spill. After the proposed 36 inch diameter pipeline exits the slick bore hole it would once again be trenched and would continue belowground outside of the coastal zone for an additional 14.7 miles to the existing Center Road Valve Station.

Accidental Spills and Sedimentation

The proposed shore crossing requires a substantial amount of soil excavation, grading, horizontal directional boring and hydrostatic pipeline testing. These activities, and the soil disturbance associated with them, have the potential to cause increases in sedimentation, wind and water erosion and the release of large amounts of drilling fluid, all of which can lead to direct adverse impacts on terrestrial biological resources.

Horizontal Directional Boring

Horizontal directional boring involves the use of a mobile bore-head that can be remotely controlled by an operator to move both horizontally and vertically belowground. In addition to the power supply and control cables attached to the bore-head, the active part of the boring apparatus is also connected to a fluid injection and recovery system to facilitate the creation of the bore hole and the removal of displaced material. This process typically involves the use of substantial volumes of fluid, sometimes in excess of 5,000 gallons.

Although drilling fluids used in the HDB process are not typically subjected to high levels of pressure, the potential exists for fluids to "frac-out" or be released through the subsoil to the surface if the borehole is pressurized beyond the containment capacity of the subsoil. Accordingly, the use of HDB technology carries an inherent risk of accidental spills or upsets of drilling fluids. Drilling fluids are typically comprised of 2 to 5% bentonite clay and 95 to 98% fresh water, with a small amount of extending polymer (polyacrylamide) added, none of which are particularly harmful or toxic. However, these fluids often carry large amounts of suspended sediments and their accidental release could adversely affect terrestrial biological resources through sedimentation, erosion or burial. For instance, if a substantial amount of drilling fluid were to be released in proximity to a riparian area, it could increase turbidity levels in the water, contribute to erosion or simply bury plants and animals in the affected area. Similarly, drilling fluids could enter and inundate portions of Ormond Beach and its associated dune habitat, potentially resulting in erosion or the burial of plant communities. Accidental releases of HDB drilling fluids could also contribute to the degradation of sensitive habitat areas.

The most effective way to guard against the inadvertent release of drilling fluid into the environment through frac-out is to drill in geologic strata that are least susceptible to frac-out. As discussed in Section 5.6 (Geology) of this report, BHP proposes to confine HDB activities to subsurface depths that have the lowest potential for fractures and faulting with the overlying strata. In addition, to address the potential accidental release of these fluids at the onshore end of the HDB or along the onshore HDB route that crosses Ormond Beach and dunes, BHP would implement a comprehensive Drilling Fluid Release Monitoring Plan (included in Appendix C). This plan would include provisions to immediately stop work upon detection of a bentonite seep into or near surface water or sensitive habitat, maintain containment equipment on site, add a non-toxic color dye to the drilling fluids to easily and quickly detect fluid releases, maintain a qualified environmental monitor onsite to monitor sensitive habitat areas, and ensure that any release of drilling fluids is properly cleaned up and disposed of.

To ensure that drilling fluids do not become contaminated by passing through areas of subsurface contamination that may potentially exist along the various HDB routes, in its consistency certification BHP has committed to collecting drilling fluids and spoils during HDB operations and analyzing them for the presence of toxic substances. This sampling and analysis program would include testing for heavy metals, total petroleum hydrocarbons, volatile organic compounds, and semi-volatile organic compounds. If elevated levels of any of these contaminants are detected in the samples, the excess drilling fluid and spoils would be collected and disposed of at a hazardous waste facility. If no contamination is detected, the material would be disposed of at a conventional approved disposal site or used as backfill.

With the inclusion of these measures to prevent and minimize the release of drilling fluids and contaminated sediments, the Commission finds that the proposed use of horizontal directional boring would not result in adverse impacts to environmentally sensitive resources or habitat areas.

Pipeline Trenching

The proposed pipeline route from the natural gas metering station to Mugu Lagoon Canal would require the excavation of a seven-foot deep by eight-foot wide trench for approximately 1,800 feet. Proposed trenching activities would temporarily disturb and expose soils, which may potentially cause erosion. If rain falls during trenching, sedimentation or erosion could bury nearby plants or degrade habitat. Trenching may also potentially expose contaminated soils that could be washed into plant communities adjacent to the pipeline right-of-way, possibly resulting in adverse impacts to individual plants. Considering the disturbed and graded condition of the proposed pipeline trench route on the power plant site and the fact that vegetation and habitat in this area is sparse and degraded, potential increases in erosion and sedimentation would be insignificant. In addition, to minimize the potential occurrence of erosion and sedimentation during trenching, BHP has committed to incorporating the erosion control and spill containment measures included in the EIS/EIR (and detailed in Appendix C) into the proposed project. These measures include the commitment to contain construction debris to prevent any erosion into streams or waterways, stabilize and surround disturbed soils with erosion control fencing upon completion of construction activities and until the area is re-vegetated and disturbed soils are properly stabilized, as well as the commitment to excavate, remove and appropriately dispose of all contaminated soils to prevent sensitive plant and animal species from becoming exposed, conduct work in a manner that minimizes erosion, and install erosion control fencing or other devices such as hay bales, straw bales, matting or mulch.

The Commission finds that by including these erosion control measures BHP would avoid affecting vegetation and sensitive habitat around the proposed pipeline trench location.

Wildlife Disturbance from Lighting and Noise

Sudden or prolonged exposure to elevated noise levels has been associated with flushing and avoidance behavior in highly mobile wildlife species such as birds. Artificial night lighting can disrupt important behaviors and physiological processes with significant ecological consequences, including the disorientation of birds during migration and foraging activities and increased predation by gulls and owls.

Lighting

Proposed onshore HDB activities would occur for approximately 108 24-hour days. During this period, the operation of boring equipment, welding and fabrication of pipelines, preparation of the staging area and excavation of the HDB launching pit would result in elevated levels of noise and the use of construction lighting at night. While light levels during construction and HDB operations would not substantially exceed the ambient light levels that currently exist at the power plant, the increased use of directional lighting may increase the existing lighting footprint and cause greater illumination of portions of critical seabird habitat on Ormond Beach. To address potential adverse impacts associated with this lighting, in its consistency certification BHP has committed to conducting all onshore construction activities outside of the recognized nesting season for the western snowy plover and California least tern, which would minimize potential adverse affects to these species during this critical life stage.

With the inclusion of this measure, the Commission finds that BHP would avoid increasing ambient nighttime illumination beyond the ambient levels currently produced by the power plant during the shorebird breeding season and therefore avoid disturbing or adversely affecting the sensitive biological resources of the Ormond Beach area.

Noise

Estimated "worst-case" noise levels at a distance of 50 feet from the proposed staging area would be up to 102 A-weighted decibels during HDB operations. These noise levels would decrease to approximately 82 A-weighted decibels at a distance of 500 feet from the project site, well within the USFWS designated critical habitat for snowy plover on Ormond Beach. These noise levels could potentially result in temporary disturbances to wildlife in the Ormond Beach area including the special status species of birds with both nesting and wintering habitat in this area. Based on over a decade of monitoring (as represented by data included in the California Department of Fish and Game's BIOS online informational system), the Ormond Beach area has been known to support between 20 and 34 snowy plover breeding pairs and 141 least tern breeding pairs between the months of March and September and up to 123 wintering snowy plovers between November 1 and February 28. To minimize potential disturbances to these endangered species, in its consistency certification BHP has committed to implementing the mitigation measures included in the EIS/EIR (and detailed in Appendix C) by:

- Monitoring noise levels to ensure compliance with sound ordinances;
- Using noise blankets and noise barriers;
- Enclosing engines, equipment and generators;
- Using strobe lights, flagmen and self-adjusting backup alarms in place of typical backup alarms;
- Restricting the use of mobile equipment during nighttime hours;
- Placing silencers on equipment engines when possible; and
- Orienting loading bins to minimize noise impacts on adjacent areas.

In its consistency certification BHP has also committed to limiting HDB operations to the months between October and February, when both nesting snowy plovers and nesting least terns are likely to be absent from the Ormond Beach area and to employ independent biological monitors that would determine if HDB activities are resulting in adverse impacts to snowy plovers, or other sensitive species.

With these measures, the Commission finds that impacts from construction noise and lighting on wintering birds would be minimized because those birds that use this area outside of the breeding season appear to have become acclimated to the noise and light generated by the operations of the power plant.

Summary of Mitigation Measures

To generally reduce potential impacts to environmentally sensitive terrestrial resources and habitats associated with all of the onshore aspects of the Cabrillo Port project described above, BHP has committed to conducting all of the mitigation and impact minimization measures included in the EIS/EIR (and detailed in Appendix C) including:

- Maintaining a biological monitor onsite during all onshore construction activities;
- Developing and implementing an Employee Environmental Awareness Program to:
  - Explain applicable endangered species laws and endangered species concerns to contractors working in the area;
  - Discuss the locations and types of sensitive biological resources on the project site and in adjacent areas;
  - Present the meaning of temporary and permanent habitat protection measures;
  - Describe what to do if previously unidentified sensitive resources are encountered;
  - Ensure that all project personnel and subcontractors adhere to all guidelines and restrictions;
  - Discuss the importance of maintaining site safety to avoid mortality of small mammals, reptiles and other less mobile species by prohibiting pets or firearms on the project site, maintaining designated protected areas, and installing exclusionary fencing in and flagging of habitats that may support sensitive habitat; and,
  - Discuss traffic management strategies such as restricting project related vehicle and equipment traffic to established roads or access routes, enforcing a 20 mile per hour speed limit within work areas, and identification of all vehicle and equipment access routes and work areas before construction activities begin.
- Preparing and implementing a Biological Resources Mitigation Implementation and Monitoring Plan to identify:
  - All biological resources mitigation, monitoring, and compliance conditions specified in any permits acquired for the project;
  - All sensitive biological resources to be impacted, avoided, or mitigated by project construction, operation or maintenance;
  - All required mitigation measures/avoidance strategies for each sensitive resource;
  - All locations, on a map of suitable scale, of laydown areas and areas requiring temporary protection and avoidance during construction;
  - All natural areas disturbed during project construction activities in pre- and post-construction photographs;
  - Duration of biological monitoring and a description of monitoring methodologies and frequency;
  - Success criteria for proposed mitigation; and,
  - Remedial measures to be implemented if success criteria are not met.
- The Biological Resources Mitigation Implementation and Monitoring Plan would include the following:
  - Measures to avoid special status wildlife and plants and their habitats during pipeline construction, operations, and maintenance, including restrictions in sensitive coastal areas, mapping, and avoidance of sensitive resources;

- Measures to protect nesting birds under the Migratory Bird Treaty Act including avoiding construction activities during the breeding season. If construction cannot avoid the breeding season, preconstruction surveys would occur per CDFG protocols; any nest found within the construction area would comply with CDFG buffer and monitoring requirements;
- Restoration of sensitive vegetation types (coastal and riparian) potentially impacted during pipeline installation or repair, in accordance with other relevant mitigation measures;
- Inclusion of measures in an Operation and Maintenance Plan to avoid and minimize impacts on special status wildlife, plants, bird nesting areas, and sensitive or protected habitats such as riparian areas during routine operation or maintenance activities;
- Creation of a map of the pipeline route depicting the location of all special status plants, wildlife, important nesting areas, and wetlands, to be used during necessary vehicular travel, for pedestrian use, or during equipment placement, to avoid these resources;
- Prohibition of disturbance to and clearing of coastal, riparian, and wetland vegetation during inspections. Travel and work areas would be flagged and fenced before repair work to identify and avoid impacts on sensitive habitats as depicted on the pipeline map; and,
- Maintenance of records of mitigation implementation on file at the pipeline maintenance office.

Conclusion

With implementation of the above-described onshore biological mitigation measures, the Commission finds that the project would avoid environmentally sensitive habitat areas, protect against any significant disruption or degradation of habitat values, and be compatible with the continuance of adjacent habitat and recreational areas. The Commission thus finds the project consistent with CCMP section 30240.

4.6 Geology

CCMP § 30253 states:

> *New development shall:*
>
> *(1) Minimize risks to life and property in areas of high geologic, flood, and fire hazard.*
>
> *(2) Assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs.*

The proposed project would be located in an area of high geologic risk, and might reasonably be expected to be subject to impacts associated with seismic activity, submarine landslides, turbidity currents, tsunamis, and beach erosion. In addition, there is potential for the accidental or intentional release of drilling fluids (including bentonite) to the seafloor and marine environment during Horizontal Directional Boring activities at the Ormond Beach landing. The EIS/EIR also analyzes for subsidence and settlement hazards; the Commission finds that these hazards are not significant with respect to CCMP section 30253.

In 2004 Representative Lois Capps (California 23rd district) requested advice from the U.S. Geological Survey (USGS) on geologic hazards that may be encountered at the Cabrillo Port site, as well as at another site offshore Ventura County. The USGS complied by reviewing previously compiled publicly available data, and produced a report (USGS, 2004) summarizing its view of the hazards that need to be considered in conjunction with the project. The lead agencies considered this report in the scoping and completion of the draft EIS/EIR, and identified the hazards cited above.

4.6.1 Geologic Setting

The proposed project lies within the Transverse Ranges physiographic province of California. The offshore portions of the project lie within the Santa Barbara Channel, part of the Santa Monica Basin and a deep submarine trough that receives sediments shed from the rising Santa Ynez Mountains to the north. The structural grain of ridges and basins, as well as most geologic structures, runs roughly east-west. The pipelines would come ashore at Ormond Beach, the seaward extension of the broad Oxnard Plain, which would be crossed by Horizontal Directional Boring beneath the beach. The pipelines would actually surface at a point approximately 1,265 feet landward of the mean high tide line.

As summarized in the EIS/EIR:

> *The offshore Project…is on the Hueneme-Mugu Shelf (the offshore extension of the Oxnard Plain), the Hueneme-Mugu Slope, and the Santa Monica Basin (see [Exhibit Geo-1]). The Hueneme-Mugu Shelf varies in width from less than 0.9 nautical mile (NM) (1.04 mile or 1.67 kilometers [km]), west of the Mugu Submarine Canyon to about 3.5 NM (4 2 miles or 6.5 km) east of the Hueneme Submarine Canyon. Slopes on the shelf are gentle, less than 0.5 to slightly more than 1 degree, and generally to the southwest (see [Exhibit Geo-1]).*
>
> *The Hueneme-Mugu Shelf is dissected by a series of submarine canyons between the Hueneme and Mugu Canyons. These canyons and intervening slopes represent the Hueneme-Mugu Slope. The pipeline route has been planned to follow the more gentle slopes along ridges between steeper canyons. The ridge slope along the proposed route ranges from about 2.5 to 6 degrees. The side slopes into the valleys on either side of the proposed pipeline route are noticeably steeper. Adjacent to the ridge slope, the side slopes of the valleys are about 15 to 20 degrees (see [Exhibit Geo-1]). With the exception of the Hueneme and Mugu Canyons, which cut into the shelf to near the shoreline, the transition between the Hueneme-Mugu Shelf and Hueneme-Mugu Slope generally occurs at an approximately 180- to 200-foot (54.9 to 61 meter [m]) depth.*
>
> *The base of the canyons opens up to the south into the Santa Monica Basin, where ongoing sediment deposition from the canyons forms the Hueneme Fan. The slope of the Hueneme Fan in the vicinity of the Project ranges from about 3 degrees near milepost (MP) 12 to less than 1 degree near the floating storage and regasification unit (FSRU) location (see [Exhibit Geo-2]).*
>
> *Onshore, the Project is on the coastal margin of the Oxnard Plain, which occupies the southwest part of the older buried Ventura Basin. The Oxnard Plain is broad and relatively flat, with a southwesterly slope (at approximately 0.2 to 0.3 percent) that rises from the sea level to an elevation of approximately 150 feet (45.7 m) near South Mountain.*

Because the project facilities would be located on the sea floor, the surface, or shallow subsurface, only surficial geologic deposits would likely be encountered during construction and operation. These deposits consist mostly of deltaic, fluvial, lagoonal, and nearshore marine deposits associated with the Santa Clara River delta. These deposits consist of poorly consolidated sands and muds, and are underlain by Miocene through Pleistocene sedimentary rocks of the Vaqueros Formation, Rincon Shale, Sisquoc Formation, Santa Margarita Formation, Repetto Formation, Pico Formation, the Santa Barbara Formation, and the San Pedro Formation. In addition, extrusive and intrusive volcanic rocks associated with the Conejo Volcanic series are present.

4.6.2 Geologic Hazards

As identified in the 2004 USGS report, seismic hazards are a primary hazard associated with the project site, which is zoned with a high level of shaking hazard. In addition to ground shaking, additional seismic hazards present at the site include rupture of known and potential faults that cross the pipeline route and liquefaction of wet and loose sandy material. Several large submarine landslides are known offshore Ventura County, and the potential for slope movements during an earthquake or storm event exists. Sediments are carried into the Santa Barbara Channel largely by turbidity currents—dense mixtures of sediment and water that flow downslope as dense slurries at high velocities. Such currents occur regularly in submarine canyons, such as Mugu and Hueneme Canyons, but also can occur outside of the canyons on submarine slopes such as the Santa Clara River delta. The Ventura coast has been impacted by tsunamis from a variety of sources—local and distant—in the past and thus hazards from tsunamis could potentially affect the proposed project. Finally, where the pipeline comes ashore it may be subjected to erosion and scour associated with beach erosion.

Seismic Hazards

Exhibit Geo-3, taken from USGS (2004), shows the locations of faults that pose hazards through the region. As explained in that report:

> *The thick black lines are faults used in the USGS National Seismic Hazard Maps (http:// eqhazmaps.usgs.gov/; Frankel and others, 1996 and 2002; Petersen and others, 1996). These maps are produced by the USGS every 3 to 5 years and are the basis for seismic provisions in both the International Building Code and the International Residential Code. The faults shown in [Exhibit GEO-3] were determined to pose a quantifiable seismic hazard by a consensus of USGS, California Geological Survey, and outside experts. To fall into this category, they must have evidence of fault slip during the past 1.6 million years (a short time in geologic history) as well as a scientifically established rate of fault slip or a history of past earthquakes from evidence such as trenches excavated across faults. In general, the fault traces are better known and documented for onshore than for offshore faults. Therefore, we also show (in dashed black lines, [Exhibit GEO-3]) recognized offshore faults that are not currently included in the National Seismic Hazard Maps and represent the result of additional research, e.g. Sorlien and others (2000); these faults may be included in future updates of the National Maps as more information on them is developed.*
>
> *All faults shown on [Exhibit GEO-3] have the potential to produce M 6.5 or greater earthquakes that would result in locally strong ground shaking and some combination of ground-surface breaks, liquefaction of near surface sediments both onshore and offshore, landslide triggering of both coastal bluffs and underwater slopes, and generating tsunamis. These effects have occurred as the result of past earthquakes in this region and thus are expected to occur in future earthquakes.*

> *The maximum magnitude of an earthquake is related to fault length: the longer the fault, the larger the potential earthquake can be (Wells and Coppersmith, 1994). For example…[the] Anacapa-Dume Fault, near Cabrillo Port, is thought to be capable of producing earthquakes as great as M 7.5 (for comparison, the great San Francisco 1906 earthquake was M 7.8). As we learn more, connections between different faults are sometimes found, increasing total fault length and the sizes of potential earthquakes.*

The faults that cross the pipeline route, as well as other faults near the project area, have the potential to produce seismic effects including ground shaking, surface rupture, liquefaction, and seismically-induced slope failures.

The Commission notes that as more studies are conducted in the area, our understanding of the seismic hazard changes. For example, Fisher et al (2005) recently published a study that suggests that current fault models may be inadequate in the project area. This study incorporates new seismic reflection data and reprocessing of previously unavailable seismic reflection data, resulting in much improved imaging of the Malibu Coast, Point Dume, and other faults. One conclusion of the study is that displacement on these faults is much greater than previously believed, increasing the seismic hazard that they represent. These suggestions, if confirmed, may change the seismic hazard assessment at the site. However, at present there is too little information available to translate these hypotheses into practical design criteria.

Ground Shaking

The USGS National Seismic Hazard Maps (Frankel and others 2002) provide estimates of the earthquake ground motion as a percentage of gravity that has a 2% chance of being exceeded in 50 years. In the project area, values greater than 100% of gravity are expected in the vicinities of the Anacapa-Dume and Malibu Coast Faults, with values dropping off to approximately 60% of gravity at the Cabrillo Port site. A more detailed seismic hazard model was undertaken by Fugro (2004). This model considered ground shaking during four earthquake scenarios at four locations within the project site. The four earthquake scenarios are:

1) The National Fire Protection Agency (NFPA) Operating Basis Earthquake (OBE), with a 10% probability of exceedance in 50 years (recurrence interval of 475 years).
2) The NFPA Safe Shutdown Earthquake (SSE), generally 1% probability of exceedance in 50 years (recurrence interval of 4,975 years).
3) The American Petroleum Institute (API) design level for ground motion that has a reasonable likelihood of not being exceeded during an oil platform's life (a recurrence interval of 200 years).
4) The API design level for a rate intense earthquake (with a recurrence interval of 1000 years).

The four locations that were considered are:

1) The anchor point of the FSRU, on the lower Santa Clara River delta fan
2) A location at the southern end of the pipeline, on the trough slope
3) A location at the northern end of the pipeline, on the ridge slope
4) An onshore location, adjacent to the shallow shelf.

The peak ground accelerations (as a fraction of gravity) predicted under these four scenarios at these four locations are summarized below:

Table 5.6-1: Ground Shaking Scenarios at Four Locations

Location	1) Anchor	2) S. Pipeline	3) N. Pipeline	4) Onshore
NFPA OBE pga (g)	0.42	0.70	0.72	0.51
NFPA SSE pga (g)	0.78	1.40	1.42	0.98
API 200 yr pga (g)	0.29	0.44	0.46	0.41
API 1000 yr pga (g)	0.53	0.93	0.94	0.68

These values are comparable to the USGS values for the 2% exceedance in 50 years earthquake, described above.

Fugro (2004) goes on to provide detailed seismic spectra, estimating the horizontal and vertical ground acceleration at various seismic wave frequencies for the various locations. These values were used by Honegger Consulting (2004) to assess the seismic hazard that the project components would be subjected to due to ground shaking, and to provide further design criteria for pipeline construction. The Honegger report concludes:

> *The offshore pipelines are not expected to experience strains greater than the 0.5% nominal yield strain of the pipe material for an unburied condition or greater than 1.5% for the case of full pipeline burial for any of the earthquake related ground displacement scenarios considered. These strains represent a large margin of safety with respect to strain limits established for continued operation and pressure integrity for the operating pipelines.*

For reference, the report adopts a longitudinal tension or compression strain limit of 2% as a reasonable limit for continued operation of the pipeline.

The Commission concurs, and finds that ground shaking during a major earthquake is not likely to interfere with the integrity of the pipelines. However, the report also concluded that:

> *The PLEM [Pipeline End Manifold] has insufficient sliding resistance to for seismic loads. Static sliding resistance of the PLEM should be increased to*

> *4,940 kN to achieve a factor of safety of 1.0 against sliding. The sliding displacements of the PLEM under sliding loads is estimated to be less than ±13 cm. Therefore, an alternative to increasing the sliding resistance of the PLEM is to confirm that this displacement is acceptable for safe operation in the final design.*

BHP has agreed to incorporate this recommendation in their final revised plans. Contingent upon review of these plans (see Appendix B), the Commission finds that the project assures stability and structural integrity with respect to ground shaking, as required by CCMP section 30253.

Fault rupture

As is apparent in Exhibit GEO-3, the proposed pipeline route crosses mapped traces of the Anacapa-Dume fault and the Malibu Coast Fault. Fugro (2004) estimated average and maximum fault displacement values for a range of fault segment scenarios on the Anacapa-Dume and Malibu Coast Faults. These estimates are based on empirical correlations by others (Wells and Coppersmith, 1994) between earthquake magnitude, rupture length, and average and maximum displacements. The greatest estimated displacement was found to be 5.5 meters along the Malibu Coast fault, if it ruptured concurrently with the Santa Cruz Island Fault.

Honegger Consulting (2004) made several assumptions with regard to fault displacements:

> *1. The relative likelihood of an earthquake rupturing multiple faults (i.e., Dume with Santa Monica and Malibu Coast with Santa Cruz Island) is considered relatively low in the Fugro-West report.*
> *2. The location of the pipeline fault crossings are sufficiently far from shore or the mooring to present no significant safety risk to the FSRU or the general public in the event of pipeline rupture.*
> *3. The financial consequences to repair pipeline damage from fault displacement are significant.*

and established design criteria as follows:

> *Based upon the above considerations, and consistent with established pipeline seismic design practice, design fault displacements were selected as two-thirds of the Single Fault Maximum Displacement Values computed using empirical relationships (Wells and Coppersmith, 1994) and listed in Table 5.1. of the Fugro-West report (Fugro-West, 2004a). This results in design fault displacements equal to two-thirds of 2.5 m, or 1.7 m, for the Dume fault and two-thirds of 3.5 m, or 2.3 m, for the Malibu Coast fault.*

The report then goes on to calculate pipeline strains associated with these reduced displacements, and concludes, as cited above, that:

> *The offshore pipelines are not expected to experience strains greater than the 0.5% nominal yield strain of the pipe material for an unburied condition or greater than 1.5% for the case of full pipeline burial for any of the earthquake related ground displacement scenarios considered. These strains represent a large margin of safety with respect to strain limits established for continued operation and pressure integrity for the operating pipelines.*

Further, the Honegger (2004) report concludes that:

> *Fault displacement on the Dume and Malibu faults will likely result in elastic upheaval buckling that will develop over several hundred meters of the pipeline alignment with upheaval displacements of 10 m to 25 m . Appropriate steps to address this potential upheaval buckling should be incorporated into post earthquake response planning.*

These very large vertical displacements could impact pipeline integrity, as well as impose hazards to marine mammals and fishing equipment.

The Commission notes that the assumptions used in this assessment of pipeline displacement appear to be more related to safety considerations and economics than to geologic conditions. The basis for choosing a single-fault model and for assuming only two-thirds of the estimated maximum displacement is poorly justified. Further, the USGS (2004) report recommends, among other things, that offshore high-resolution multibeam bathymetry be collected, and existing seismic reflection data be reprocessed and examined, in order to locate any additional active faults. Commission staff expressed the need for such studies to the lead agencies during comments on Drafts of the EIS/EIR, but these have not been undertaken to date.

As detailed in Appendix C, the applicant has proposed mitigation measures for the fault rupture hazard, including additional geotechnical studies, avoidance of known faults, and ensuring pipeline flexibility by installing the pipelines on the seafloor rather than buried. Further, the BHP proposes to install mainline valves equipped with either remote valve controls or automatic line break controls to isolate pipeline segments in the event of rupture. However, the Commission finds that these mitigation measures are insufficient to assure stability and structural integrity. Accordingly, the Commission finds that the proposed project is not consistent with CCMP section 30253 with regard to fault rupture hazard, in that it has not been demonstrated that the new development will assure stability and structural integrity.

Liquefaction

The 2004 USGS report describes the liquefaction hazard at the project site:

> *The potential for earthquake-induced liquefaction of wet and loose sandy material and several other potential causes of instability should be addressed for this project. Portions of the proposed projects may be developed on coastal areas of artificial fill, which generally performs poorly during earthquakes if not properly engineered. For example, liquefaction of artificial fills in the coastal town of Oceano, California, caused significant damage to buildings and lifelines despite being 30 miles from the 2003 M 6.5 San Simeon earthquake. Other portions of the proposed projects may be developed on naturally deposited sediments with similarly poor performance during earthquakes. For example, sandy continental shelf deposits in the Klamath Delta area of far northern California liquefied and flowed during a 1980 M 7.0 earthquake. The flow failures produced a 3 to 6 foot high scarp. Such failures could also occur on the continental shelf of the Santa Barbara Channel and might impact offshore pipelines. Thus, it is necessary to assess the ability of underlying geologic materials and fills to stably support the foundations of buried and surface engineered structures.*

The same type of liquefaction and lateral spread failures can occur on the sea floor as well as above sea level. The Fugro (2004) report identifies potential liquefaction effects, including settlement and lateral spreading displacement, along the shallow shelf portion of the pipeline alignment and at the onshore landing. Further offshore, sediments are too clay-rich to be susceptible to liquefaction. The Honegger (2004) report considers the following conditions to be the "bounding, worst case design conditions" for liquefaction-related effects:

> *1. A lateral spread along 200 m of the pipeline alignment occurring as a block of soil displacing 10 m near the top of the ridge slope.*
> *2. An abrupt settlement of 5 m along 200 m of the pipeline alignment near the top of the ridge slope.*
> *3. An abrupt lateral spread displacement of 10 m along 200 m of the pipeline alignment occurring perpendicular to the shore at the HDD exit.*

These conditions were justified as follows:

> *The length of 200 m was selected based upon a review of historical lateral spread displacements indicating that approximately 85% of historical lateral spread displacements have a length (measured parallel to the direction of ground movement) less than 200 m (Honegger, 1994). A lateral spread displacement of 10 m was selected as a value representative of the maximum onshore lateral spread displacement that has been observed as evidenced by data provided in (Bartlett and Youd, 1992).*

Using these assumptions, Honegger Consultants (2004) calculated the stresses that such a displacement would place on the pipelines, whether buried onshore, or on the surface offshore. They conclude:

> *The highest computed pipeline strains occur for the case of an assumed lateral spread displacement along the onshore HDD portion of the pipeline. For a conservative upper-bound lateral spread displacement of 10 m, the maximum pipeline strains are approximately 1.35%. More realistic assumptions with respect to the amount of ground displacement and distribution of ground displacement with depth will result in much lower computed pipeline strains. For example, assuming a lateral spread displacement of 6 m reduces the maximum pipeline strain to the nominal yield strain of 0.5%.*

Again, consider that a longitudinal tension or compression strain limit of 2% was adopted by these consultants as a reasonable limit for continued operation of the pipeline. Although somewhat better justified than the surface rupture displacement discussed above, the Commission finds that the displacement values are arbitrary and do not necessarily represent "worst case" conditions. There has been very limited documentation of lateral spread displacements in offshore waters and, as documented below, large-scale slope movements have certainly occurred in the Santa Barbara Channel area in the past. From review of the calculations going into this conclusion, it is apparent that only modestly larger lateral spreads than those assumed above would place strains on the pipeline exceeding the maximum assumed safe limit of 2%.

The applicant has proposed mitigation measures for the liquefaction hazard (as detailed in Appendix C), including using the proper seismic design criteria and ensuring pipeline flexibility by installing the pipelines on the seafloor rather than buried. Further, the BHP proposes to install mainline valves equipped with either remote valve controls or automatic line break controls to isolate pipeline segments in the event of rupture. However, the Commission finds that these mitigation measures are insufficient to assure stability and structural integrity.

Accordingly, the Commission finds that the proposed project is not consistent with CCMP section 30253 with regard to lateral spread hazard, in that it has not been demonstrated that the new development will assure stability and structural integrity.

Turbidity Currents

The submarine fan comprising the Santa Clara River delta was largely built by turbidity currents. Turbidity currents are dense mixtures of sediment and water that result from the sudden failure of steep submarine slopes. Such currents are most common in submarine canyons, such as Hueneme and Mugu Canyons in the project area, but they can occur outside of such canyons as well. These dense flows of sediment and water can move at great speeds and can damage structures on the seafloor. As described in USGS (2004):

> *Turbidity currents, especially on steeper slopes in submarine canyons, move with such speed and power that the only comparable on land processes are the catastrophic volcanic flows that rush down the flanks of volcanoes during explosive eruptions. A turbidity current in the Laurentian Fan, off of Nova Scotia, broke submarine telecommunications cables and is thought to have traveled at 45 miles per hour (see review of turbidity current processes in Normark and Piper, 1991). The Santa Monica Basin has less relief than the Laurentian Fan, so turbidity currents there would not reach the same speed. Reynolds (1987) documents a turbidity current event in the Santa Monica Basin about 100 years ago that transported more than a million cubic yards of sediment at speeds of 2 miles per hour. This event is suggested to have resulted from the southern California flood of 1884. A much larger turbidity current that transported more than 10 million cubic yards of sediment occurred about 200 years ago; it transported coarser (larger grain-size) sediment and its velocity must have been substantially greater (Malouta and others, 1981). This earlier event is suggested to have been generated as a result of sediment failure during the 1812 Santa Barbara earthquake.*

With regard to the project, the report goes on to state:

> *Turbidity currents capable of transporting sand-sized sediment more than 35 miles from the Hueneme Canyon to the basin floor have occurred about every 200 years on average during the last 3000 years (Normark and McGann, 2004). Triggered commonly by earthquakes and large storms, these flows are typically 150 feet high (Piper and others, 2003). The proposed site for the Cabrillo Port facility is directly in the path of such energetic flows. Several of the smaller canyons on the delta slope east of Hueneme Canyon are filled by deposits of past debris flows up to 35 feet thick (Piper and others, 1999). These debris flows were probably generated by seismic shaking from nearby earthquakes. All of the proposed pipeline routes to move gas from Cabrillo Port to the coast cross one or more of the canyons and channels on the young and still active submarine delta slope.*

Fugro (2004) examined the pipeline route in more detail, and identified four potential initiation scenarios for turbidity flows that could impact the pipeline:

1. *Sloughing of the surface sediments along the Upper Ridge into the two adjacent canyons…that flank the proposed pipeline route*
2. *Slump failure of the headwall of Canyon D*
3. *Slump failures where the Malibu Coast Fault cross the Upper Ridge, and*
4. *Sloughing of the surface sediments off the Continental Slope in the area where the slope is abnormally steep to the east of Mugu Canyon.*

The volumes and characteristics of sediments that could be mobilized as a result of each of these initiation scenarios was calculated from bathymetric data. These volumes range from a low of 250,000 cubic meters of sediment for Scenario 3 to a high of 20,000,000 cubic meters for scenario 1. Numeric analyses were then used to compute probable turbidity flow paths and velocities following each initiation scenario. From this exercise, three areas of the pipeline—15, 25, and 29-33 km from the Ormond Beach landing—were identified that could be impacted by the turbidity. These areas are illustrated in Exhibit GEO-4. Assuming a 30 m deep turbidity current at pipeline impact, loading pressures on the pipeline were calculated. For the maximum anticipated percentage of solids in the flow (5%), these pressures range from 13 to 28 kPa for seafloor slopes of 1 to 5 degrees (appropriate for the pipeline route).

The report concludes by providing design values for pressures at the three locations:

> ***KP 15.*** *…the seafloor slope is about 2 degrees where the Scenario 1 flow path crosses the pipeline near KP 15. For this slope, with Cv = 0.05, … the estimated velocity is estimated to be about 5.6 meters/second, and the estimated flow pressure is about 18 kPa. At this location, the turbidity flow will be constrained within a 300- to 600-meter-wide valley.*
>
> ***KP 25.*** *Turbidity currents from Scenarios 1, 2, and 3 cross the pipeline near KP 25 on a seafloor slope of about 1 degree or less. For this slope, the estimated flow velocity is about 5 meters/sec, …and the estimated flow pressure is about 13 kPa …. At this location, the turbidity flow will have extended out beyond the side constraints imposed by the canyon sidewalls. For preliminary design, we suggest that the pressures from the turbidity flow be imposed on a one-half to one-kilometer wide section of the pipeline.*
>
> ***KP 29-33****. …Scenario 4 turbidity currents are expected to reach the pipeline in the vicinity of KP 29-33 on a seafloor slope less than 1 degree. For this location, flow velocities are expected to be near 5 meters/sec., and the associated estimated flow pressures will be near 13 kPa. At this location, the turbidity flow will have extended out across basin floor. For preliminary design, we suggest that the pressures from the turbidity flow be imposed on a one-half to one-kilometer wide section of the pipeline.*

These design scenarios were used by INTEC (2004 a, b) to calculate pipeline stability under these assumed loads. The study concludes:

> *Turbidity flows potentially impact the pipeline route at three locations. The pipeline base case design, as given in previous project documents, is not stable during the predicted turbidity flow events.*
>
> *Pipeline stability can be achieved at all three turbidity flow locations by increasing the weight of the pipeline in the form of added wall thickness or added Concrete Weight Coating (CWC).*

> *Preliminary installation analysis indicates that adding CWC may not be practical due to the risk of crushing the concrete as a result of high overbend strains. If a vessel with high tension capability is used, the radius of the stinger can be increased and the overbend strain could be reduced to a value that is acceptable for CWC pipe.*
>
> *The pipeline system does have adequate global lateral soil capacity to withstand a turbidity flow event, even if the pipeline should become locally unstable and lose all the lateral resistance within the bounds of the turbidity flow. The maximum length of pipe required to resist a turbidity flow event, is approx. 5.4-kilometers.*

The stability of other project components, including the flowlines, risers, and moorings, were evaluated in the Honegger (2004). Although the components themselves would not fail due to impact by turbidity current, several components have insufficient sliding resistance or uplift resistance to remain in place during a turbidity current event. Honegger (2004) made several conclusions and recommendations to address these stability issues:

> *Loads from turbidity currents on the flexible jumpers and umbilical lines on the seabed, risers and umbilical lines in the water column, and mooring lines are well below the tensile capacity of these components with factors of safety ranging from 1.4 to 6.3. Therefore, it is concluded that turbidity currents alone do not pose a direct threat to the structural integrity of these components. It is recommended that this conclusion be examined in the final design incorporating any additional relevant operational loads.*
>
> *Turbidity current loads acting on the PLEM, PLETs [Pipeline End Terminations], and umbilical anchors are much greater than the sliding capacity of these components. It is recommended that the loads estimated in this report be reexamined in more detail in the final design to determine the required sliding resistance. As an alternative, acceptable sliding resistance can be achieved by limiting the exposure of the flexible jumpers and umbilical lines to turbidity current loading by covering these lines with articulated concrete mats.*
>
> *Estimates of the uplift load transferred to the PLET as a result of turbidity currents acting on the flexible riser exceed the submerged weight of the PLET. It is recommended that the reaction loads at the PLET estimated in this report be reexamined in more detail in the final design to determine the required uplift resistance.*
>
> *The submerged weight of the umbilical anchor exceeds estimates of the uplift load transferred to the umbilical anchor as a result of turbidity currents acting on the umbilical lines by a factor of 1.3. It is recommended that the reaction loads at the umbilical anchor estimated in this report be reexamined in more detail and include additional relevant operational load conditions in the final design to determine the required uplift resistance.*

BHP has agreed to incorporate these recommendations into their final design, and to submit the final designs for review and approval of the Executive Director prior to commencement of construction (as detailed in Appendix B). Contingent upon review of these final plans, the Commission finds that the project assures stability and structural integrity with regard to the turbidity current hazard, as required by CCMP section 30253.

Slope stability

Very large submarine landslides have been observed in medium-resolution multi-beam bathymetry in the Santa Barbara Channel. As described in the USGS (2004) report:

> *Multibeam bathymetric imaging of the Santa Barbara Channel has shown the remains of a number of very large submarine landslides (Eichhubl and others, 2002). The largest is located offshore of Goleta and 18 miles west of Platform Grace; the "Goleta Slide" measures 8.5 miles long and 6.5 miles wide, and probably occurred within the past 6000 years. Mathematical modeling indicates that when this landslide occurred, it could have generated a tsunami with a height at the coast ranging from 6 to 65 feet (Borrero and others, 2001). There are also buried remains of other landslides. The estimated recurrence interval for these very large landslides is about 15,000 years (Lee and others, 2004). Several medium-sized submarine landslide deposits also exist in Santa Barbara Channel; the best known is the Gaviota Slide (Lee and others, 2004). This slide, 28 miles west of Platform Grace, measures over a mile on each side and likely occurred in the last 300 years. It may have been triggered by the 1812 Santa Barbara earthquake*.

Slope stability analyses reported on in Fugro (2004) were mostly associated with seismically-triggered submarine landslides. Such landslides certainly can occur without a seismic trigger, but analyzing slopes for stability under seismic loading conditions is a conservative approach to analyzing slope stability.

Several types of slope failure were evaluated. First, granular sediments (sand) at the edge of the shallow self were examined. Parameters evaluated include peak ground accelerations derived from the studies cited above, slope inclination, and an internal angle of friction of 28 to 32 degrees. The analyses indicate that:

> *…downslope movement of the sediments below the pipeline route is unlikely, but raveling or failure of the surface sands into the headwall of the adjacent valleys is possible.*

The Commission concurs with this finding.

Of somewhat more concern is slope stability in cohesive sediments that may move downslope as intact blocks, carrying the pipeline with it. Off of the shelf break, surficial sediments are dominated by a clay layer. As reported in the Fugro (2004) report:

> *… some downslope creep of the surface clay sediment could occur on the Ridge Slope where the slope inclination is between 4 and 6 degrees, if the clay is more than 4 to 5 meters thick… For the Trough Slope, where the slope inclination is between 1.5 and 2.5 degrees, the results suggest that the surface clay layer should not move downslope under seismic loading. The results of the preliminary analyses suggest significant potential for sloughing of the surface clay layer into the valleys flanking the ridge. …The results for the NFPA OBE suggest that adjacent to the Ridge Slope where the inclinations of the adjacent valley side slopes are typically between 8 and 20 degrees:*
>
> - *For the maximum 20 degree slope inclination, clay sediments layers greater than 0.5 to 1- meter-thick will be unstable;*
> - *A 2-meter-thick clay layer will be unstable on slopes steeper than 16 degrees, and will experience some movement on slopes steeper than 12 degrees; and,*
> - *Where the side slopes into the adjacent valleys are between about 8 and 12 degrees, clay layers thicker than 3 to 5 meters will probably slough downslope.*
>
> *For the lesser API 200 year return period the results suggest:*
>
> - *For the maximum 20 degree slope inclination, clay sediments layers greater than 3-meters-thick will be unstable; and,*
> - *Where the side slopes into the adjacent valleys are between about 11 and 13 degrees, clay layers thicker than 5 meters will slough downslope.*

These results indicate that slope failures are to be expected during a seismic event. The liquefaction analysis quoted above demonstrates the susceptibility of the pipeline to slope movements.

The applicant has proposed mitigation measures for the slope stability hazard (as detailed in Appendix C), including avoidance of areas of known instability and ensuring pipeline flexibility by installing the pipelines on the seafloor rather than buried. Further, BHP proposes to install mainline valves equipped with either remote valve controls or automatic line break controls to isolate pipeline segments in the event of rupture. However, the Commission finds that these mitigation measures are insufficient to assure stability and structural integrity. Accordingly, the Commission finds that the proposed project is not consistent with CCMP section 30253 with regard to slope stability hazards, in that it has not been demonstrated that the new development will assure stability and structural integrity.

Tsunamis

Tsunamis are sea waves generated by the displacement of a large volume of ocean water. They may form as a result of earthquake, landslide or volcanic eruptions. In the open ocean, these waves have very long periods and wavelengths, very low amplitude, and travel at speeds of hundreds of miles per hour. As a tsunami enters shallow water its speed decreases but its amplitude increases. Historic tsunamis have come ashore with amplitudes of over 100 feet.

Coastal Ventura County is susceptible to tsunamis from both local and distant sources. The region has been affected in the past by tsunamis as high as 20 feet, and thus hazards from future tsunamis could affect the project site.

Some historical tsunamis in Southern California are described in USGS (2004):

> *In southern California, this tsunami [generated by the 1964 M 9.2 Alaska earthquake] was observed as multiple surges as high as 10 feet accompanied by very strong currents. The latter caused most of the damage in ports and harbors, with smaller boats capsizing and larger ships ramming into docks and piers. In Los Angeles harbor, an oil tanker ripped out a 175-foot section of dock. A local M 5.2 earthquake in 1930 was followed by a tsunami with 20 feet of runup in Santa Monica, which caused a fatality in Redondo Beach (Lander, Lockridge, and Kozuch, 1993); the tsunami was probably caused by a submarine landslide triggered by the earthquake.*

With regard to tsunami impact to the project's offshore components, the EIS/EIR states that:

> *Tsunamis typically cannot be detected from a ship at sea due to the long wavelength and small amplitude in the open ocean. Variations in sea level waves are less than those of normal storms, and the forces on Project pipelines would be similar to or less than the forces of normal storm waves and currents.*
>
> *The design tsunami event would cause a sea level change of approximately 10 feet 6 (3 m), with a negligible water slope at the FSRU site with a wave period of 4 to10 minutes. The design of the mooring and risers would account for a 61-foot (18.6 m) change.*

Although the "design tsunami event" is not specifically described, the State Lands Commission's Marine Oil Terminal Engineering and Maintenance Standards provide estimated tsunami run-up heights of 11.0 feet for a 100-year return interval, and 21 feet for a 500-year return interval (CSLC 2004). The EIS/EIR identifies this hazard, but concludes that:

> *There is little risk of damage from tsunamis to facilities located in deep water, such as the proposed location of the FSRU, but significant erosion, high current, and wave forces could occur in shallow water near the shore. This impact is considered adverse but not significant due to the depth of burial of*

> *the pipeline at the shore crossing; however, potential tsunamis could damage the Ormond Beach Metering Station.*
>
> *The Applicant has incorporated the following into the proposed Project:*
>
> ***AM GEO-6a. Pipeline Burial.*** *The pipeline at the shore crossing would be buried at least 50 feet (15.2 m) below the surface of the beach and deeply enough below sea level to minimize the potential of frac-outs. This will also avoid potential damage from tsunamis.*

The Commission finds that, with the proposed burial of the shore crossing, the project assures stability and structural integrity with respect to the tsunami hazard as required by the CCMP.

Beach Erosion

The EIS/EIR does not address coastal erosion hazards at the site. Nevertheless, evidence exists that the pipeline landing site at Ormond Beach has been undergoing significant beach erosion in recent years. This evidence was recently quantified with the publication of Part 3 of the USGS's National Assessment of Shoreline Change (Hapke et al., 2006). This assessment of historical change along California's sandy beaches presents for the first time systematic data showing beach accretion and erosion throughout the State.

The assessment made use of shoreline positions taken from NOAA T-sheets and from LIDAR data. Shoreline positions were taken from four time periods. For the Ormond Beach area, these time periods are 1852-1889, 1920-1934, 1971-1976, and 1998. The three earliest time periods represent dates on NOAA T-sheets, and the 1998 shoreline is taken from LIDAR data. From these data, shoreline change rates were derived from linear regression of shoreline position through time. Shoreline change rates are presented for the long-term (1800s-1998) and short-term (1970s-1998).

Over both the long- and short-term, Ormond Beach was determined to have the highest erosion rates in the southern Santa Barbara coast region. Between 1852/89 and 1998 the shore eroded at an average rate of 0.7 meters (2.3 feet) per year. This rate accelerated in the latter part of this period, with a short-term erosion rate of 5.5 meters (18 feet) per year. This is among the highest erosion rates encountered throughout California in the study, and may reflect the influence of the Port Hueneme jetties and harbor dredging, which may interfere with the flow of sand to the Ormond Beach area.

The EIS/EIR does not indicate the distance from the point where the pipelines surface to the current shoreline. However, it does indicate that the bore would be approximately 4,265 feet long and would terminate 3,000 feet offshore; by inference, the entry point is approximately 1,265 feet from the shoreline. Given this distance, the fact that the pipeline would be buried 50 feet beneath beach, and an assumed project life of 40 years, it would appear that the pipeline would not be impacted by coastal erosion within its economic life. Based on the above, the Commission finds that the proposed development assures stability and structural integrity with respect to coastal erosion, as required under CCMP section 30253.

4.6.3 Potential Impacts Associated with Horizontal Directional Boring

BHP is proposing to land the pipelines at Ormond Beach, crossing the beach using Horizontal Directional Boring (HDB) technology. As described in the EIS/EIR and Cherrington (2006), two parallel bores, one for each pipeline, would be drilled approximately 4,265 feet long and 100 feet apart to cross the shore at the landfall site. The two bores would be drilled from the onshore landing to the offshore exit site, located approximately 3,000 feet offshore at a water depth of approximately 42 feet. Minimum depth below ground surface would be 50 feet, except where the bores angle upwards to the entry and exit sites. A schematic of the HDB bore is depicted in Exhibit GEO-5. HDB operations would require approximately 108 days of drilling 24 hours per day, seven days a week.

Features of the HDB method include a thrusting unit located at the surface entry point, a rotating drill head, an internal pumping unit for drilling fluid and entrained cuttings, and an articulated head for direction control (Exhibit GEO-6). The HDB method would use a pump to return drilling fluid and cutting spoils back to the drill rig for separation and recycling. As a result, HDB drilling does not require high drilling fluid pressures such as those required by Horizontal Directional Drilling (HDD), which in turn reduces the risk of frac-outs and the release of drilling muds into the surrounding environment. The pipeline is installed behind the drilling head, and advances into the bore from the entry point

The cutting head would create a bore with a diameter approximately 25% greater than the outside diameter of the pipe installed. The HDB process would use a drilling fluid composed of 95 to 98% fresh water, and 2 to 5% bentonite, a naturally occurring clay mixed with a small amount of extending polymer (polyacrylamide). The drilling fluid transports drilling spoils back to the surface at the entry point, cools and cleans the cutters on the drill head, reduces friction between the drill pipe and the walls of the bore, stabilizes the bore, transmits hydraulic power which turns the drill head, excavates the soil hydraulically, and reduces the shear strength of the surrounding soil. At the conclusion of the HDB boring, excess drilling fluid and spoils collected by the return system would be disposed of in accordance with federal, State and local regulations. BHP has agreed to submit the final plans for the HDB bore for the review and approval of the Executive Director prior to commencement of construction.

The HDB technique allows installation of the pipeline from the entry point, and avoids the need for drilling a pilot hole, then pulling back the pipeline from a laydown area beyond the exit point, as is done in HDD. This would greatly simplify marine operations, but there would still be a need to use a series of barges at the exit point to facilitate joining the pipelines installed by HDB to the pipelines that would extend from the exit bore locations to the FSRU. BHP has prepared a marine operations plan (MPMI, 2005a) and an anchor mitigation plan (MPMI, 2005b). Impacts to marine resources associated with these operations are described in Section 5.1 (Marine Resources and Water Quality) above.

Drilling fluids may inadvertently be released to the marine environment through "frac-out." Frac-out occurs when excess drilling pressure fractures the soil or rock that is being bored and propels the drilling fluid to the surface. Frac-out is most likely in brittle, fractured rocks, in areas with abundant boulders, or cobbles. In order to characterize the geologic conditions at the site, the applicant has commissioned geotechnical studies researching existing literature (Fugro 2005) and using nearby borings (Fugro 2004b). These studies indicate that the boring would be entirely in alluvium, consisting mostly of silty sand and sandy silt. These materials generally make for good boring conditions. The depth to bedrock is estimated at 50 to 75 feet, so it should be possible to keep 50 feet of overburden between the pipe and the seafloor without drilling in these harder materials. Guided by these studies and using the HDB rather than the HDD technique, the risk of frac-out is relatively low.

BHP has prepared a drilling fluid monitoring a spill cleanup plan (BHC, 2005; see Exhibit GEO-7 and Appendix C) to detect and clean up any bentonite that is released to the marine environment as a result of frac-out. The essentials of this plan call for the injection of a non-toxic fluorescent dye into the drilling mud, and the periodic sampling of marine waters along the drill path. During drilling, the return of drilling fluids to the entry point would be monitored. As long as more than 40% of the drilling fluid returns to the surface, "condition one" would be assumed, and drilling would proceed normally and monitoring would be routine (including periodic testing of seawater samples from above the bore for the presence of the dye). In the event of loss of fluid returns, "condition two" would be implemented. A "Decision Making Team" would decide what course of action to take, including: modifying drilling fluid properties, advance or retreat of bore pipe, or introduction of "Loss Control Materials." If drilling fluid returns resume, drilling proceeds normally under "condition one." If dye or drilling fluid is detected being released to the surface, "condition three" operations would take effect. Under "condition three" operations, work would temporarily stop to locate and quantify the release. The contractor would attempt to determine if a drilling fluid release is occurring. Additionally, the contractor would take appropriate measures to attempt to prevent a possible drilling fluid release. These may include: modifying drilling fluid properties, modifying pressure and volume, advance or retreat the bore pipe, or the introduction of loss control materials according to manufacturer's instructions. Clean up procedures and equipment to be held on site also are described in the plan. The potential environmental impacts of the release of bentonite to the seafloor are discussed in Section 5.1 (Marine Resources and Water Quality) above.

Despite the precautions to be taken to prevent and contain the inadvertent release of drilling fluids to the seafloor, BHP proposes to *intentionally* release up to 10,000 gallons of drilling fluids into a "transition trench" cut into the seafloor at the exit point. This trench would measure approximately 150 feet in width (to cover both bore's exit points), 200 feet in length, and be about 5 feet deep. The potential environmental impacts of the excavation of this trench and are discussed in Section 5.1 (Marine Resources and Water Quality) above. The drilling heads would exit the seafloor in this trench, releasing up to 10,000 gallons of drilling fluids. BHP claims that these drilling fluids would be denser than seawater and would be contained in the trench. BHP proposes to use a vacuum device, guided by divers, to evacuate this material to a floating barge for disposal (Exhibit Geo-8).

However, as Commission staff commented during review of the EIS/EIR, the assumption that drilling fluid would immediately settle to the seafloor upon release is based solely on an erroneous comparison between the specific gravities of seawater and drilling fluid. Direct observations of marine "frac-outs," along with laboratory studies of the physics of drilling-fluid mixing in seawater, contradict this specious assertion. Specifically, drilling-fluid forms lightweight flocs when it mixes with seawater (Pickens and Lick 1992, Huang 1992). These flocs are buoyant enough to remain suspended in the water column for long periods of time and become widely dispersed in the marine environment (Coats 1994). Moreover, direct measurements of seafloor frac-outs have repeatedly demonstrated that, upon release, the warmer drilling fluid extends upward into the cooler water column, where buoyancy-induced turbulence disperses the drilling fluid, and currents transport the dilute mixture well away from the discharge point (Coats 2003). The dynamics of the drilling fluid-seawater mixture are a particularly important consideration when evaluating marine impacts from the intentional release of drilling fluid resulting from drill-head daylighting on the seafloor.

It also is unrealistic to assume that up to 10,000 gallons of drilling fluid intentionally released into a seafloor excavation would remain there during cleanup. Moreover, the offshore location of the drill head cannot always be precisely determined and controlled. It is entirely possible that the drill head could exit the seafloor well outside of the targeted locations within the seafloor excavation. Finally, given the prevailing wave climate along this shallow section of coastline, the efficacy of capturing and removing drilling fluids within the seafloor excavation is overstated. In particular, the excavation pit is unlikely to fully contain the drilling fluids released, unless the wave and current conditions at this nearshore site happen to be exceptionally quiescent at the time of the release. The potential environmental impacts of proposed intentional release of drilling fluids to the marine environment, are discussed in more detail in Section 5.1 (Marine Resources and Water Quality) above.

Regardless of potential impacts to marine resources from the HDB operations, which are discussed elsewhere, the Commission finds that the site is geologically suitable for HDB, and that the subsurface installation of the pipelines would mitigate coastal erosion and tsunami hazards.

4.6.4 Conclusion

For the reasons detailed above, the Commission finds that the proposed project is not consistent with CCMP section 30253. It cannot be found that the new development will assure stability and structural integrity with respect to fault rupture hazard, lateral spread associated with liquefaction or slope stability.

Because the Cabrillo Port would be a "coastal-dependent industrial facility," it is presumptively subject to analysis under CCMP section 30260. For this analysis, see Section 5.11 (Coastal Dependent Industrial "Override" Policy) of this report.

4.7 Commercial Fishing

CCMP § 30234.5 states:

> *The economic, commercial, and recreational importance of fishing activities shall be recognized and protected.*

Commercial fishing is an important component of the regional economy in central and southern California. Common commercial fishing gear types used at or near the Cabrillo Port project area include trawls, trolling gear, longlines, purse seines, gillnets, and traps for lobster, crab and shrimp. The largest components of Santa Barbara area commercial fisheries in recent years have been market squid and red sea urchins, which together represented over 68% of the dollar value of the commercial catch in 2004.[79] Other important commercially caught species in the area include California spiny lobster, Pacific sardine, northern anchovy, California halibut, rock crab, white seabass, sea cucumber, ridgeback and spot prawn, Pacific bonito and rockfish.

Commercial fishing activities have the potential to be affected adversely by the proposed project in the following ways: (1) interference with commercial catch offloading activities due to support vessel traffic in Port Hueneme; (2) loss of fishing gear due to entanglement with the proposed pipeline; (3) loss of access to fishing grounds due to the placement of the FSRU and the regulation of its associated safety zone; and (4) temporary exclusion of commercial fishers from fishing grounds along the proposed pipeline route during pipeline construction and placement.

Interference with Commercial Catch Offloading Activities at Port Hueneme

Due to its proximity to the Cabrillo Port site, BHP has proposed using Port Hueneme as a pick-up and drop-off point for the Cabrillo Port's associated support tugs, crew transport vessels and supply boats. Port Hueneme is home to the largest commercial deep-water harbor between Los Angeles and San Francisco. On average, approximately 486 commercial transport vessels transit into and out of the port each year. In addition, as many as 400 or more commercial fishing vessels also use the port to offload their catch annually. These vessels combine for the largest commercial wetfish landings in the Ventura and Santa Barbara areas in both pounds and dollar value. To process and receive these commercial landings there are five commercial wetfish producers that operate in the port. Two of these producers operate receiving stations within the inner port area and three others operate a joint facility located just inside the entrance to the port.

Because the Port of Hueneme is primarily a cargo port, vessels associated with the loading and offloading of cargo have priority over fishing vessels. Fishing vessels are required to remain outside the harbor until given permission by the port to enter, and must leave the harbor as soon as they have offloaded their catch. Additionally, offloading of commercial

---

[79] CDFG (2005).

fishing vessels at the jointly operated receiving station near the port's entrance is required to stop upon the approach of any vessel of 300 gross registered tons or more. When these piloted vessels are entering or exiting the port, commercial fishing vessels must leave the harbor temporarily to make room for the larger incoming or outgoing vessel. This interruption of catch offloading often results in delays of up to an hour and may cause a complete cessation of wetfish production activities until offloading can commence again.

Given the already heavy use of Port Hueneme by all types of commercial cargo vessels, the regional importance of commercial fishing operations at the port and recent capital investments made to the port's commercial catch offloading facilities, members of the California Wetfish Producers Association have expressed concern over the increased number of vessels transits into and out of Port Hueneme that would result from the operation of Cabrillo Port and the potential for these transits to disrupt catch offloading procedures. The amount of total transit traffic at the port from the Cabrillo Port's support vessels is anticipated to be between 8 and 10 trips per week for an annual maximum of 468 transits into and out of the port. Depending on the specific design and size of these vessels, they may be over 300 gross registered tons and would be required to use a certified pilot to enter and exit the port, in which case their passage would cause commercial catch offloading procedures to cease at the production facility near the port's entrance.

BHP states that its crew vessels would not exceed 300 gross registered tons and therefore would not require the use of a pilot. However, Cabrillo Port's tugboats would exceed this weight limit and therefore require a pilot. The tugboats would require transit into and out of Port Hueneme twice per week. BHP may seek from the Commanding Officer of Naval Base Ventura County a pilotage exemption certificate, which can be granted to tugboat captains. If such an exemption is granted, the tugboats would not require a pilot and all commercial catch offloading procedures would not be required to cease during tugboat transits. If a pilotage waiver is not granted, BHP, in its consistency certification, has committed to scheduling the Port Hueneme tugboats trips in advance, to inform affected fishermen of the schedule, and to hold outside the entrance to Port Hueneme or at the dock to allow fishing vessels that are offloading to finish offloading.

Loss of Fishing Gear Due to Entanglement

BHP is proposing to construct and install two parallel 22.77 mile undersea pipelines from the FSRU to the beginning of the horizontal directional boring site offshore Ormond Beach. These pipelines would be 24 inches in diameter, carbon steel (and occasionally concrete coated), and would rest on the seafloor without being buried.

The commercial fishery that has the greatest potential for interacting with the proposed undersea natural gas pipelines is the trawl fishery. Despite recent changes enacted by the Pacific Coast Fisheries Management Council to the Groundfish Fishery Management Plan resulting in increased trawl fishing restrictions and a reduction in the number of areas where trawling is permitted, the EIS/EIR concludes that approximately 17 miles of the proposed undersea natural gas pipeline route would traverse areas designated as trawl fishing grounds. Although adjustments in fishing technique (i.e. using roller gear or raising the gear off the ocean floor to clear the pipelines) may allow trawlers to continue fishing in the area occupied by the pipelines, the potential exists for fishing gear to become damaged, entangled or lost through contact with these pipelines. In addition to trawls, several other types of bottom contact fishing gear have the potential to become entangled with the proposed pipeline as well. These include bottom longlines, set gillnets, and lobster, crab and shrimp traps.

Impacts can occur to commercial fishing vessels when fishing equipment comes in contact with the offshore pipelines. With trawlers and bottom longline vessels, damage to steel trawl doors or anchors may occur if the pipeline is not buried or armored, and damage may also occur to the pipeline. With lobster and crab trapping vessels and for set gillnetters, traps and anchors can become entangled in the pipelines, although this equipment tends to be too light to damage the pipelines.

Additionally, construction and pipelaying activities and the increases in support vessel traffic between the FSRU and Port Hueneme during construction and operation of the Cabrillo Port facility may also result in the entanglement, damage and loss of commercial fishing equipment. Nearshore set gear fishing areas within California Department of Fish and Game Catch Block 683, such as Hueneme Flats, would be crossed up to 10 times per week by a variety of support vessels during normal operation of the facility and substantially more frequently during the construction phase of the project. These crossings increase the likelihood of supply and support boats interfering with or entangling commercial fishing gear.

To address the potential loss of commercial fishing equipment due to entanglement with the proposed pipelines or support vessels, BHP has committed in this consistency certification to implement certain measures to minimize impacts to the commercial fishing industry and mitigate for unavoidable impacts (see Appendix C). To minimize entanglements, BHP has joined the Oil Caucus of the Joint Oil/Fisheries Committee of South/Central California (JOFLO), which negotiated a set of voluntary-compliance vessels traffic corridors in 1986 to minimize the interactions between commercial fishing gear (set nets and traps) and oil industry support and service vessel traffic.

As a member of JOFLO, BHP has agreed to abide by these voluntary-compliance vessels traffic corridors within depths of 180 feet or less. Additionally, BHP has established fixed travel routes between the FSRU and Port Hueneme that would be followed by all of the Cabrillo Port's support vessels. By establishing and adhering to established vessel corridors and providing detailed maps of these routes to the commercial fishing industry, fishing vessels should be able to avoid setting gear within areas of high vessel traffic. Similarly, the pipeline route would also be marked and labeled on navigational charts (as required by the U.S. Department of Transportation) to allow longline and trawl vessels to avoid the area if they choose to. Although these measures should reduce the potential for support vessels to become entangled in commercial fishing gear and fishing gear to become entangled in pipelines, over the life of Cabrillo Port, gear loss may occur. JOFLO has in place guidelines and claim procedures for reimbursing fishermen for lost gear if a fisherman can demonstrate that the gear loss was caused by the presence of a facility's underwater infrastructure, such as pipelines. These guidelines have been included as Exhibit COM-1.

Permanent Exclusion from Fishing Grounds due to FSRU Safety Exclusion Zone

United States Coast Guard (USCG) regulations provide for the designation of a circular safety zone around the FSRU that would exclude all commercial fishing vessels and public maritime traffic. This safety zone would radiate outward 2,683 feet (818 meters) from the FSRU's mooring point and 1,640 feet (500 meters) from the stern or outer edge of the FSRU itself. Additionally, BHP has also proposed designating an Area to be Avoided (ATBA) with a radius of 2.3 miles (3.7 km), also centered on the FSRU's mooring point. Each of these zones would be marked on nautical charts and would serve as part of the Notice to Mariners to avoid this area.

The smaller of these areas, the 2,683-foot radius safety zone, would eliminate 0.81 square miles of commercial fishing grounds from California Department of Fish and Game Catch Block 705. Two 15,000-horse power tugboats that would be permanently assigned to the FSRU to aid in normal operations would carry out enforcement of this safety zone through regular patrols. These tugboats would monitor for the presence of other vessels, notify approaching vessels to avoid the area and intercept those vessels that enter the safety zone. Similar enforcement would not be carried out for the larger Area to be Avoided as the designation of this area is considered by the USCG to be a routing measure only. Mariners could choose whether or not to avoid this area and would not be penalized for entering it nor would any direct action be taken to require them to leave the ATBA. Nevertheless, the designation of the ATBA and its demarcation on maritime charts and Notices to Mariners may serve to discourage fishing within an additional 16.61 square miles of California Department of Fish and Game Catch Blocks 704 and 705.

To compensate for any decreases in catch revenues for commercial fisheries due to the exclusion from fishing grounds described above, affected fishermen would work through JOFLO's well-established protocols for negotiating compensation due to lost fishing caused by the presence of oil and gas activities. First, BHP and the affected party would attempt to negotiate a settlement. If these voluntary negotiations are not concluded within three months, a mutually agreed-upon arbitrator, to be paid for by BHP, would resolve the dispute.

Temporary Exclusion from Fishing Grounds during Pipeline Construction and FSRU Mooring Activities

The offshore construction component of the proposed project can be clearly divided into three distinct phases, 1) FSRU mooring construction, 2) offshore pipeline construction and placement, and 3) shore crossing and horizontal directional boring.

BHP anticipates that the FSRU mooring construction phase would occur over a 20 day period on a 24 hour basis. This phase would necessitate the use of two 15,000-horsepower tugs/supply vessels, one 25,000-horsepower tug, one 6,500-horsepower tug, one crewboat, and two construction barges. During construction activities, BHP proposes to station safety vessels 3 to 5 nautical miles from the construction site to warn approaching vessels about the construction. BHP would issue A Notice to Mariners to alert mariners about the presence of the construction site. Commercial fishing vessels would not be actively excluded from the vicinity of the FSRU mooring site during construction but they would be discouraged from approaching construction barges and equipment and may choose to avoid the area due to vessel traffic and construction activities. Accordingly, commercial fishing operations would be temporarily excluded from a portion of the southwest corner of California Department of Fish and Game Catch Block 705.

The offshore pipeline construction and placement phase is estimated to take roughly 35 days, 24 hours a day. Five specialized vessels would be used during this phase to transport materials and workers and to position and install the pipeline segments. Construction of each 22.77 mile pipeline is expected to proceed at a rate of 1.87 nautical miles per day. Various measures would be taken to keep non-construction vessels out of the immediate vicinity of the pipelaying barge and other equipment to reduce the potential for accidents and collisions. Commercial trawlers would especially be targeted as trawl gear could become entangled with the suspended pipeline during construction. In areas of know trawl fishing, BHP proposes to use both safety vessels and guard boats to inform trawlers of the location of construction work and the necessary standoff distances that should be adhered to. During pipeline construction and placement various portions of California Department of Fish and Game Catch Blocks 682, 683, 705, and 706 would be made temporarily off limits to commercial fishing. Due to the rate of pipeline construction (1.87 nautical miles per day) and its progression along the pipeline route, the specific areas in which fishing would be prohibited would fluctuate on a daily basis throughout this phase of construction.

The final offshore construction phase, the shore crossing and horizontal directional boring, would take approximately 60 days and would necessitate the use of up to eight vessels during various stages of construction. Because this phase would be carried out closest to shore in a section of California Department of Fish and Game Catch Block 683 known to support trawl fishing, similar precautions as those outlined above would be taken to ensure that commercial fishing vessels are excluded from the construction site. For approximately 60 days both safety vessels and guard boats would use a variety of tactics including direct vessels interceptions, VHF radio broadcasts, visual and audio warnings and Notices to Mariners to ensure that non-construction vessels remain at a safe distance from the construction site.

To compensate for any potential decreases in catch revenues for commercial fisheries due to the temporary exclusions from fishing grounds described above, affected fishermen can avail themselves of JOFLO's claim procedures described above.

Conclusion

As described above, BHP would implement certain measures the would minimize affects to commercial fishermen. Where unavoidable or permanent impacts occur, such as permanent loss of fishing grounds, affected fishermen can avail themselves of the well-established claim and dispute resolution procedures of JOFLO. The Commission therefore finds that the project would be carried out in a manner protective of commercial fishing and is therefore consistent with CCMP section 30234.5.

4.8 Public Access and Recreation

CCMP § 30210 states:

> *In carrying out the requirement of Section 4 of Article X of the California Constitution, maximum access, which shall be conspicuously posted, and recreational opportunities shall be provided for all the people consistent with public safety needs and the need to protect public rights, rights of private property owners, and natural resource areas from overuse.*

CCMP § 30211 states:

> *Development shall not interfere with the public's right of access to the sea where acquired through use or legislative authorization, including, but not limited to, the use of dry sand and rocky coastal beaches to the first line of terrestrial vegetation.*

CCMP § 30220 states:

> *Coastal areas suited for water-oriented recreational activities that cannot readily be provided at inland water areas shall be protected for such uses.*

CCMP § 30234.5 states:

> *The economic, commercial, and recreational importance of fishing activities shall be recognized and protected.*

Cabrillo Port has the potential to interfere with the public's access to and recreational use of the beach and ocean in the following ways: 1) reduce access to Ormond Beach due to temporary construction of the shore crossing; 2) reduce the recreational experience at Ormond Beach temporarily with the noise effects of pipeline boring activities, 3) create a *de facto* fishing closure of 17 square miles due to the designation of a safety zone and Area to be Avoided around the FSRU; 4) increase tug, crew boat and tanker traffic in the project area, thereby increasing navigational hazards; and 5) reduce the recreational experience on the water by the presence of the FSRU.

Public Access to Ormond Beach and Onshore Recreation

Ormond Beach is approximately two miles long, and public access to it is limited to two access points, one down coast of the proposed pipeline landing at the Ormond Beach Generating Station, at Arnold Drive, and up coast at Perkins Road. The public does not heavily use the section of beach fronting the Ormond Beach Generating Station, likely due to the presence of an industrial power plant and public access points further upcoast and downcoast. This section of coastline is, however, highly valued by surfers.

During construction activities, the public's access to the beach would not be limited. No public parking spaces would be used for construction-related activities and there would be no trenching or other construction on the beach. For the duration of underground pipeline boring, BHP would temporarily deploy (about 108 days) a shielded, 10 millimeter diameter copper cable on the beach, from the power plant to the water's edge and then back to the power plant, to guide the HDB drill head electromagnetically. However, this small and temporary looped cable would not interfere with the public's use of the beach. Once boring activities under the beach are completed, BHP would remove the cable.

Noise generated by the boring activities could interfere with the public's enjoyment of the beach at and near the Ormond Beach Generating Station. Boring activities would take place 50 feet from the closest edge of the beach and are to continue 24 hours a day for an estimated 108 days. In its consistency certification, BHP has committed to implement a number of noise reduction measures identified in the EIS/EIR (and detailed in Appendix C), including use of noise blankets, noise barriers and enclosed engines and equipment whenever possible. Notwithstanding these measures, anticipated noise levels exceed the City of Oxnard's sound ordinance limits of 55 A-weighted decibels (dBA) during the day and 50 dBA at night for Sound Zone II Residential Property, and exceed Oxnard's limit of 70 dBA at anytime for an industrial area. The EIS/EIR estimates that noise levels would be up to 102 dBA at a distance of 50 feet, and up to 76 dBA at 1,000 feet. During the temporary drilling phase, beach users right at or near the Ormond Beach Generating Station may experience noise levels greater than what is typically generated from daily power plant operations.

Surfing should not be affected by the proposed project. Offshore pipeline installation activities would occur far beyond the surf break and would not interfere with near shore and beach activities such as surfing.

Offshore Recreation

Cabrillo Port is to be sited within the Southern California Bight, an area heavily used by boaters, including recreational fisherman. The Southern California Bight represents one of the last examples of natural Mediterranean and California coastal ecosystems in North America, prompting UNESCO to designate the entire Bight an International Biosphere Reserve. The Bight contains the chain of islands collectively referred to as the Channel Islands, which are extensively used for recreation. Of the eight islands, five make up Channel Islands National Park, where the U.S. Congress has declared the surrounding waters a National Marine Sanctuary. In addition, Santa Catalina Island, to the south, provides a wide and popular array of recreational opportunities. The U.S. Navy owns San Nicholas and San Clemente Islands, and recreational opportunities at those islands are limited.

Boaters from all over Southern California use the entire 15,000 square mile Southern California Bight—from Point Conception to San Diego, extending offshore to San Nicholas Island. Recreational activities popular in this area include sport-fishing, whale watching, diving, boating, snorkeling, jet skiing and kayaking.

Project-related construction activities could temporarily affect boaters. Vessel traffic, including recreational boaters, would be restricted during installation of the FSRU and pipelines. To minimize any construction-related effects to mariners, BHP has committed to the following measures (detailed in Appendix C):

- BHP would station a safety vessel approximately 3 to 5 nautical miles from the pipe-laying barge to warn approaching vessels of the pipe-laying activity.
- BHP would give notice to mariners regarding the planned positions of the construction vessels every 30 minutes, and post the construction schedule at local marinas.

Increased Traffic on the Water

Ongoing Cabrillo Port operations would also increase vessel traffic in this area of the Southern California Bight. Recreational boaters make over 430,000 boat trips in the Bight per year.[80] In the course of a year, the Channel Islands alone provide a mooring or harbor slip to a minimum of 75,000 recreational boats, and over 36,000 boats visit the islands of Santa Cruz and Anacapa. Sixteen recreational harbors/marinas are in local proximity to the islands: Santa Barbara, Ventura, Channel Islands, Marina del Rey, Redondo Beach, Los Angeles, Long Beach, Alamitos Bay, Huntington, Newport, Dana Point, Oceanside, Mission Bay, San Diego, and Avalon and Two Harbors (both on Catalina Island). In addition, Port Hueneme is home to several sport-fishing enterprises. A large percentage of Southern California boaters make trips of over 100 miles multiple times per year.[81]

The EIS/EIR estimates there would be 2,098[82] yearly (or 5 daily) recreational fishing vessels entering the project area—the ATBA and Cabrillo Port traffic lanes—from the three harbors closest to the project area—Port Hueneme, Ventura Harbor and Channel Island Harbor. However, there are a total of 17 local harbors serving recreational vessels that use the entire Bight intensively. These 17 harbors represent over 3.3 million recreational fishing trips yearly in the Bight. When all 17 harbors are taken into account, annual recreational fishing trips in or near the project area is within the range of 6,300 to 11,900, or up to 32 per day.[83]

Operation of Cabrillo Port may increase hazards to recreational boaters. On a weekly basis, BHP estimates a maximum of four tanker trips to and from the FSRU and 10 crew/supply boat trips between the FSRU and Port Hueneme. Boaters from the southern end of the Bight traveling to destinations at the northern must cross the traffic lane close to Port Hueneme, as do boaters from the northern end of the Bight traveling to Santa Catalina and points south.

---

[80] "The Southern California Boater's Guide" 2nd ed. Santa Monica Bay Restoration Commission. 2005.

[81] "CA Boating Facilities Needs Assessment," California Department of Boating and Waterways, October 15, 2002..pg. 48 - 49.

[82] Table 4.3-1, "Cabrillo Port Liquefied Natural Gas Deepwater Port Final EIS/EIR," pg. 4.3-7.

[83] BHP's estimate counts vessels from only 3 of 17 local harbors—a 1:5.7 ratio. The lower estimate of the range represents a tripling of BHP's estimate, recognizing that distance is a deterring factor in a vessel's presence in the project area. The higher estimate simply multiplies BHP's estimate by the same factor of 5.7.

Thus the operation of the FSRU would increase traffic congestion and the risk of large vessels colliding with recreational vehicles. Congestion on the water is currently cited as the greatest impediment to safe boating in the Bight,[84] and mariner expertise is generally recognized to be lower among recreational boaters. Recreational vessels are not required to have an Automatic Identification System (AIS) for quick identification by other vessels' radar, and many do not monitor Channel 16 consistently for alerts. Therefore, the increased traffic could present increased hazards to them.

In its consistency certification, BHP has committed to implement certain measures identified in the EIS/EIR's Mitigation Monitoring Plan (and detailed in Appendix C) to minimize interference with recreational boaters. These include:

- BHP would establish routes to and from Port Hueneme so that tugs and crew boats would be consistent and, therefore, predictable in their transits.
- BHP would also allow only one LNG carrier in the approach route to the FSRU to minimize traffic.

Effects on Recreational Fishing

Recreational fishermen make over 3.3 million fishing trips in the Bight annually.[85] Approximately 600,000 of these annual trips take fishermen beyond state waters. While these fishing trips into federal waters comprise only 18% of total fishing trips, almost 50% more fish are caught recreationally in federal waters than in State waters.[86] There are currently approximately 8,000 sq. nm of the Bight where recreational fishermen are restricted.[87] In 2007, NOAA expects to add 139 square nautical miles of fishing-restricted areas in the Channel Islands National Marine Sanctuary. The FSRU would lay directly in the California Counter Current, a warm-water current especially popular with anglers.

No activities can occur within the 0.3 square mile U.S. Coast Guard safety zone that would encircle the port. This area would be off limits to boaters and recreational fishermen. Boaters traversing the area would need to go around the safety zone. Additionally, BHP is proposing to establish a 16.7 square mile Area to be Avoided (ATBA).[88] The safety zone and ATBA,

---

[84] "CA Boating Facilities Needs Assessment," California Department of Boating and Waterways, October 15, 2002. Vol. 11, pg. 1-52.

[85] Statistics queried at http://www.st.nmfs.gov/pls/webpls/MR_EFFORT_TIME_SERIES.RESULTS. NOAA Fisheries requires this citation: "Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division."

[86] Statistics queried at http://www.st.nmfs.gov/pls/webpls/MR_CATCH_SNAPSHOT.RESULTS. "Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division."

[87] Protected areas currently include: State Marine Reserves, State Marine Conservation Areas, State Marine Parks, the Cow Cod Conservation Area, the Rockfish Conservation Area, the Channel Islands National Marine Sanctuary (CINMS) and Channel Islands National Park

[88] The extent of the ATBA is established through the advice and consent of the US Coast Guard's Office of Vessel Traffic Management.

both to be marked on navigational charts, would comprise an area around the FSRU of 17 square miles. Although boaters would not be prohibited from entering the ATBA, designation of an ATBA would discourage mariners from using the area for safety reasons, and therefore create a *de facto* fishing closure. Establishment of the safety zone and ATBA thus would reduce ocean area available to recreational boaters and fishermen. However, the size of the overall *de facto* closure is relatively small with respect to the entire Bight, and so it would not affect recreational fishermen significantly.

Presence of the FSRU

The physical presence of the FSRU and LNG carriers would likely affect boaters who traverse this area of California's coast. It's difficult, however, to assess the extent of the effect of the port's facilities on the experience of recreational boaters. For some, the presence of the massive FSRU and LNG carriers may attract boaters; for others, its industrial presence would be adverse and reduce the recreational experience.

Conclusion

As described above, several aspects of the project have the potential to affect the public's recreational experience along this section of coast. Any adverse recreational effects at Ormond Beach or along the offshore construction corridor would be temporary, however. A permanent effect, the reduction of ocean area for fishing and boaters, is relatively small in size and not significant. The Commission finds that with implementation of the measures described above, the project would be carried out in a manner protective of the public's access to and recreational use of the beach and sea and is therefore consistent with the CCMP's public access and recreation policies.

4.9 Visual Resources

CCMP § 30251 states

> *The scenic and visual qualities of coastal areas shall be considered and protected as a resource of public importance. Permitted development shall be sited and designed to protect views to and along the ocean and scenic coastal areas, to minimize the alteration of natural land forms, to be visually compatible with the character of surrounding areas, and, where feasible, to restore and enhance visual quality in visually degraded areas. New development in highly scenic areas such as those designated in the California Coastline Preservation and Recreation Plan prepared by the Department of Parks and Recreation and by local government shall be subordinate to the character of its setting.*

BHP proposes to site the FSRU and its berth in federal waters approximately 12.01 nautical miles offshore of Malibu's Leo Carrillo State Beach. Although its proposed location is far offshore, on or near the horizon, the FSRU and berthed LNG carriers would be visible from many public viewing points along miles of scenic coastal California. Its placement would add to the coastal viewshed a permanent industrial facility. The highly scenic qualities of this coastal area are among the most valued in the state and constitute a major attraction for visitors to the beaches and surrounding areas. The viewshed is open ocean, and placement of a permanent industrial facility within this viewshed is incompatible with the character of the surrounding area.

The proposed FSRU is a massive industrial structure, floating higher on the water than the Queen Mary II, and 82 feet wider (see Exhibit VIS-1). It would measure approximately 985 feet long, 213 feet wide, and would tower 164 feet above the water. The cold stack, a small-diameter exhaust pipe located near the mooring, would be 269 feet above the water. The hull of the FSRU would be painted gray. The FSRU would be equipped with a revolving tower system allowing it to "weathervane" or rotate around the fixed anchor point subject to prevailing water and wind currents. Because the prevailing water and wind currents in the project vicinity come from a west to west-northwest direction, the orientation of the FSRU would primarily be parallel with the coast, presenting its entire length.

The FSRU would be much larger than the many ships that use the Traffic Separation Scheme (TSS) in this area, and its shape and proportions would be very different than the ships in the TSS. For these reasons, the FSRU would be visible from much greater distances than, for instance, container ships which are nearly as long, but only half as high. Oil tankers and Navy aircraft carriers, while closer in size, do not use the TSS and are not generally visible from this area. In addition, the FSRU would be stationary and never pass from view, as smaller vessels do.

The FSRU and LNG carriers would be visible from a long stretch of the coast—particularly from elevations above beach-level—and from the Channel Islands to the north. Encompassing the surrounding coastline, and rising into the mountains inland, is the Santa Monica Mountains National Recreation Area (NRA), which includes many State and County parks and the scenic corridor associated with Mulholland Drive. The FSRU would be visible from many points in the NRA. Previsualists Inc. and Vallier Design Associates created simulated views from various key observation points (KOPs) (Exhibit VIS - 2). The KOPs indicate the FSRU would be visible as a small object, on or near the horizon, from various points within the NRA, for instance from Triunfo Lookout, Sandstone Peak and Point Mugu. The FSRU would be visible, as well, from Ormond Beach, Leo Carrillo State Beach, Ocean view Drive in Port Hueneme, Highway 1 near Leo Carrillo State Beach (an area eligible for designation as a Scenic Highway), Encinal Canyon Road in Malibu and the Malibu Bluffs. Also, it would be visible from elevated points on Anacapa and Santa Cruz Islands.

Of particular concern is night lighting. Since the FSRU would operate 365 days per year, 24 hours per day, it would need to be lit brightly during periods of darkness and reduced visibility. BHP has committed to implement measures to minimize the effects of lighting at night (detailed in Appendix C). These include:

- Limit lighting used during construction and operation activities to the number of lights and wattage necessary to perform such activities.
- Extinguish all lights used for that activity, once an activity has been completed.
- Shield lights so that the beam falls only on the workspace and so that no light beams are directly visible more than 3,281 feet (0.62 miles) distant.
- Limit lights shining into the water to the area immediately around the vessels, except that searchlights may be used when essential for safe navigation, personnel safety, or for other safety reasons.

Notwithstanding the above measures, the FSRU and LNG carriers require significant lighting in order to carry out LNG transfer operations safely. How bright the FSRU and LNG carriers would appear at night from coastal public viewing points is not known for certain.

Conclusion

For the reasons described above, the Commission believes that the proposed siting of Cabrillo Port would add to the coastal public viewshed a permanent industrial facility that is not visually compatible with the surrounding area. The Commission therefore finds the project is not consistent with the CCMP's scenic and visual protection policy, CCMP section 30251. Because Cabrillo Port would be a "coastal-dependent industrial facility," it is presumptively subject to analysis under CCMP section 30260. See Section 5.11 (Coastal Dependent Industrial "Override" Policy) of this report.

4.10 Cultural Resources

CCMP § 30244 states:

> *Where development would adversely impact archaeological or paleontological resources as identified by the State Historic Preservation Officer, reasonable mitigation measures shall be required.*

Cultural resources may include prehistoric and historic archaeological sites; artifacts of aboriginal, Spanish, Mexican or American origin; or any other physical evidence associated with human activity considered important to a culture, subculture, or community for scientific, traditional, religious or other reasons. Installation of the FSRU, pipelines and other onshore infrastructure could cross an object of cultural significance.

Offshore – FSRU Anchoring Array and Pipeline

The installation of the subsea pipelines and FSRU would affect an area of approximately 553 acres—22.77 miles long by 61 meters wide. If an object of cultural significance is present in the construction corridor, it could be damaged or destroyed.

In 2003 and 2004, Fugro Pelagos, Inc., on behalf of BHP, conducted an offshore geophysical survey to identify geologic and anthropogenic hazards and constraints within the construction footprint. The survey did not include subsurface exploration. Using remote sensing over a 300-meter swath centered on the pipeline route, the survey revealed 202 targets, 46 of which a marine archaeologist identified as potential cultural resources. Fourteen of the objects identified as potential cultural resources occur within 100 meters of the pipeline and the FSRU anchoring array. In 2005, BHP retained a cultural resource specialist to conduct a records search to determine if the proposed offshore and onshore construction corridors would cross known archaeological or historic resources. This records search included the California State Lands Commission's Shipwreck Database, the California Register of Historical Resources, the California Historical Landmarks, and the National Register of Historic Places. This record and database search did not identify any known offshore cultural resources within or near the offshore construction corridor. Nevertheless, BHP is assuming that all 14 objects are significant cultural resources that must be avoided fully. BHP has submitted an Avoidance Plan that states it can and will avoid all 14 targets.

Onshore – HDB Activities at Ormond Beach

Since BHP proposes to use HDB to install the pipelines under the beach and surfzone, no earth-moving activities would occur on the beach.

The proposed pipeline route, from the Ormond Beach Generating Station (power plant) site landward, begins on the power plant site. From pipeline mile post 0.0 to approximately mile post 0.3, the proposed pipeline route is within the coastal zone. BHP proposes to excavate pipeline trenches and bore entry pits on the power plant site totaling approximately 0.4 acres, up to 20 feet deep.

A search of the Sacred Lands database and other files under the jurisdiction of the Native American Heritage Commission did not reveal any known cultural resources in this area, however, BHP interviewed Ventura Chumash descendants to determine if unknown significant resources are likely to exist in the area of the HDB activities. Ventura Chumash descendents expressed concern about areas adjacent to active creeks, stream and washes, as well as agricultural and dune areas. The record and database search above did not identify any known onshore cultural resources within or near the onshore construction corridor within the coastal zone. However, in its consistency certification, BHP has committed to implement certain mitigation measures identified in the EIS/EIR that would minimize effects to cultural resources (detailed in Appendix C). These include:

- BHP would provide an archaeological monitor for all HDB and trenching activities in the coastal zone, and further, to use a qualified Native American archaeological monitor for these activities, provided sufficient Native American archaeological monitors are available.
- If the site cannot be avoided through redesign, BHP would implement a data recovery program to mitigate impacts.
- BHP would include Native American monitoring in activities that result in disturbance of surface and subsurface archaeological sites.
- BHP would provide recovered artifacts to a qualified museum or historical facility that allows access to Native Americans.
- If human remains are found, BHP would implement Health and Safety Code section 7050.5 and Public Resources Code section 5097.98.

In addition, BHP has submitted an Unanticipated Discoveries Plan. This plan would ensure that contractors clearly understand the laws and regulations regarding unanticipated cultural discoveries during construction, and details immediate actions to take place should a discovery be made. The plan covers: authority to halt construction, procedures when skeletal remains are found, protection of remains while awaiting recommendations from most likely descendants, reporting of the find, treatment as recommended by most likely descendants and curating of archaeological material not associated with human remains.

Conclusion

As described above, several aspects of the project have the potential to affect cultural resources. Because construction activities would not take place on Ormond Beach, and with the measures BHP has committed to above, the Commission finds the project consistent with the cultural resources provisions of CCMP section 30244.

4.11 Coastal-dependent Industrial "Override" Policy

Section 30260 Coastal-Dependent Industrial "Override" Provision

CCMP section 30101 defines a coastal-dependent development or use as that which "requires a site on or adjacent to the sea to be able to function at all." Section 30001.2 of the CCMP lists ports, commercial fishing facilities, offshore oil and gas developments and liquefied natural gas facilities as "coastal-dependent developments" under CCMP section 30101.

In section 30260, the CCMP further provides for special approval consideration of coastal-dependent industrial facilities that are otherwise found inconsistent with one or more resource protection and use policies contained in Chapter 3 of the Coastal Act. Cabrillo Port qualifies as a coastal-dependent industrial facility. Coastal-dependent industrial facilities must first be tested under all applicable CCMP policies in Chapter 3. If the proposed coastal-dependent industrial project does not meet one or more CCMP policies in Chapter 3, the development can nevertheless be approved if it satisfies the requirements of CCMP section 30260 , which specifically states:

> *Coastal-dependent industrial facilities shall be encouraged to locate or expand within existing sites and shall be permitted reasonable long-term growth where consistent with this division. However, where new or expanded coastal-dependent industrial facilities cannot feasibly be accommodated consistent with other policies of this division, they may nonetheless be permitted in accordance with this section and section 30261 and 30262 if (1) alternative locations are infeasible or more environmentally damaging; (2) to do otherwise would adversely affect the public welfare; and (3) adverse environmental effects are mitigated to the maximum extent feasible.*

As described in Section 5.2 (Air Quality), Section 5.4 (Oil and Hazardous Substance Spills), Section 5.6 (Geology), and Section 5.9 (Visual Resources) of this report, BHP's proposed project does not meet the standards of CCMP sections 30232, 30251 and 30253. Since the project qualifies as a coastal-dependent industrial facility, the Commission must proceed to apply the three requirements of CCMP section 30260 to determine the extent of the project's conformity to them.

Requirement 1 – Alternative Locations

The Coastal Commission may approve the proposed development notwithstanding the project's inconsistency with one or more Chapter 3 policies if it finds that alternative project locations are "infeasible or more environmentally damaging."

In the past, locations from Point Conception south to north of the San Diego Harbor have been considered as potential locations for both offshore and onshore LNG facilities. In the early 1970s, several public utilities proposed LNG import facilities at the Port of Los Angeles, Oxnard, and Point Conception. Under the LNG Terminal Siting Act of 1977, repealed in 1988, the California Public Utilities Commission (CPUC), with input from the Coastal Commission and California Energy Commission (CEC), was given exclusive state permit authority to approve a single site for an LNG terminal. In part, the LNG Siting Act of 1977 required the Coastal Commission to identify, evaluate, and rank both onshore and offshore locations for an LNG terminal site. The Commission was to evaluate the relative merit of each site applying the policies and objectives of the CCMP.

As required, the Commission completed its two studies, *Final Report Evaluating and Ranking LNG Terminal Sites, May 24, 1978 and Offshore LNG Study, Sept. 15, 1978*, and submitted them to the Legislature. These studies evaluated 82 onshore and offshore potential LNG terminal locations along the entire coast of California. These two siting studies represent, to date, the only comprehensive review of alternative potential LNG terminal locations in California.

Factoring in potential environmental impacts, safety risks and population densities, the Commission's 1978 LNG siting studies concluded that an offshore site is preferable to an onshore site. The offshore study eliminated sites offshore Los Angeles, San Diego, and northern California due to population densities, seismic concerns, adverse weather and current conditions, naval operations, and sensitive marine and coastal resources. It then focused its evaluation on 16 sites between Point Conception and the Mexican border. The Commission selected seven sites as potential offshore terminal locations. These included: Ventura Flats, offshore of Deer Canyon, offshore of Camp Pendleton, offshore of Chinese Harbor, offshore of Smuggler's Cove, offshore of San Pedro Point, and Bechers Bay (See Exhibit OVR-1). Of these seven sites, the Commission selected the Ventura Flats area in the Santa Barbara Channel as the optimal location.

Although many technologies have improved (specifically, pipelines can be laid at greater water depths) and environmental factors have changed since 1978, the EIS/EIR for the Cabrillo Port project concludes that the LNG siting criteria used in the Commission's 1978 LNG siting studies is nevertheless informative in evaluating potential alternative site locations for Cabrillo Port. The EIS/EIR uses the results of the 1978 LNG siting studies as its starting point for evaluating potential alternative locations for the proposed project.

The EIS/EIR identified five onshore and 10 offshore location alternatives for the proposed FSRU and mooring, three offshore pipeline route alternatives, and four onshore crossing alternatives. The locations of these alternative sites are shown in Exhibit OVR-1.

On December 12, 2006, Michael Peevey, president of the CPUC, sent to the Coastal Commission a letter and memorandum setting forth the CPUC's position on the need for LNG in California. Although the CPUC recognizes the need for LNG terminals to provide additional natural gas supplies to California, it believes they must be sited in remote locations away from densely populated areas, at least 10 miles offshore (see Exhibit OVR-2). The Commission agrees, given the safety risks and consequences described in Section 5.3 (Siting Hazardous Development) of this report, that any LNG facility sited in California should be sited far offshore. The Commission therefore will focus its analysis of alternative project locations to offshore sites only.

Out of the 10 alternative offshore LNG sites considered, the EIS/EIR concludes that only one offshore site meets the criteria of a reasonable and feasible alternative location to Cabrillo Port. The alternative location is referred to in the EIS/EIR as the "Santa Barbara Channel/Mandalay Shore Crossing/Gonzales Road Pipeline Alternative," and is essentially identical to the Ventura Flats location that the Commission previously selected as the optimal offshore location in its 1978 offshore LNG studies. The analysis in the EIS/EIR concludes, for a variety of environmental and other reasons (e.g., recreational impacts, visual, sensitive marine areas, proximity to marine sanctuaries, conflicts with military uses), that the remaining nine potential alternative locations for the FSRU and mooring are more environmentally damaging as compared to the location proposed for the Cabrillo Port project.

It further concludes that the proposed Cabrillo Port site is less environmentally damaging as compared to the location of the "Santa Barbara Channel/Mandalay Shore Crossing/Gonzales Road Pipeline Alternative." The Santa Barbara Channel alternative is about 8.5 miles offshore of Rincon Beach between two existing oil and gas platforms, Platforms Grace and Habitat. In part the EIS/EIR states that the proposed location of the FSRU is superior to the Santa Barbara Channel alternative location because it would have fewer 1) visual impacts, 2) conflicts with recreational fishers, boaters, marine mammals, and 3) effects on commercial fishing and marine traffic. For these reasons, the Commission agrees the site of the proposed Cabrillo Port project is environmentally superior relative to the alternative locations analyzed in the EIS/EIR.

The EIS/EIR also identifies four alternative pipeline routes between the FSRU and the shore crossing at the Ormond Beach Generating Station. All were eliminated from serious consideration essentially due to significantly greater geologic hazards as compared to the proposed route (e.g., greater chance of slope failure, landslides, exposure to storm surges).

Additionally, the EIS/EIR considers two alternative onshore crossings as potential reasonable and feasible alternatives to the proposed crossing at Ormond Beach: "The Arnold Road Shore Crossing/Arnold Road Pipeline Alternative" and "The Point Mugu/Casper Road Pipeline Alternative." (See Exhibit OVR-1). The EIS/EIR concludes, however, that the proposed crossing at Ormond Beach is environmentally preferable to the other two alternatives in part because the HDB activities and the construction of the metering station would be on disturbed land within an existing industrial power plant site. Both the Arnold Road and Point Mugu Alternatives would be constructed on undeveloped, moderately developed, and agricultural lands. As a result, both these alternative shore crossings would have greater impacts to sensitive terrestrial biota than at the proposed location. Also, as compared to the proposed project, the alternative crossings could result in permanent conversion of agricultural land to non-agricultural uses and greater construction-related public access impacts. The Commission agrees that after weighing all environmental factors, the proposed shore crossing is environmentally preferable to the two alternative sites identified in the EIS/EIR.

For the reasons discussed above, the Commission finds that alternative project locations are more environmentally damaging as compared to the proposed project location.

Requirement 2 – Maximum Feasible Mitigation

The second test of 30260 requires a finding that the adverse environmental impacts of a proposed project have been mitigated to the maximum extent feasible. The discussions below describe mitigation measures included as part of the proposed project meant to address impacts in the areas of policy inconsistency identified above.

Oil and Hazardous Substance Spills: As discussed in Section 5.5 (Oil and Hazardous Substance Spills) of this report, even with using current state-of-the-art on-water oil spill response and clean-up equipment, the trajectory analyses showed that a worst case vessel diesel spill would still have the potential to adversely impact the shoreline resources of California. Therefore, the Commission has determined that the project is inconsistent with CCMP section 30232 due to the inability to keep oil from adversely affecting the shoreline in the event of an accidental offshore spill.

Notwithstanding this inconsistency, BHP has incorporated into the Cabrillo Port project the highest feasible level of oil spill containment and recovery equipment and emergency spill response planning to comply with California, federal, and international oil spill prevention and response laws and regulations. Accordingly, the Commission concludes that BHP has mitigated potential oil spill impacts to the maximum extent feasible.

Visual Resources: As discussed in Section 5.9 (Visual Resources) of this report, the proposed siting of Cabrillo Port would add a permanent industrial facility to the coastal public view shed that is not visually compatible with the surrounding area, and would add nighttime lighting of the FSRU of an unpredictable brightness and appearance. Therefore, the Commission has determined that the project is inconsistent with CCMP section 30251 due to adverse visual effects.

Notwithstanding this inconsistency, BHP has committed to mitigate these effects to the maximum extent feasible by painting the FSRU gray to blend into the viewshed, and by minimizing the use of nighttime lighting to only that which is needed for safety and operations. BHP has further committed to shield and focus lighting to have the least possible affect. These measures mitigate the Cabrillo Port project's adverse visual effects to the maximum extent feasible.

Geology: As discussed in Section 5.6 (Geology) of this report, even with the planned mitigation measures discussed in the EIS/EIR, the project cannot assure stability and structural integrity with regard to fault rupture hazard, lateral spread during earthquake-induced liquefaction, or submarine landslide. Therefore, the Commission has determined that the project is inconsistent with CCMP section 30253.

Nonetheless, as discussed in Section 5.6, BHP has incorporated into the Cabrillo Port project avoidance of known fault traces, the performance of additional geotechnical studies to accurately define fault locations, measures to assure pipeline flexibility, and installation of mainline valves equipped with either remote valve controls or automatic line break controls to isolate pipeline segments in the event of rupture. These measures mitigate the adverse geological effects of the Cabrillo Port project to the maximum extent feasible.

Air Quality: As discussed in Section 5.2 (Air Quality) of this report, the Cabrillo Port project does not comply with the emission offset and best available control technology (BACT) requirements of the Clean Air Act (i.e., as set forth in VCAPCD Rule 26.2), and thus with the requirement of CCMP section 30253(3) that new development "be consistent with requirements imposed by an APCD." BHP proposes a "voluntary" air mitigation package – to retrofit the engines of two long-haul tugs – to mitigate for all Cabrillo Port project-related air impacts. BHP's proposed package fails to satisfy its obligations under Rule 26.2 because Rule 26 does not allow for the creation and "banking" of mobile offshore emission reductions to offset stationary air quality such as the one from the Cabrillo Port project. Even if VCAPCD allowed for offsetting of FSRU stationary emissions using mobile offshore emission reductions, the Commission still finds BHP's proposed mitigation inadequate. This is, in part, because many of the benefits of mobile source offsets would accrue to other areas of California where the long-haul tug boats travel and not in the Ventura District, which would absorb much of impacts of the BHP stationary source. As described in Section 5.2, BHP has submitted documentation to the Commission outlining BHP's unsuccessful efforts to acquire offsets and identify new onshore emission reduction projects to meet the Rule 26.2 requirements. While BHP has demonstrated the difficulty of meeting Rule 26.2's offset requirements, the Commission is not convinced that BHP's efforts have been exhaustive and therefore cannot conclude at this time that satisfying the offset requirement is infeasible. Also, as discussed fully in Section 5.2, BHP has not demonstrated the infeasibility of employing BACT as required by Rule 26.2. Accordingly, the Commission finds the project does *not* satisfy the "mitigated to the maximum extent feasible" test of CCMP section 30260.

<u>Greenhouse Gas Emissions</u>: Cabrillo Port, and its supply chain, would result in considerable emissions of greenhouse gases. As detailed in Heede (2006), these supply chain emissions take the form of both methane and carbon dioxide, and are released at the Scarborough gas production site, the gas pipeline to the Pilbara liquefaction facility, the liquefaction facility itself, the tanker fleet carrying LNG to California, the Cabrillo Port operations and, of course, the end use of the natural gas itself. These emissions total 22,823,000 metric tonnes of CO_2 equivalent annually, according to the report. Of this, some 346,400 metric tonnes is attributable to the annualized construction emissions and regular operation of Cabrillo Port. These emissions are greatly exceeded by emissions from the LNG carrier fleet, which could be as high as 2,400,000 metric tonnes annually (Heede, 2006).

The recently released Fourth Assessment Report of Working Group I of the Intergovernmental Panel on Climate Change (IPCC) represents the consensus of some 50 top international scientists working in fields related to climate change. The report concludes that the evidence of global climate system warming is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global mean sea level (IPCC, 2007). Further, the report concludes that "most of the observed increase in globally averaged temperatures since the mid-20th century is very likely [>90% probability] due to the observed increase in anthropogenic greenhouse gas concentrations. The report cites numerous long-term changes in climate, including changes in Arctic air temperatures, the amount of Arctic sea ice, widespread changes in precipitation amounts, ocean salinity, wind patterns and patterns of extreme weather including droughts, heavy precipitation, heat waves and tropical storms. Based on six emissions scenarios ranging from "business as usual" to aggressive shifts to cleaner technologies, the best estimates of global average temperature increase are between 1.8 and 4.0 degrees Celsius by 2099, and that sea level will rise between 0.18 and 0.59 m. This amount of sea level rise does not include contributions from rapid melting of either the Greenland or Antarctic ice caps, as has been suggested by recent studies (Bindschadler, 2006; Ekström et al., 2006; Joughin, 2006; Kerr, 2006).

In addition, absorption of carbon dioxide by the ocean leads to a reduction in ocean pH with concomitant consumption of dissolved carbonate ions, which adversely impacts calcite-secreting marine organisms, marine water quality and the abundance and distribution of marine species (The Royal Society, 2005).

CCMP Protections and Resource Impacts: The CCMP specifically protects many of the resources that would be directly affected by global climate change resulting from increases in greenhouse gases such as those from this project. CCMP sections specific to these resources include section 30230 (protection of marine resources), section 30231 (protection of biological productivity and quality of coastal waters), section 30240 (protection of environmentally sensitive habitat areas, including but not limited to wetland areas) and section 30253 (minimization of risk to life and property and prohibition of shoreline protective devices that alter natural landforms). CCMP provisions require protections not provided herein. Under CCMP section 30260, the project, as currently proposed and taken as a whole, does not mitigate the adverse environmental effects associated with the project's greenhouse gas emissions to the maximum extent feasible.

Impacts to the California Coastal Zone: In July 2006, the California Climate Change Center released a series of reports describing ongoing and future effects of global warming on the California environment (Baldocchi and Wong, 2006; Battles et al., 2006; Cavagnaro et al., 2006; Cayan et al., 2006a; Cayan et al., 2006b; Cayan et al., 2006c; Drechsler et al., 2006; Franco and Sanstad, 2006; Fried et al., 2006; Gutierrez et al., 2006; Joyce et al., 2006; Lenihan et al., 2006; Luers et al., 2006; Luers and Moser, 2006; Medellin et al., 2006; Miller and Schlegel, 2006; Moritz and Stephens, 2006; Vicuña, 2006; Vicuña et al., 2006; Westerling and Bryant, 2006). Drawing on three projected warming scenarios (low, medium, and high), the reports projected severe impacts by the end of the century in the areas of public health, water resources, agriculture, forests and landscapes, and sea level. Many of these effects will impact the coastal zone, including impacts to air quality, species distribution and diversity, agriculture, expansion of invasive species, increase in plant pathogens, wildfires, rising sea level, coastal flooding, and coastal erosion and will affect resources specifically protected by the Coastal Act. In addition, absorption of carbon dioxide by the ocean leads to a reduction in ocean pH with concomitant consumption of dissolved carbonate ions, which adversely impacts calcite-secreting marine organisms.

As identified in the 2006 Climate Change Center reports, the median emission scenario will lead to 75-85% more days in the Los Angeles area conducive to smog generation. Air quality will also be compromised by soot from wildfires, which the report predicts will increase. Coastal agriculture, already threatened by land development and habitat fragmentation, will be subject to further impacts from climate change. Impacts to coastal agricultural will include impacts to wine grapes, which will be subject to premature ripening and decreased fruit quality; impacts to fruit and nut trees, many of which require a certain number of "chill hours" per day for proper ripening; and impacts to milk production. Other threats to coastal agriculture identified by the Climate Change Center reports include the expansion of the ranges of agricultural weeds and an increase in plant pests and pathogens. Coastal forests and scrublands will be increasingly susceptible to wildfires due to longer and warmer periods of summer drying. This, together with the warmer climate itself, will lead to shifts in vegetation type, probably resulting in the loss of coastal scrub as it is converted to grasslands. Inasmuch as suitable habitat exists, species requiring cooler climates can migrate northward or to higher elevations. Their ability to do this, however, will be limited by the speed with which they are able to disperse, the suitability and interconnectivity of available habitat, and their ability to compete with non-native invasive species which, by definition, are able to disperse and exploit habitat efficiently. All of these effects will lead to a decline in forest productivity, with a concomitant loss in habitat.

The most direct impacts of global warming focused on the coastal zone are sea level rise and its associated impacts, ocean warming, and ocean acidification.

Sea Level Rise: According to tide gage data, global mean sea level has been rising at the rate of approximately 1.8 mm/yr for the past century (IPCC, 2001). Although no acceleration of this rate is apparent from the tide gage data (IPCC, 2001), satellite measurements starting in the early 1990s indicate an annual rate of approximately 2.8 mm/yr (Church and White, 2006). Sea level is clearly rising, and the rate of increase may in fact be accelerating. Since land can also change elevation due to either uplift or subsidence, global sea level change affects various coastal areas differently. Much of the California coast is rising; however the rate of uplift is, everywhere except northernmost California, lower than the rate of sea level rise. The *relative* historic rate of sea level rise (relative sea level rise is global sea level minus local land uplift or plus local land subsidence) has been calculated by Commission staff to range from a high of 2.16 ± 0.11 mm/yr in San Diego to a low of 0.92 ± 0.17 mm/yr in Los Angeles. Relative sea level is actually falling at Crescent City due to the high rates of tectonic uplift at that locality. (California Coastal Commission, 2001).

Even the 0.18 to 0.59 meter rise in sea level by 2100 predicted by the IPCC will have a large impact on the California coast. The effects of a much larger increase in sea level due to large contributions from the Greenland and/or Antarctic ice sheet would be truly catastrophic. The 2001 Coastal Commission report concluded:

> *The most obvious consequence of a large rise in sea level will be changes in areas that are submerged. Lands that now are only wet at high tide could be wet most of the day. Structures that are built above the water, like docks and*

> *piers, will be closer to the water, or eventually submerged. A second consequence will be an increase in wave energy. Wave energy is a factor of wave height. Waves heights along the California coast are influenced greatly by bottom depths and for most locations along the coast, the heights of nearshore waves are "depth limited". When the water depth increases, the wave height can be higher. Thus, higher waves impact the coast during high tide than during low tide. Wave energy increases with the square of the wave height. Thus, a 2-foot (0.6-meter) wave would have 4 times the energy of a 1-foot (0.3-meter) wave. Small changes in water level can cause significant changes in wave energy and the potential for shoreline damage from wave forces. A 1-foot to 3-foot (0.3 to 0.9 meter) rise in sea level, such as projected to occur over the next 100 years, would cause enormous changes in nearshore wave energy. The consequences of a 1-foot to 3-foot (0.3 to 0.9 meter) rise in sea level are far reaching. Along the California coast, the best analogy for sea level rise is thought to be El Niño, where a significant rise in sea level will be like El Niño on steroids. One of the factors that contributed to the amount of damage caused by the 1982/83 El Niño was that several storms coincided with high tide events and the elevated water levels (from tides and low pressure system combined) brought waves further inland than would have occurred otherwise…*
>
> *Beaches and Coastal Bluffs: Open coastal landforms like beaches and bluffs will be exposed to greater and more frequent wave attack. There will more potential for erosion and shoreline retreat. For gently sloping beaches, the general rule of thumb is that 50 to 100 feet of beach width will be lost from use for every foot of sea level rise… Some global circulation models predict significant increases in run-off from coastal watersheds in California (Wolock and McCabe, 1999) …*

In general, erosion of the landward edge of a beach, dune, or coastal bluff creates additional beach area, and so even in a period of sea level rise such as the present, in which the seaward extent of the beach is reduced by flooding and erosion, new beach creation can result in a relatively constant beach width. However, when threats to existing development from erosion lead to the construction of shoreline protective devices that halt the landward migration of the back beach, continued flooding of the seaward beach results in a reduction in beach width. Thus, on beaches experiencing erosion due to rising sea level, the protection of threatened structures will result in the loss of beaches wherever property owners choose to harden the coast to prevent coastal erosion. This loss of beach has immense negative impacts, including loss of recreational value, tourism, marine mammal haul-out area, sandy beach habitat, and buffering capacity against future bluff erosion.

The 2001 Coastal Commission report goes on to indicate other potential impacts of sea level rise on the California coast:

> *Wetlands: Coastal wetlands will be greatly modified by changes in sea level; however, the consequences will vary with the different wetland areas. Overall there will be greater areas of inundation. The change in the intertidal area will depend on local topography, the future change in tidal range, and the ability of the wetland to migrate both up and inland. Historically many wetlands have accommodated the rise in sea level by increasing the base elevation. Sediment collects in the roots and vegetative mass of the wetland and provides a substrate for new growth. If the rate of sediment entrapment equals the rate of sea level rise, the wetland will remain fairly constant. If the rate of sedimentation exceeds the rate of sea level rise, the wetland will convert to a wet meadow or other system with more supratidal vegetation. If the sediment rate is less than the rise in sea level, the wetland will become intertidal and subtidal habitat.*
>
> *Wetland changes also will be affected by inland development. Historically, wetland areas migrated both upward and landward as they were inundated. If the inland area has a slope and soil composition that can support a wetland and is not already developed, then inland migration may be possible. If there is a steep bluff or some type of fixed development, such as a highway or bulkhead, inland of a wetland, inland migration will not be possible and the wetland area will diminish over time.*
>
> *Another physical change to wetland in response to a rise in sea level is an increase in the tidal currents, with the potential for increased scour. Also, for estuarine systems there will be a shift in the location of the salt water-freshwater interface, and an inland movement of the zone of brackish water…*
>
> *Ports, Harbors and Marine Facilities: Much of the infrastructure of a port or harbor will be affected by a change in sea level. So too will marine terminals and offshore structures. All of the horizontal elements, such as the decking of wharves and piers, will be exposed more frequently to uplift forces larger than those occurring now. Compared to current conditions, ships will ride higher at the dock and cargo-handling facilities will have less access to all parts of the ship. Loading and unloading may have to be scheduled for low tide periods to allow greatest access into the ship, or else mooring and cargo handling facilities will need to be elevated.*
>
> *If breakwaters or jetties protect the harbor, these structures will become less efficient as water levels increase. The breakwaters and jetties will need to be enlarged and heightened to keep up with the rise in sea level, or the harbor will have to accept a higher level of overtopping and storm surge, and a higher probability of storm damage. The increase in water level could also increase*

> *the tidal prism of the harbor, resulting in increased scour at the foundations of any structures in the harbor. So, it may also be necessary to reinforce the base of the breakwater or jetty to insure stability. Benefits that could occur from a rise in sea level would be the opportunity for harbors to accommodate deeper draught ships and a decrease in dredging to maintain necessary channel depths.*
>
> *Seawalls and other engineered shoreline protection: [Seawall] foundations would be exposed to greater scour and the main structure would be exposed to greater and more frequent wave forces. As with breakwaters and jetties, these structures will need to be reinforced to withstand these greater forces, or a lower level of protection will have to be accepted for the backshore property.*

Ocean Warming: In December 2006 the Commission held the first in a series of workshops on global warming. One of the well-recognized connections between the atmosphere and the ocean is heat exchange. Global warming of the atmosphere is expected to cause an increase in ocean warming as the ocean absorbs greater amounts of thermal energy from the atmosphere. At the workshop, Dr. James Berry (Associate Scientist, Monterey Bay Aquarium Research Institute) presented a summary of observed and predicted effects of ocean warming on California coastal ecosystems. Dr. Barry inventoried intertidal animals along the Monterey coast, and compared his results to a 1932 baseline inventory. He found that species that increased in abundance in southern California had increased markedly since the baseline study. Over the same time, there was a dramatic decline in species more associated with northern California. This demonstrates that the observed warming of the ocean over the past 60 years has resulted in a shift in the geographic ranges of species. With continued warming, species can be expected to continue to migrate northward as long as suitable habitat is available.

Some instances of remarkable biodiversity are due to the fortuitous combination of suitable ocean temperature and suitable geomorphic conditions. For example, one of the most diverse shallow water habitats in California is found in the rocky-bottom waters around the northern Channel Islands. This is a zone of mixing of species characteristic of a “southern California realm” and a “northern California realm.” The abundant rocky bottom habitat in the shallow waters ringing the islands provides a niche in which this diversity is expressed. If, because of global warming, the suitable temperature zone migrates northward, it will be moved off of the abundant rocky bottom habitat and the diversity and ocean productivity might decrease significantly.

Declines in ocean productivity due to habitat shifts are an indirect consequence of ocean warming. Ocean warming can cause a direct loss of primary productivity as well. Warming of the surface of the ocean results in increased ocean stratification, limiting the upwelling of deep, nutrient-rich waters that are responsible for California’s rich coastal productivity. Roemmich and McGowan (1995) report a 1.2 to 1.4 degree centigrade increase in ocean temperature between 1950 and 1994. This was accompanied by a 75% reduction in zooplankton biomass. Reductions in phytoplankton and zooplankton biomass have profound cascading effects throughout the food chain. Short term warming events, such as El Niño events, have resulted in abrupt decline in commercial fish species, marine mammals, and birds (Laws, 1997; Nezlin et al., 2005). Similar effects might accompany global warming on a longer time scale, vastly affecting California's coastal resources.

Ocean warming could also create a disconnect between historic feeding and breeding grounds for many species. Welch and others (1998) reported on potential changes in sockeye salmon distribution due to future global warming. Sockeye salmon, which spend 2-3 years in waters of the northern Pacific, migrate northwards to areas of high productivity, such as the Bering Sea, in the summer. Productivity decreases with temperature increase, however, and as the Bering Sea warms, migration routes would have to be longer. Eventually, the metabolic cost of migrating further northwards to feeding grounds could make the migration infeasible. When summer feeding grounds are disconnected from winter breeding grounds, a population crash may be anticipated. A population crash in such species would not only impact commercial fishing in California, but would ripple up through the food chain, impacting protected coastal resources such as marine mammals and birds. At the December 2006 workshop, Dr. Barry concluded that although ocean warming will be a direct consequence of global warming, and ocean warming will cause ocean communities to change, perhaps drastically, the nature of future ocean ecosystems remains unclear.

Ocean Acidification: Just as there is an exchange of thermal energy between the atmosphere and the oceans, there is an ongoing exchange of gases between the atmosphere and the ocean. Each year some 92 billion metric tonnes of CO_2 annually are directly absorbed by the ocean from the atmosphere. At the same time, approximately 90 billion metric tonnes are released back to the atmosphere (Schlesinger, 1997). The net increase in dissolved CO_2 in the ocean is a direct result of increases in the atmosphere related to changes humans are making to the carbon cycle—most notably fossil fuel burning and land use changes (deforestation, mostly in the tropics). The ocean is an enormous reservoir that can absorb a vast amount of CO_2, although the rate of ocean mixing is too slow to prevent the current buildup in the atmosphere. Without this net absorption of CO_2 by the oceans, the atmospheric buildup—and global warming—would be far greater than it is now.

Over the past 200 years, the oceans have taken up approximately half of the industrial age CO_2 emissions, substantially reducing the net atmospheric concentrations of CO_2. This effect does not come without a cost, however. When CO_2 is absorbed by the ocean, some of it combines with water to form carbonic acid (H_2CO_3). This results in only a modest decrease in ocean pH, however, because most of the carbonic acid recombines to form bicarbonate ions (HCO_3^-). However, in the process, carbonate ions (CO_3^{-2}) are consumed. The net result is that absorption of CO_2 by the ocean consumes carbonate ions and reduces the pH of the ocean. The decrease in pH is minor because of the "buffering capacity" of these carbonate reactions, but appears to have decreased mean average surface water pH by 0.1 pH units over the past 200 years (Caldeira and Wickett, 2003). Because the pH scale is logarithmic, this decrease in ocean pH (commonly called "ocean acidification," but more properly referred to as a decrease in alkalinity) means that hydrogen ion activity (which defines acidity) has increased by some 30% in this time frame (The Royal Society, 2005).

The effects of decreasing ocean alkalinity and carbonate ion concentration are twofold. First, many species are directly affected by the reduction in pH. In his presentation before the Commission in December 2006, Dr. Barry identified several physiologic stresses to which some species are susceptible. These stresses include respiratory stress (reduced pH limits oxygen binding and transport by respiratory proteins, such as hemoglobin, leading to reduced aerobic capacity), acidosis (disruption of acid/base balance which impairs function and requires energy to restore or maintain optimal pH balance), and metabolic depression (reduced pH associated with increased environmental CO_2 can cause some animals to enter a state of torpor or semi-hibernation). In addition to these physiologic effects, calcite-secreting organisms (including many phytoplankton, zooplankton, clams, snails, sea stars, sea urchins, crabs, shrimp, and many others) have more difficulty secreting their shells or tests under reduced carbonate ion concentrations. Deep-sea species will be particularly affected because increasing CO_2 levels in seawater decreases the saturation state of seawater with respect to calcium carbonate ($CaCO_3$) and raises the saturation horizon closer to the surface. The $CaCO_3$ saturation horizon is a depth in the ocean above which $CaCO_3$ can form, but below which $CaCO_3$ dissolves. Increasing surface CO_2 levels could have serious consequences for organisms that make external $CaCO_3$ shells and plates (The Royal Society, 2005).

The consequences of reduced calcification are not fully known, but are likely to include changes to plankton communities, higher metabolic costs for water-breathing species, resulting in lower growth, survival and reproduction, and higher metabolic costs for calcite secreting organisms. The effect on food webs is unclear, but it is very likely that these effects will result in a loss of biodiversity and complexity in California's coastal marine ecosystems.

<u>Mitigation of Greenhouse Gas Emissions</u>: The EIS/EIR estimates the annual greenhouse gas emissions of the Cabrillo Port to be 288,000 metric tones CO_2-equivalant per year. This includes the energy and emissions from unloading 2.2 LNG carriers per week, emissions from fuel used by the Cabrillo receiving terminal's tugs, tenders, and crew boats, and the natural gas used in the FSRU's re-gasification units (the largest emissions source at the Cabrillo Port). BHP omits methane leakage from the FSRU (fugitive methane) and emissions from construction of the mooring facilities and pipelines. Heede (2006) made an estimate of the fuel consumed by these operations, added the resulting emissions to the Cabrillo Port start-up and annualized this into the supply chain operating emissions with a 25-year time horizon. The result is that the Cabrillo Port start (annualized) would result in the 400 metric tonnes CO_2-equivalent per year. Adding fugitive methane sources to the Cabrillo Port operations results in increasing the EIS/EIR estimate for Cabrillo Port operations to 346,000 metric tonnes CO_2-equivalent per year (Heede, 2006).

A recently released report from the International Council on Clean Transportation demonstrates that ocean-going vessels contribute significantly to global emissions of nitrogen oxides, sulfur oxides, and particulate matter. Furthermore, according to the report, carbon dioxide emissions from the international shipping sector as a whole exceed annual *total* greenhouse gas emissions from most of the Kyoto protocol Annex I countries (Friedrich et al., 2007).

The greenhouse gas emissions from the LNG carrier fleet serving the facility dwarf the greenhouse gas emissions associated with start up and operation of the Cabrillo Port. These emissions could total nearly 2,400,000 metric tonnes CO_2-equivalent per year (Heede, 2006). These emissions would incrementally increase greenhouse gas emissions in the atmosphere, and contribute to a cumulative impact on California's coastal resources as described above.

LNG carrier operations require that a certain amount of LNG be "boiled off" in the form of methane. This methane can be vented to the atmosphere (where it would contribute to Earth's greenhouse gas inventory and to global warming), compressed and reliquefied (which consumes energy, resulting in additional greenhouse gas emissions), or burned in the ships engines. In the latter case, the combustion of methane would still result in CO_2 emissions to the atmosphere, but natural gas produces less CO_2 per unit of energy than other fossil fuels. According to the Department of Energy's National Energy Technology Laboratory, natural gas emits 56 kg of CO_2 per million BTU, compared to 79 kg for fuel oil. In addition, the combustion of natural gas produces much less NO_x (also a greenhouse gas), SOx, volatile organic compounds, and particulates than does fuel oil (Howell, 1993).

BHP has not committed to a design for their LNG carrier fleet, but has agreed to power their ships 99% by natural gas while in California coastal waters. This would imply that they intend to use duel fuel diesel electric propulsion, currently the latest LNG carrier propulsion technology. It is necessary to burn a small amount of marine diesel fuel at all times in these engines, but they can operate at any ratio of diesel to natural gas from 99% natural gas to 100% diesel.

Heede (2006) calculated the CO_2 equivalent emissions for three fuel scenarios:

> 1. *Gas-only mode that used LNG boil-off gas plus an additional quantity of vaporized natural gas sufficient to fuel the engines: 430 gCO2/kWh times 18.1 million kWh for each one-way trip = 7,800 tonnes of CO2, consuming 6,740 m^3 of LNG en route;*
>
> 2. *Duel-fuel mode that burned boil-off gas at the normal rate supplemented with diesel fuel at 630 gCO2/kWh, which means a blended rate of 529 gCO2/kWh = 9,590 tonnes of CO2 and the consumption of 3,420 m^3 of LNG en route (of which the boil-off gas, at 0.15 percent per day, would supply approximately 54 percent of the required fuel);*
>
> 3. *Diesel-only mode at 630 gCO2/kWh resulting in 11,430 tonnes of CO2 for each one-way trip, with zero LNG consumption. Note: this assumes re-liquefaction of the boil-off gas*

In order to deliver the proposed 800 million cubic feet of gas per day to Cabrillo Port, a fleet of eleven 138,000 m^3 capacity carriers would be needed, making 101-112 deliveries annually (depending on which fuel scenario is adopted). The annual round-trip greenhouse gas emissions for the three scenarios are 1,799,349 tonnes; 2,094,602 tonnes; and 2,368,925 tonnes, respectively. These calculations assume 60,000 HP engines requiring 18,144,180 kWh (equivalent of Wärtsilä 18V50DF duel-fuel engines), 138,000 m^3 capacity carriers, 7,900 nautical miles one-way trip distance, vessel speed of 19.5 knots and a 24-hour turn around time at each terminal. If the LNG tankers were to burn only LNG boil-off gas and vaporized LNG, with 1% diesel, there could be an annual CO_2 reduction of 569,576 metric tonnes as compared to the diesel only mode and 295,253 metric tonnes as compared to the duel fuel mode.

The greenhouse gas reductions from running the duel-fuel engines in gas mode (or at a very high gas:diesel ratio in duel-mode) are feasible. Greenhouse gas emissions from the Cabrillo Port itself are much smaller than those from the carrier fleet, and are already mitigated to the maximum extent feasible through, for example, the use of natural gas in the re-gasification units (the largest source of greenhouse gases attributable to the port). Other potential mitigation strategies include the purchase of carbon offsets, carbon banking and carbon sequestration. All of these strategies are more complex and less certain to produce clear mitigation than running the LNG tanker fleet in gas mode. For example, the purchase of carbon offsets to be used in reforestation projects requires a complex trading scheme, a certification of the offset or banking authority, and demonstration that the offset program is not a program that would have been undertaken without the sale of offsets. Carbon sequestration presents technological hurdles that have yet to be overcome, and it is not clear where or how carbon could be sequestered at the offshore facility.

Based on this information, the Commission believes that it is feasible to make the complete round trip using some combination of LNG boil off gas and vaporized LNG for the majority of the ships' fuel. Indeed, BHP has agreed to use 99% gas and 1% diesel to fuel the tankers in California waters. Thus, the maximum feasible amount of mitigation for the Cabrillo Port and LNG fleet greenhouse gas emissions would be to use mostly natural gas for the entire round trip. At the time of the writing of this staff report, BHP has not agreed to do this. Accordingly, the Commission cannot find that the greenhouse gas emissions of the project have been mitigated to the maximum extent feasible.

Requirement 3 – Public Welfare

The third test of 30260 states that non-conforming coastal-dependent industrial development may be permitted if "to do otherwise would adversely affect the public welfare." The test requires more than a finding that, on balance, a project as proposed is in the interest of the public. It requires that the Commission find that there would be a detriment to the public welfare were the Commission to object to a proposal.

The Cabrillo Port project is to deliver additional quantities of natural gas to California and the United States. The CEC and the CPUC are the State of California agencies responsible for ensuring that California's energy-related interests and needs are met. The CPUC coordinates on energy policies with the CEC. California law (Public Resources Code § 25302) directs State agencies to carry out their respective energy-related duties and responsibilities based upon the information and analyses contained in a biennial, integrated, energy policy report adopted by the CEC. The State's Energy Action Plan (EAP), which was adopted by the CEC and the CPUC, finds that a more diversified supply of natural gas is needed in California, and that LNG should be considered as part of the state's diversified natural gas supply portfolio.

On December 12, 2006, Michael Peevey, President of the CPUC, sent a letter and memorandum to the Commission, setting forth the CPUC's position on the need for LNG terminals as an additional supply source of natural gas for California (See Exhibit OVR-3). Mr. Peevey states:

> *A number of individuals or organizations have been stating in the press that there is no such need for LNG supplies, but this has been based upon an incomplete analysis of the natural gas market (both producing and consuming markets) in North America and how it affects the California market.*
>
> …
>
> *Although the CPUC recognizes the need for LNG terminals to provide additional natural gas supplies to California, the CPUC believes they must be sited in remote locations away from densely populated areas. Many analysts agree that in addition to the Sempra LNG terminal (which is in a remote area in Baja California, Mexico, and already more than 50% constructed), the market will support an LNG import terminal along the California coast.*

The CPUC's December 12, 2006 Memorandum states:

> *On average, California requires a little more than 6000 million cubic feet per day (MMcfd) of natural gas and obtains about 85-90% of its natural gas supplies from outside of California. These out-of-state supplies are delivered by interstate pipelines from natural gas producing basins in the southwestern and Rocky Mountain regions of the U.S. and in western Canada. Only the remaining 10-15% is obtained from California production, which production has been overall declining.*
>
> *It is prudent for California to have access to a diverse portfolio of natural gas supplies to assure adequacy of supplies to the State and to have ample access to the lowest cost supplies of natural gas as market conditions change. The California Public Utilities Commission (CPUC) has become especially concerned in recent years about the adequacy of natural gas supplies to the State, and the increasing price of natural gas. Our concerns are based on several developments that we've observed in the natural gas market over the past few years (particularly since about 2002), and that may well continue in the future. These developments include:*
>
> - *natural gas prices that are about three to four times the prices in 2002,*
> - *decreasing production rates from natural gas wells in North America,*
> - *decreasing imports of natural gas from Canada, the United States' main source of natural gas imports, and a big part of California's portfolio,*

- *future increases in national gas demand, partly due to increasing natural gas demand for electric generation,*
- *the realistic possibility that a portion of Rocky Mountain production, another important part of California's supplies, will be diverted to Midwestern and eastern markets, and*
- *potential changes in the southwest and northwest interstate pipeline markets.*

> *Increases in the price of natural gas, not just in California but across the U.S., have been occurring due to a variety of factors. Some of the primary reasons include the increased tension between national supply and demand, the price of oil, and the increased cost of drilling. Prices have more than tripled between 2002 and now, and the prices have also become much more volatile. It is important to keep in mind that, because the natural gas market is strongly integrated and California heavily depends on out-of-state supplies, trends in market prices that California consumers pay are heavily determined by overall North American market developments, including increased demand in the other states, Canada and Mexico. In fact, in the future, natural gas prices are expected to be increasingly influenced by international developments.*
>
> *The CPUC believes that LNG should be a component of California's natural gas supply portfolio. As part of the State's Energy Action Plan (EAP), the CPUC and the California Energy Commission (CEC) are placing considerable emphasis on trying to meet a substantial portion of the State's energy needs through increasing reliance on energy efficiency measures and renewable energy for electric generation. However, even with <u>strong</u> demand reduction efforts and our goal of 20% renewables for electric generation by 2010, demand for natural gas in California is expected to roughly remain the same, rather than decrease, over the next 10 years. This is because, a substantial portion of the other 80% of electric generation (not met by renewable energy sources) will need natural gas as its fuel source, and natural gas will still be needed for the growing number of residential and business customers of the natural gas utilities. Therefore, the State's EAP also endorses obtaining new natural gas supply sources, such as LNG. Accordingly, one focus of the CPUC's current natural gas regulatory efforts has been to enable access to California's natural gas utility systems by new supply sources, including LNG.*

However, notwithstanding the CPUC's position that LNG should be considered as part of California's natural gas supply portfolio, the Commission believes that the public welfare benefits of the Cabrillo Port project are outweighed by the failure of the project to meet Clean Air Act requirements, and thus that the Commission's objection thereto would not, on balance, adversely affect the public welfare. We note, in fact, that the Clean Air Act itself states that one of the Act's purposes is "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population" (42 USC §7401(b)(1)). The Commission further believes that this, or another, LNG terminal should be able to both supply California with natural gas <u>and</u> meet relevant Clean Air Act requirements. As described in the findings above, to satisfy California's approved Clean Air Act requirements, BHP must provide offsets and BACT consistent with

VCAPCD's Rule 26.2. BHP has not done so. Noncompliance with offset and BACT requirements so as to fully avoid or mitigate all project-related air quality impacts constitute detriments to the public welfare that outweigh the public welfare benefits that might be realized from this LNG import terminal. Further, the Commission believes that the public welfare benefits of the Cabrillo Port project are outweighed by the project's failure to mitigate to the maximum extent feasible the greenhouse gas emissions that it generates. As discussed above, the Commission finds that by using 99% natural gas (or as near to that percentage as possible) in duel-fuel engines powering the fleet of LNG carriers needed to supply Cabrillo point, it is possible to mitigate up to approximately 569,576 metric tonnes CO2-equivalent greenhouse gas emissions as compared to the diesel-only mode and 295,253 metric tonnes as compared to the duel-fuel mode. The Commission therefore finds the project inconsistent with the public welfare test of section 30260.