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PETROLEUM CSG

HSE MANAGEMENT SYSTEM CONTROL

ENVIRONMENT CONTROLS

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INTRODUCTION

Purpose

The Petroleum Environment Controls define requirements to manage environmental risks in Petroleum. The Petroleum Environment Controls form part of the [Petroleum HSE Management System](#)⁽¹⁾ and have been established with regard to applicable industry practices and legal requirements.

Application and Scope

These Petroleum Environment Controls apply at Petroleum sites, and to personnel and visitors involved in activities undertaken for or on behalf of Petroleum. Table 1 outlines the scope of the Environment Controls.

Where a conflict exists between the requirements in the Environment Controls and applicable local environmental laws, the more stringent must be applied.

Table 1 Application of Environment Controls

Control	Application
Drilling Muds and Drilled Cuttings	Drilling, completions, or well workover operations where drill fluids or cuttings may be discharged, including extended reach drilling, horizontal directional drilling or horizontal directional boring.
Combustion Emissions	Combustion of all fuels in engines, turbines and process equipment, including marine vessel engines associated with exploration, development and production.
Flaring, Venting and Fugitive Emissions	Onshore or offshore activities where flaring, venting or fugitive releases may occur, including venting and fugitive releases from storage tanks and ship/tanker loading and unloading operations.
Produced Formation Water (PFW)	Onshore and offshore treatment and discharge of all PFW co-produced with oil and gas.
Wastes	Waste material, both hazardous and non-hazardous, that is associated with Petroleum exploration, construction, production or closure activities. Where a hazardous material is involved, the Fatal Risk Controls ⁽¹⁾ also apply.
Physical Disturbance	Onshore and offshore oil and gas exploration, construction, installation and production activities, and all associated infrastructure (e.g., roads, shore bases).
Marine Noise	Offshore oil and gas activities and operations.

The Petroleum Environment Controls apply to the entire lifecycle of Petroleum's activities, processes and products, including exploration and planning, development, operation, closure (decommissioning, remediation and rehabilitation), marketing and acquisitions and divestments. To the extent that the requirements apply, they must be followed. However, requirements specific to design do not apply to existing facilities until the next scheduled opportunity for equipment replacement or retrofit.

Responsibility

Unless otherwise stated, managers and supervisors are accountable for the implementation of the Environment Controls specified in this document.

Personnel must comply with the requirements in the document, and the expectations detailed in [Petroleum HSE Management System](#).⁽¹⁾

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ENVIRONMENT CONTROLS

This document defines the requirements for managing environmental risks associated with Petroleum activities and provides direction to related Petroleum and other reference documentation.

The mandatory requirements of these Controls are signified by the use of the word “must”. However, there will be circumstances where local conditions may demonstrate that the requirement is either not applicable, compliance is not possible or an alternative approach is necessary. In cases where “should” has been used in a requirement or a risk assessment has been conducted to demonstrate that a different control ensures the risk is tolerable, variation can only be considered as compliance if the senior manager of the operation approves it based on an evaluation of the risk. The risk management approach adopted must be consistent with the performance requirements of [Petroleum HSE Management System](#) ⁽¹⁾ (Element 3 Hazards and Risks), and follow the appropriate Hierarchy of Controls (Waste Management Hierarchy of Controls and/or **Risk Management Hierarchy of Controls**) as shown below. A number of these options may be considered and applied individually, or in combination.

- **Eliminate:** The complete elimination of the hazard;
- **Substitute:** Replacing the material or process with a less hazardous one;
- **Redesign:** Redesigning the plant, equipment or work processes;
- **Separate:** Isolating the hazard by guarding or enclosing it;
- **Administrative:** Providing control, such as training, procedures;
- **Pollution control device:** Using appropriate pollution control equipment where other controls are not practical; pollution control devices include impact minimization equipment such as spill clean-up material or dust suppression measures.

When discussing emissions, discharges and wastes, the **Waste Management Hierarchy of Controls** must be applied in the following order ⁽²⁾:

- **Eliminate:** The complete elimination of the waste; also includes management measures that result in no direct impact to the terrestrial, marine or atmospheric environment;
- **Reduce:** Generating less waste through more efficient practices;
- **Reuse/recycle:** Reusing material in its original form, or recycling the waste product by extracting energy from it or converting it into usable materials;
- **Treatment:** Destroying, detoxifying or neutralizing waste by biological, thermal, chemical or physical methods, e.g., incineration;
- **Disposal:** Releasing to the atmosphere, marine dumping or landfill of the waste.

The remainder of this document describes the intent of each Control and provides a set of corresponding mandatory performance requirements.

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ENVIRONMENT CONTROL 1 – DRILLING MUDS AND DRILLED CUTTINGS

INTENT

To eliminate or minimize adverse environmental impacts resulting from the discharge of drilling muds and cuttings. Adverse impacts due to toxicity may occur to offshore water quality or marine life, or to onshore groundwater, wildlife or local populations if these materials are not managed properly. Offshore, riser-less drilling or seafloor discharges of cuttings may cause smothering of seafloor life, due to accumulations of cuttings.

PERFORMANCE REQUIREMENTS

Plant and Equipment

- | | |
|---|--|
| <p>1.1 Where a synthetic based mud (SBM) or oil based mud (OBM) system is used, separation equipment that is capable of ensuring the volume of SBM or OBM retained on drilled cuttings is no more than 10% by dry weight must be used.</p> <p>1.2 Onshore treatment of drill fluids and cuttings should include consideration of injection disposal wells, thermal drying, bioremediation and incineration, or recycle back to supplier for reuse.</p> <p>1.3 Onshore, pits associated with drilling and completion operations must be constructed to prevent unauthorized access and in a manner to eliminate leaching, leakage or unauthorized discharge of pit contents into the surrounding environment, unless justified by risk assessment. These pits must be sized to ensure that overflow associated with rainfall will not occur.</p> | <p>1.7 Overboard discharge of OBM or OBM-contaminated cuttings must not be allowed⁽⁷⁾.</p> <p>1.8 Use of freshwater WBM must be used when drilling through known and potential freshwater aquifer formations.</p> <p>1.9 The selection of base drilling fluids, drilling muds and completion fluids, including chemicals and additives, must be based on a risk assessment (Petroleum HSE Management System,⁽¹⁾ Element 3 Hazards and Risks). The assessment must consider the HSE impacts and ecotoxicity, as well as performance, cost, efficiency, capability and availability.</p> <p>1.10 Where the consequence associated with the potential impacts of drilling muds and drilled cuttings is assessed as intermediate or higher as defined in the Petroleum HSE Risk Matrix⁽⁶⁾, additional controls must be implemented.</p> |
| <p>Procedures</p> <p>1.4 A plan(s) that incorporates the applicable performance requirements of this Control must be prepared and maintained to manage and control the relevant impacts to land, water, biodiversity, air, and communities. Guidance on the preparation of a management plan is provided in Appendix A.</p> <p>1.5 The Waste Management Hierarchy of Controls (Table B1, Appendix B) must be considered during the planning and design of new operations and facilities and when establishing control measures. Any deviation to a lower level of control must demonstrate that the higher options cannot be implemented. Any level of control which has the potential to result in a community or reputation consequence rated as intermediate or higher as defined in the Petroleum HSE Risk Matrix⁽⁶⁾ must be approved by a Division President prior to implementation.</p> <p>1.6 Low toxicity water based muds (WBM) should be evaluated for all drilling activities except for hole sections where technical justification for use of SBM or OBM is provided.</p> | <p>1.11 Offshore, excess or surplus dry bulk cement must not be discharged overboard, unless specifically allowed by local regulations.</p> <p>1.12 Ecotoxicity testing (acute, sublethal and/or chronic) must be conducted on any fluid to be discharged. This may be a prior test conducted on a generic mud composition for the well, or it may be a test on the actual mud in use during the drilling operation.</p> <p>1.13 For any physical disturbance that may impact shoreline, near shore areas or areas protected for the purposes of conservation, hydrodynamic modelling to predict the extent of impacts to offshore habitat must be conducted, and baseline benthic monitoring must be conducted to predict the extent of impacts to habitat.</p> |

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People

1.14 An environmental awareness program for drilling personnel and contractors associated with equipment or procedures specific to drilling muds or drilled cuttings must be conducted prior to commencement of activities.

The program must include:

- methods for storage, handling and disposal of drilling muds and cuttings;
- specific temporal (e.g., migration), or spatial (e.g., habitat) sensitivities and adverse impacts due to toxicity;
- management controls to reduce environmental impacts;
- response to an unplanned or unauthorized drilling fluid release.

ENVIRONMENT CONTROL 2 – COMBUSTION EMISSIONS

INTENT

To eliminate or minimize the adverse environmental impacts resulting from the emission of products of combustion including carbon dioxide (CO₂), carbon monoxide (CO), sulphur dioxide (SO₂), nitrogen oxides (NO_x), particulates (PM) and unburned hydrocarbons. Emissions may lead to degradation of local air quality and may contribute to global warming.

PERFORMANCE REQUIREMENTS

Plant and Equipment

- 2.1 During project selection, the BHP Billiton Carbon Pricing Protocol must be applied to applicable capital decisions⁽⁴⁾.
- 2.2 Natural gas must be the preferred fuel at production facilities. Where natural gas is not available, diesel may be used for fuel.
- 2.3 Where diesel is used as the fuel source, low sulphur diesel (containing sulphur equal to or less than 500 ppm) must be used. If low sulphur diesel is unavailable, SO₂ controls (e.g., flue gas desulphurization equipment) should be considered for major emissions sources operated continuously (e.g., power generator turbines or engines).
- 2.4 Where energy is required from power grid sources, power from renewable sources should be evaluated.
- 2.5 In new projects and for new equipment purchases, the options of single-source powered equipment versus multiple sources (i.e., dual fuel) of gas and electric equipment should be evaluated, (considering lifecycle fuel costs and the relative contributions to the overall environmental impact from atmospheric pollutants, greenhouse gasses (GHG) and fuel efficiency).
- 2.6 Waste heat recovery must be undertaken for new facilities or opportunistic retrofit if emissions are greater than 50,000 tonnes per year of CO₂ equivalent (CO₂-e).
- 2.7 Non-carbon energy sources should be evaluated for use for non-critical equipment on fixed or permanent installations.
- 2.8 Electronic controls should be evaluated for use to optimize air-to-fuel ratios on Petroleum-owned engines.
- 2.9 Clean/lean burn technology, including controls such as Selective Catalytic Reduction and oxidation catalyst, should be evaluated for use on BHP Billiton-owned new or replacement equipment for control of NO_x, CO and volatile organic compounds.

- 2.10 Engines and turbines (permanent and temporary) owned or operated by Petroleum must comply with the emission guidelines for PM, SO₂ and NO_x indicated by the International Finance Corporation, World Bank Group guidelines for air emissions and ambient air quality⁽⁵⁾.
- 2.11 Variable speed drivers should be considered to optimize mechanical and energy efficiency in BHP Billiton-owned equipment.

Procedures

- 2.12 A plan(s) that incorporates the applicable performance requirements of this Control must be prepared and maintained to manage and control the impacts to land, water, biodiversity, air, and communities. Guidance on the preparation of a management plan is provided in [Appendix A](#).
- 2.13 For operations or projects where emissions exceed or are anticipated to exceed 50,000 tonnes of CO₂-e per year, an Energy and Greenhouse Gas Management Plan must be implemented and maintained. Guidance on the preparation of a management plan is provided in Appendix A. Where emissions exceed or are anticipated to exceed 1,000,000 tonnes CO₂-e per year, the operations or project must maintain an energy mass balance, a GHG emissions baseline and 5-year forecast, and a GHG reduction cost curve, pursuant to [Appendix A](#).
- 2.14 The Waste Management Hierarchy of Controls (Table B1, [Appendix B](#)) must be considered during the planning and design of new operations and facilities, or when establishing control measures. Any deviation to a lower level of control requires demonstration that the higher options cannot be implemented. Any level of control which has the potential to result in a community or reputation consequence rated as intermediate or higher as defined in the [Petroleum HSE Risk Matrix](#)⁽⁶⁾ must be approved by a Division President prior to implementation.

2.15 The following leading management practices must be implemented for combustion sources, and must be incorporated into the Management Plan:

- Reduce emissions of air pollutants by technological or operational methods (e.g., particle traps to reduce particulate matter).
- Ensure diesel-powered construction equipment is properly tuned and maintained and shut off when not in direct use.
- Prohibit engine tampering to increase horsepower.
- Locate engines, motors and equipment as far as possible from residential areas or living quarters and sensitive receptors (e.g., schools, day care centers and hospitals).
- Use engine types such as electric, liquefied gas, hydrogen fuel cells and/or alternative diesel formulations, where available.
- Emissions from combustion sources on controlled marine vessels (e.g., incinerators), must comply with the requirements of MARPOL 73/78 Annex VI⁽¹⁴⁾.

2.16 Energy efficiency improvement goals and action plans must be established annually to reduce emission levels from operations on a normalized year-by-year basis and must be included in the management plan.

2.17 An assessment of energy efficiency must be conducted during the selection of new or replacement equipment for fixed or permanent installations. Energy efficiency evaluations are case-specific for the selection of the required parameters to conduct a lifecycle analysis.

2.18 Where the consequence associated with the potential impacts of combustion emissions is assessed as intermediate or higher as defined in the [Petroleum HSE Risk Matrix](#)⁽⁶⁾, additional controls must be implemented.


2.19 Personnel working at Petroleum sites must implement a risk-based preventative maintenance program for onsite internal combustion engines or external combustion burners to reduce and minimize the impact of air emissions from combustion sources.

2.20 Carpool shuttles and vans should be evaluated for transport of construction workers to and from construction sites and of workers to operations sites to eliminate some single-occupancy vehicle trips and reduce combustion emissions. Strategies to minimize construction-related trips of workers and equipment should also be evaluated.

People

2.21 An environmental awareness program for personnel and contractors associated with equipment or procedures specific to combustion emissions must be conducted prior to and during activities to discuss environmental impacts and proposed management measures to reduce impacts of combustion emissions. The program must include:

- specific temporal (e.g., migration) or spatial (e.g., habitat) sensitivities and adverse impacts from the emissions of products of combustion;
- effects of climate change and reduced air quality from these emissions;
- management controls to reduce environmental impacts.

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ENVIRONMENT CONTROL 3 – FLARING, VENTING AND FUGITIVE EMISSIONS

INTENT

To eliminate or minimize the adverse environmental impacts resulting from the flaring, venting or fugitive release of natural gas or liquid hydrocarbons or CO₂ venting from an acid gas removal system at LNG processing facilities.

PERFORMANCE REQUIREMENTS


Plant and Equipment

- 3.1 During project selection, the BHP Billiton Carbon Pricing Protocol must be applied to applicable capital decisions⁽⁴⁾.
- 3.2 Where flaring is undertaken on facilities or drilling rigs, high-efficiency flare equipment must be utilized⁽⁷⁾.
- 3.3 Smokeless flare equipment should be evaluated for use at all production facilities⁽⁷⁾ so that any smoke from flaring does not obscure an observer’s view in excess of the opacity shown on the Ringelmann Chart No. 1⁽⁸⁾, or equivalent measurement.
- 3.4 Use of ground flares should be evaluated as an alternative to tower flares. Utilization of ground flare versus tower flare must be weighed alongside safety factors when considering as an alternative.
- 3.5 Vapor recovery equipment should be evaluated for new facilities or opportunistic retrofit for all planned or steady state venting sources.
- 3.6 To minimize releases to a flare system, utilization of low or no-bleed pneumatic devices to regulate pressure and control valves should be evaluated for use.
- 3.7 Electronic igniters should be evaluated for use as a means of lighting flares in lieu of permanent pilots. Flare gas recovery systems should be evaluated for new facilities or opportunistic retrofit.
- 3.8 Compressed air should be evaluated for use instead of natural gas for powering instruments and controllers.
- 3.9 Flash gas and vent gas should be evaluated for fuel use at new facilities or at opportunistic retrofit.
- 3.10 During design, a bypass or closed-loop system should be evaluated for new facilities or opportunistic retrofit to eliminate excessive flaring associated with commissioning and start-up activities.
- 3.11 Process upsets should be piped to a flare, rather than cold vent, except where risk assessment indicates otherwise.

Procedures

- 3.12 A plan(s) that incorporates the applicable performance requirements of this Control must be prepared and maintained to manage and control the relevant impacts to land, water, biodiversity, air, and communities. Guidance on the preparation of a management plan is provided in Appendix A.
- 3.13 For operations or projects where emissions exceed or are anticipated to exceed 50,000 tonnes of CO₂-e per year, an Energy and Greenhouse Gas Management Plan must be implemented and maintained. Guidance on the preparation of a management plan is provided in [Appendix A](#). Where emissions exceed or are anticipated to exceed 1,000,000 tonnes CO₂-e per year, the operations or project must maintain an energy mass balance, a GHG emissions baseline and 5-year forecast, and a GHG reduction cost curve, pursuant to [Appendix A](#).
- 3.14 The Waste Management Hierarchy of Controls (Table B1, [Appendix B](#)) must be considered during the planning and design of new operations and facilities and when establishing control measures. Any deviation to a lower level of control must demonstrate that the higher options cannot be implemented. Any level of control which has the potential to result in a community or reputation consequence rated as intermediate or higher as defined in the [Petroleum HSE Risk Matrix](#)⁽⁶⁾ must be approved by a Division President prior to implementation.
- 3.15 Where the consequence associated with the potential impacts of flaring, venting or fugitive emissions is assessed as intermediate or higher as defined in the [Petroleum HSE Risk Matrix](#)⁽⁶⁾, additional controls must be implemented.
- 3.16 There must be no intentional flaring of liquids from production facilities. Collection of hydrocarbons from well clean-up and well test activities should be considered for onshore sale/disposal.
- 3.17 The quantities of gas vented and flared, excluding fugitive emissions, must be measured (preferably) or

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estimated (alternatively), recorded and reported internally⁽¹⁾.

- 3.18 In the absence of any regulatory requirements, a decision process on whether to conduct flared well tests should evaluate the environmental impacts.
- 3.19 A preventive maintenance program must include procedures to ensure that gas leaks are not occurring and that control and flare equipment are working properly⁽⁷⁾.

People

3.20 An environmental awareness program for site personnel and contractors associated with equipment or procedures specific to flaring, venting or fugitive emissions must be conducted prior to activities to discuss environmental impacts and proposed management measures to reduce the impacts of flaring, venting and fugitive emissions. The program must include:

- specific temporal (e.g., migration) or spatial (e.g., habitat) sensitivities and adverse impacts from flaring, venting and fugitive emissions;
- effects of climate change and reduced air quality from these emissions;
- management controls to reduce environmental impacts.

ENVIRONMENT CONTROL 4 – PRODUCED FORMATION WATER

INTENT

To eliminate or minimize the adverse environmental impact resulting from the discharge of produced formation water (PFW). The physical characteristics and chemical composition of PFW give rise to the concerns for potential water and land degradation.

PERFORMANCE REQUIREMENTS

Plant and Equipment


- 4.1 Offshore, inline oil-in-water analysers with shut-downs/auto-bypasses or manual sampling and testing must be used for all PFW overboard discharges to minimize the possibility of off-spec water being discharged.
- 4.2 Onshore, preference should be given to storage of PFW in tanks rather than pits/ponds. If tanks are used, they must be bunded such that 110% of the volume of the largest single tank, or 25% of the total storage capacity (whichever is greater)⁽⁵⁾, is capable of being contained in the event of a tank release. If pits/ponds are used, they must be constructed to prevent unauthorized access and in a manner to eliminate leaching, leakage or unauthorized discharge of the pit/pond contents into the surrounding environment, including overflow from any weather-related event.

Procedures

- 4.3 A plan(s) that incorporates the applicable performance requirements of this Control must be prepared and maintained to manage and control the relevant impacts to land, water, biodiversity, air, and communities. Guidance on the preparation of a management plan is provided in [Appendix A](#).
- 4.4 The Waste Management Hierarchy of Controls (Table B1, [Appendix B](#)) must be considered during the planning and design of new operations and facilities and when establishing control measures. Any deviation to a lower level of control must demonstrate that the higher options cannot be implemented. Any level of control which has the potential to result in a community or reputation consequence (e.g., marine disposal of NORM waste) rated as intermediate or higher as defined in the [Petroleum HSE Risk Matrix](#)⁽⁶⁾ must be approved by a Division President prior to implementation.
- 4.5 The selection of an appropriate option must demonstrate consistency with the Waste Management Hierarchy of Controls; where the consequence associated with the potential impacts of

PFW is assessed as intermediate or higher as defined in the [Petroleum HSE Risk Matrix](#)⁽⁶⁾, additional controls must be implemented.

- 4.6 The selection and usage of chemicals associated with PFW should be evaluated, based on risk assessments and cost benefit analysis. These risk assessments must compare the HSE performance of the chemicals (utilizing Material Safety Data Sheets (MSDS) and ecotoxicity data) against cost, efficiency, capability and availability. The risk assessment may be conducted utilizing Chem Alert or equivalent.
- 4.7 Prior to initiating disposal or discharge of PFW, the baseline condition of the receiving medium and surrounding environment must be established. Modelling of the zone of effect from produced water must be undertaken and the results must be included in the environmental impact/risk assessment for the facility.
- 4.8 Baseline testing or annual monitoring must include a full analysis of PFW physical characteristics and chemical composition, including tests for hydrocarbons (total hydrocarbons, PAH and BTEX), heavy metals, hypersalinity, temperature, pH, NORMs and residual chemical concentrations. Baseline testing must also be triggered when conditions and flow streams change significantly, e.g., due to new wells, water breakthrough in old wells, changes in production chemicals used during oil/water separation, etc. Any significant variation from previously recorded levels must trigger a review of the environmental risk assessment for the facility (including re-running modelling).
- 4.9 For offshore discharges of PFW, the 24-hour average oil and grease concentration must not exceed 30 mg/l⁽⁹⁾. In cases where local regulations stipulate lower limits, the lower figure must apply. This requirement must be implemented for new facilities or for existing facilities at the next scheduled opportunity for equipment replacement or retrofit.


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- 4.10 Sampling procedures and laboratory tests must comply with internationally accepted standards and protocols, such as ISO 9377-2 (Mod) for determination of oil in PFW⁽¹⁰⁾.
- 4.11 The volumes of PFW discharges and oil-in-water concentrations must be recorded and reported internally and externally as required by local regulatory requirements.
- 4.12 On a daily basis, PFW treatment and disposal systems must be monitored and checked for proper performance to ensure compliance with regulations and applicable Company standards.
- 4.13 Where chemicals are used for PFW treatment and PFW is discharged overboard, records of usage must be maintained, including hazard class, concentrations and volumes discharged.
- 4.14 Ecotoxicity testing (acute, sub lethal and/or chronic) must be conducted on PFW as part of any impact/risk assessment associated with PFW discharge. Ecotoxicity testing must also be triggered when conditions and flow streams change significantly, e.g., due to new wells, water breakthrough in old wells, changes in production chemicals used during oil/water separation, etc.

People

- 4.15 An environmental awareness program for site personnel and contractors associated with equipment or procedures specific to PFW must be conducted prior to activities to discuss environmental impacts and proposed management measures to reduce impacts of PFW discharge. The program must include:
- specific temporal (e.g., migration) or spatial (e.g., habitat) sensitivities and adverse impacts, handling and disposal of PFW;
 - effects of PFW including contaminants in the PFW such as hydrocarbons, heavy metals, total dissolved solids, pH, the presence of NORM and residual process chemicals commingled with the PFW;
 - management controls to reduce environmental impacts.

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ENVIRONMENT CONTROL 5 – WASTES

INTENT

To eliminate or minimize the environmental impacts resulting from the production, storage, handling, transport, recycling and disposal of wastes.

PERFORMANCE REQUIREMENTS

Plant and Equipment

- 5.1 The design and layout of plant facilities must include physical requirements for the handling, storage, treatment and transportation of waste.
- 5.2 Wastes in storage must be identified, segregated and stored according to waste, e.g., oily wastes, inert, putrescible (decaying / decomposing matter), recyclable, etc.
- 5.3 Hazardous material and hazardous waste storage areas must have secondary containment that are at least 110% of the largest single waste container, or 25% of the total storage capacity (whichever is greater)⁽⁵⁾.
- 5.4 Onshore, the pits used for the collection of rubbish or non-hazardous wastes must be constructed to prevent unauthorized access and in a manner to eliminate leaching, leakage or unauthorized discharge of the pit contents into the surrounding environment. Netting or covers must be used to prevent rubbish from blowing from the pit.
- 5.5 To prevent corrosion and leakage into the environment, waste drums and containers of metal construction must be placed such that water will not collect on tops and resting surfaces.

Procedures

- 5.6 A plan(s) that incorporates the applicable performance requirements of this Control must be prepared and maintained to manage and control the relevant impacts to land, water, biodiversity, air, and communities. This waste management plan must include a description and review of the wastes expected from the operation and prescribed practices for minimization, handling, storage and proper disposal of waste. The plan must also provide the names, locations and specific procedures regarding waste contractors, including handlers, transporters and disposal sites. Guidance on the preparation of a management plan is provided in [Appendix A](#).
- 5.7 The Waste Management Hierarchy of Controls (Table B1, [Appendix B](#)) must be considered during the planning and design of new operations and facilities

- and when establishing control measures. Any deviation to a lower level of control must demonstrate that the higher options cannot be implemented. Any level of control which has the potential to result in a community or reputation consequence (e.g., marine disposal of NORM waste) rated as intermediate or higher as defined in the [Petroleum HSE Risk Matrix](#)⁽⁶⁾ must be approved by a Division President prior to implementation.
- 5.8 Petroleum must identify the environmental impacts associated with Petroleum products, and will provide BHP Billiton Marketing with information about these impacts, as required.
 - 5.9 Where the consequence associated with the potential impacts of waste is assessed as intermediate or higher as defined in the [Petroleum HSE Risk Matrix](#)⁽⁶⁾, additional controls must be implemented.
 - 5.10 Hazardous wastes must be disposed of to the more stringent of: 1) local, state, regional or national law and standards, or 2) the requirements of the United Nations Environment Programme “Basel Convention on the Control of Transboundary Movements on Hazardous Wastes and Their Disposal”⁽¹¹⁾.
 - 5.11 Waste management contractors should be subject to risk-based HSEC evaluation prior to final contractual arrangements, taking into account the nature of their services (access to appropriate waste management sites that are approved and permitted by statutory authorities or regulators) and demonstrated experience, in order to mitigate impacts to land, water, biodiversity, air and communities..
 - 5.12 Audits or assessments must be performed at least every two years, or more frequently according to the risk exposure and potential long-term liability, on waste management contractors to ensure their operating practices are appropriate and they continue to be permitted / licensed appropriately. Review must include the chain of custody of waste handling to ensure the final disposal point is at an approved and appropriate location in order to

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mitigate impacts to land, water, biodiversity, air and communities..

- 5.13 Offshore, blackwater and grey water must be treated according to MARPOL 73/78 Annex IV⁽¹²⁾, and MARPOL 73/78 Annex V⁽¹³⁾, respectively, or comply with applicable permits prior to discharge, or otherwise be treated in a marine sanitation unit.
- 5.14 The selection and usage of process and production chemicals, materials and products should be evaluated using risk assessments and cost benefit analysis. These risk assessments must compare the HSE performance of the chemical, material or product (utilizing MSDS and ecotoxicity data) against cost, efficiency, capability and availability. The risk assessment may be conducted utilizing Chem Alert or equivalent.
- 5.15 In the absence of more stringent state or local regulations, onshore hydrostatic test water must be injected into a disposal well or discharged to surface waters or land after meeting the requirements of the International Finance Corporation (World Bank Group)⁽¹⁵⁾:
- 5.16 For offshore hydrostatic testing of pipelines, a hydrotest water disposal plan must be prepared that considers points of discharge, rate of discharge, chemical use and dispersion, environmental risk and monitoring. Disposal of hydrotest water into shallow coastal waters should be avoided unless risk evaluation indicates such disposal is acceptable.
- 5.17 Sediment control methods must be used to protect aquatic biota and water quality during discharge of hydrostatic test waters. For discharge to land, a site must be selected to prevent flooding, erosion or diminished agricultural capacity⁽¹⁵⁾.
- 5.18 At each facility, records of waste generation, transportation, storage, elimination, reduction, reuse, recycling, treatment and disposal must be maintained and reported internally.
- 5.19 A review of the cost-effectiveness of materials and products purchased by Petroleum for use in the production process must be conducted every three years; the review must include an evaluation of disposal costs and potential long-term liabilities.

People

- 5.20 An environmental awareness program for site personnel and contractors associated with equipment or procedures specific to waste management must be conducted prior to activities to discuss environmental impacts and proposed management measures to reduce impacts of waste discharge/ disposal. The program must include:
 - specific temporal (e.g., migration) or spatial (e.g., habitat) sensitivities and adverse impacts handling and disposal of waste;
 - the specific nature of hazardous and non-hazardous waste generated on the facility;
 - effects of improper waste disposal;
 - management controls to reduce environmental impacts;
 - benefits of waste-reduction initiatives, including reduced energy and resource waste;
 - understanding of product stewardship implications for the products generated on the facility.

ENVIRONMENT CONTROL 6 – PHYSICAL DISTURBANCES

INTENT

To minimize the adverse impacts or footprint to terrestrial and submerged lands, flora, fauna, habitat and air and water quality caused by onshore and offshore oil and gas activities, including seismic, drilling, and installation activities.

PERFORMANCE REQUIREMENTS

Plant and Equipment

6.1 Vehicles, plant or equipment that will cause ground or seabed disturbance must be sized for minimal disturbance (meeting operational requirements and allowing safe operation).

Procedures

6.2 A plan(s) that incorporates the applicable performance requirements of this Control must be prepared and maintained to manage and control the relevant impacts to land, water, biodiversity, air, and communities. Guidance on the preparation of a management plan is provided in [Appendix A](#).

6.3 The Risk Management Hierarchy of Controls (Table B2, [Appendix B](#)) must be considered during the planning and design of new operations and facilities and when establishing control measures. Any deviation to a lower level of control must demonstrate that the higher options cannot be implemented. Any level of control which has the potential to result in a community or reputation consequence rated as intermediate or higher as defined in the [Petroleum HSE Risk Matrix](#)⁽⁶⁾ must be approved by a Division President prior to implementation.

6.4 Where the consequence associated with the potential impacts of physical disturbance is assessed as intermediate or higher as defined in the [Petroleum HSE Risk Matrix](#)⁽⁶⁾, additional controls must be implemented.

6.5 A disturbance approval procedure must be implemented for land, freshwater, and marine areas that addresses regulatory requirements. This may be covered by the site closure plan or Environmental Management Plan. For guidance refer to [Appendix A](#).

6.6 Physically disturbed sites or routes must be restored, remediated and/or rehabilitated to pre-disturbance condition (or better) as soon as practicable after physical disturbance occurs, and be consistent with pre-disturbance or alternate land uses developed in consultation with stakeholders, in accordance with a documented rehabilitation timetable. This may occur immediately following the disturbance (for example,

backfilling a pipeline trench after pipelay) or at the end of the useful life of the plant or equipment (e.g., restoration of a pad site once a gas plant has been removed). Minor seabed disturbances, such as grab samples, piston cores and seabed deep borings, are excluded from this requirement.

6.7 Timing of offshore seismic, drilling, construction, installation or other activities must be such that known marine mammal calving areas (regulated, designated or otherwise indicated) are avoided during calving periods.

6.8 Timing of offshore seismic, construction, drilling, installation or other activities should be such that known migratory pathways (regulated, designated or otherwise indicated) are avoided wherever practicable during known marine mammal migratory periods.

6.9 Do not explore, develop or drill in the following instances:


- a. Within the boundaries of World Heritage listed properties;
- b. Adjacent to World Heritage listed properties unless the proposed activity is compatible with the outstanding universal values;
- c. Within the boundaries of the International Union for the Conservation of Nature (IUCN) Protected Areas Categories I-IV, unless a Biodiversity Action Plan is implemented that delivers measurable benefits to biodiversity commensurate with the level of expected biodiversity impact and meets regulatory requirements and authorizations. The Biodiversity Action Plan must be endorsed by the Asset Leader/Project Director and approved by the Chief Executive, Petroleum, and the Head of Group HSEC must be informed.
- d. Identify any local IUCN Red List Threatened Species and do not operate where the direct impact will result in their extinction in the wild.

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- 6.10 For any physical disturbance that may impact shoreline, near shore areas or areas protected for the purposes of conservation, hydrodynamic modelling to predict the extent of impacts to offshore habitat must be conducted, and baseline benthic monitoring must be conducted to predict the extent of impacts to benthic habitat.
- 6.11 Liquid hydrocarbon storage and pipelines must be identified and mapped, and managed to control the risk of land and water contamination.
- 6.12 All new liquid hydrocarbon storage tanks and pipelines must be constructed above ground unless a risk assessment determines below-ground or subaqueous construction will achieve a lower risk. Additionally, a risk assessment must be conducted for all existing below-ground or subaqueous liquid hydrocarbon storage tanks and pipelines to determine the likelihood of containment failure and any required controls.

People

- 6.13 An environmental awareness program for construction personnel and contractors associated with equipment or procedures specific to physical disturbance must be conducted prior to activities to discuss environmental impacts and proposed management measures to reduce impacts of physical disturbance. The program must include:
 - specific temporal (e.g., migration) or spatial (e.g., habitat) sensitivities and adverse impacts of physical disturbances;
 - importance of biodiversity protection;
 - management controls to reduce environmental impacts.

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ENVIRONMENT CONTROL 7 – MARINE NOISE

INTENT

To minimize the impact to marine fauna from underwater noise generated by oil and gas operations such as seismic, drilling, marine vessel, and installation and operations activities.

PERFORMANCE REQUIREMENTS

Plant and Equipment

7.1 All source vessels involved in seismic acquisition should consider the use of passive acoustic monitoring (PAM), particularly for use in areas where marine mammals are likely to inhabit the proposed survey location.

Procedures

7.2 A plan(s) that incorporates the applicable performance requirements of this Control must be prepared and maintained to manage and control the relevant impacts to land, water, biodiversity, air, and communities. Guidance on the preparation of a management plan is provided in [Appendix A](#).

7.3 The Risk Management Hierarchy of Controls (Table B2, [Appendix B](#)) must be considered during the planning and design of new operations and equipment and when establishing control measures. Any deviation to a lower level of control must demonstrate that the higher options cannot be implemented. Any level of control which has the potential to result in a community or reputation consequence rated as intermediate or higher as defined in the [Petroleum HSE Risk Matrix](#)⁽⁶⁾ must be approved by a Division President prior to implementation.

7.4 Where the consequence associated with the potential impacts of marine noise is assessed as intermediate or higher as defined in the [Petroleum HSE Risk Matrix](#)⁽⁶⁾, additional controls must be implemented.

7.5 During seismic operations, the sound power intensity of seismic shots must be built up gradually ("soft-start") over at least a 20-minute period according to JNCC guidelines⁽¹⁶⁾ to allow marine mammals time to leave the area. For high resolution site surveys and operations that produce lower acoustic output, refer to JNCC guidelines⁽¹⁶⁾ for pre-shooting guidance

7.6 During seismic operations, soft-start of the source array must not begin unless conditions allow the sea surface to be visually and/or acoustically inspected

for marine mammals, according to JNCC guidelines⁽¹⁶⁾. In areas where cetaceans are not expected and in the absence of PAM systems, judgement must be used to ensure an area is free from cetaceans prior to the soft start.

7.7 Where seismic activities and/or operations take place in known (regulated, designated or otherwise indicated) marine mammal migratory pathways, seismic vessel crews must continually watch for marine mammals during pre-shooting search, soft-start and while airguns are firing, and all operational seismic source vessels must carry at least one competent Marine Mammal Observer (MMO) to watch for and alert vessel crews of the presence of marine mammals prior to the soft-start, in accordance with JNCC guidelines⁽¹⁶⁾, where more stringent guidelines do not otherwise apply.

7.8 For seismic operations, where stricter guidelines do not apply:

- a. If marine mammals are seen within 500 meters of the center of the array during the pre-shooting search, the soft-start must be delayed according to the methodology specified in the JNCC Guidelines. However, if marine mammals are detected within 500 meters of the center of the airgun array while the airguns are firing, either during the soft-start or while at full power, there is no requirement to stop firing the airguns⁽¹⁶⁾.
- b. After shut down of the seismic source, or if all airguns have stopped and not restarted for at least 10 minutes, the pre-shooting search and soft-start procedures must be conducted in accordance with JNCC guidelines⁽¹⁶⁾.
- c. Where marine mammals are congregating around a drilling or production platform, or other structures, seismic activities should begin at least 500 meters from the platform⁽¹⁶⁾.


7.9 Contractors should address noise reduction measures in their bid proposals. This should include details on best practices to reduce equipment noise emissions⁽¹⁶⁾.

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People


- 7.10 Training of the MMO must include a course or instruction on implementing the JNCC guidelines.
- 7.11 An environmental awareness program for site personnel and contractors associated with equipment or JNCC procedures specific to marine noise must be conducted prior to activities to discuss environmental impacts and proposed management measures to reduce impacts of marine noise. The program must include:
- specific temporal (e.g., migration) or spatial (e.g., habitat) sensitivities and adverse impacts of marine noise;
 - importance of biodiversity protection;
 - management controls to reduce environmental impacts.

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APPENDIX A: GUIDANCE ON THE PREPARATION OF MANAGEMENT PLANS

PURPOSE

This document provides guidance for the preparation of a management plan where it is required as specified in this Control. A management plan is defined as *“A document which either contains or provides direction to information that is required to manage an HSEC aspect. It may cover multiple aspects, multiple entities or be contained within another plan.”*

APPLICATION AND SCOPE

A separate management plan may not be needed if the required information is already contained in other, existing documents, including Plans prepared to meet regulatory requirements or submitted to regulatory authorities. Where existing documents fulfil these performance requirements, a summary document may be prepared that specifically points or maps to the existing documents. This summary and the backup documents may then be used as evidence that the requirement has been met.

In situations where an environmental aspect is not present or does not apply (e.g., sites with no air emissions impacts or sensitive areas, no contaminated sites, etc.) , a management plan may be not be required, provided that an analysis or study is provided in a summary document to support the position that the environmental aspect is not present.

CONTENT OF A MANAGEMENT PLAN

This guidance provides a generic structure and content for a management plan. Additional sections may be added as necessary but a management plan should, at a minimum, include the following elements:

1. Introduction
2. Inventory or Baseline Assessment
3. Impact Assessment
4. Controls
5. Monitoring and Review
6. References and Appendices

Information regarding the contents of each of these sections is provided below:


1. Introduction

Discuss the purpose of the management plan. List the objectives of the management plan. For example, the objectives might include:

- Demonstrate compliance with regulations
- Demonstrate understanding of how the operations interact with the environment
- Demonstrate that environmental effects and risk are as low as reasonably practicable
- Ensure implementation of commitments in the Environmental Impact Assessment (EIA), Environment Management Plan (EMP) or similar documents

Describe the site or project, including references to existing documents. For example, an EIA, EMP or other documents may contain information or data that may support or meet the requirements for the management plan.

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2. Inventory or Baseline Assessment

The management plan must include an inventory or baseline assessment against the existing environment. The term "baseline assessment" is defined as: *"An evaluation of environmental conditions that exist prior to commencement of controlled activities so that there is a means of determining the potential and actual impacts of controlled activities."* The existing environment includes the physical, biological or socioeconomic conditions. Physical conditions refer to climate and meteorology, oceanography, geology/hydrology, air quality and noise, and water resources/water quality. Biological conditions refer to terrestrial and marine biology, species of concern and areas of conservation. Socioeconomic conditions refer to the local or affected population, employment, housing, public services, infrastructure and land use. Again, an EIA or EMP may describe the inventory or baseline assessment.

3. Impact Assessment

The management plan must include an assessment of potential impacts to the resource and quantify the acceptable level of environmental impacts, accounting for regulatory and community expectations. Risk assessment, baseline surveys, monitoring and/or modelling results may be referenced to satisfy the impact assessment requirement, with full results provided in an appendix of the Plan. Alternatively, impacts may be referenced to a document that contains an impact assessment, such as an EIA.

4. Controls

Controls must be identified and implemented to achieve the acceptable level of impacts. If controls are already in place to minimize impacts, these should be referenced. Controls to reduce impacts may not be required if there are findings, analyses, assessments or surveys concluding that there are no sensitive environmental, cultural and community receptors. Applicable performance requirements of this Environment Controls must be addressed.

5. Monitoring and Review

All management plans must include a monitoring and review program to assess the impacts and verify the effectiveness of controls in reducing the impacts from the operation.

6. References and Appendices

Include references of all source documents cited in the plan.

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SPECIFIC REQUIREMENTS FOR MANAGEMENT PLANS

PLAN	REQUIREMENT
Land Management Plan	<p>Land use must be managed to control the risk of adverse environmental impact to biodiversity, water, air and communities through the implementation and maintenance of a Land Management Plan.</p> <ul style="list-style-type: none"> • Identify and map the owned, leased or managed land, freshwater and marine areas, designated protected areas and areas of high conservation value. • Assess the baseline biodiversity and land uses for areas potentially impacted. • Identify and assess contaminated sites and environmental liabilities. • Assess potential impacts on biodiversity and land use. • Quantify the acceptable level of impact to biodiversity and land use, taking into account regulatory requirements and community expectations. • Implement controls designed to achieve the acceptable level of impact to biodiversity and land use. • Implement a monitoring and review program that verifies the effectiveness of controls. • Implement a disturbed land approval procedure for land, freshwater and marine areas that addresses regulatory requirements (Performance Req. 6.5) • Rehabilitate disturbed land in accordance with a documented rehabilitation timetable and consistent with the pre-disturbance land use or alternate land uses developed in consultation with stakeholders (Performance Req. 6.6) • Do not explore, develop or drill within World Heritage listed properties (Performance Req. 6.9a). Do not explore or mine adjacent to World Heritage listed properties unless the proposed activity is compatible with the outstanding universal values (Performance Req. 6.9b). • Identify any boundaries of International Union for the Conservation of Nature (IUCN) Protected Areas Categories I-IV, and do not operate unless a Biodiversity Action Plan was prepared and implemented (Performance Req. 6.9c) • Identify any local IUCN Red List Threatened Species and do not operate where the direct impact will result in their extinction in the wild (Performance Req. 6.9d)
Water Management Plan	<p>Water use and discharge must be managed to control environmental risks to water resources, biodiversity and communities through the implementation and maintenance of a Water Management Plan.</p> <ul style="list-style-type: none"> • Assess the baseline quantity and quality of water potentially impacted. • Assess potential impacts on water quality and quantity. • Quantify the acceptable level of impact to water, taking into account regulatory requirements and community expectations. • Implement controls designed to achieve the acceptable level of impact to water (including quantity and quality criteria limits for water supply sources and discharges). • Implement a monitoring and review program that verifies the effectiveness of controls. • Where high quality water use exceeds or is anticipated to exceed 3,000 mega liters per annum for an operation or project, or where water management is or is anticipated to be a material risk issue:

PLAN	REQUIREMENT
	<ul style="list-style-type: none"> ○ Maintain a quantitative water balance model. ○ Maintain a high quality water use reduction cost curve that identifies potential projects to reduce all high quality water usage. ○ Identify and assess water requirements, supply options and supply risks for the life of the operation. ○ Implement controls designed to deliver water supply requirements for the life of the operation.
Air Emissions Management Plan	<p>Air emissions must be managed to control environmental risk of pollution of the atmosphere and subsequent impacts on water, land, biodiversity and surrounding communities through the implementation and maintenance of an Air Emissions Management Plan.</p> <ul style="list-style-type: none"> ● Maintain an inventory of air emissions that could impact sensitive receptors. ● Assess the baseline air quality at sensitive receptors. ● Assess potential air quality impacts on sensitive receptors. ● Quantify the acceptable level of impact to sensitive receptor's air quality, taking into account regulatory requirements and community expectations. ● Implement controls designed to achieve the acceptable level of impact to sensitive receptor's air quality (including air emissions criteria limits). ● Implement a monitoring and review program that verifies the effectiveness of controls.
Energy and GHG Management Plan	<p>Energy use and greenhouse gas (GHG) emissions must be managed where emissions exceed or are anticipated to exceed 50,000 tonnes CO₂-e per annum for an operation or project through the implementation and maintenance of an Energy and GHG Management Plan.</p> <ul style="list-style-type: none"> ● Identify, evaluate and implement energy reduction and GHG reduction projects based on current and forecasted energy use and GHG emissions. ● Implement a monitoring and review program that verifies the effectiveness of the energy reduction and GHG reduction projects. ● Where emissions exceed or are anticipated to exceed 1,000,000 tonnes CO₂-e per annum, the operation or project must maintain: <ul style="list-style-type: none"> ○ an energy mass balance; ○ a GHG emissions baseline and 5 year forecast (covering 100 percent of GHG emissions); ○ a GHG reduction cost curve that identifies potential projects to reduce all GHG emissions, addressing cost, lead time and implementation options.

PLAN	REQUIREMENT
Waste Management Plan	<p>Waste must be minimized, stored, transported and disposed in a manner that controls the risk of adverse impacts to the environment and communities through implementation and maintenance of a Waste Management Plan.</p> <ul style="list-style-type: none"> • Record the type, source and volume of wastes and the storage, and disposal locations. • Assess the potential environmental impacts of wastes (including during the processes of reuse, recycling, transport, treatment and disposal). • Quantify the acceptable level of environmental impacts, taking into account regulatory obligations and community expectations. • Implement controls designed to achieve the acceptable level of environmental impact (including the tracking of wastes from source to disposal). • Implement a monitoring and review program that verifies the effectiveness of controls. • Implement a monitoring and review program that verifies that waste transport activities and external disposal facilities meet environmental regulatory requirements at least every two years.
Noise and Vibration Management Plan	<p>Noise and Vibration must be managed to control environmental impacts on water, land, biodiversity and surrounding communities through the implementation and maintenance of a Noise and Vibration Management Plan.</p> <ul style="list-style-type: none"> • Maintain an inventory of sources of noise and vibration that could impact sensitive receptors. • Assess the baseline noise and vibration at sensitive receptors. • Assess potential impacts of noise and vibration on sensitive receptors. • Quantify the acceptable level of impact to sensitive receptors, taking into account regulatory requirements and community expectations. • Implement controls designed to achieve the acceptable level of impact to sensitive receptors (including noise and vibration criteria limits). • Implement a monitoring and review program that verifies the effectiveness of controls.
Hydrocarbon Management	<p>Liquid hydrocarbon storage and pipelines must be managed to control the risk of land and water contamination for each operation. A traditional management plan is not required, but compliance is required pursuant to the following performance requirements of Environment Control 6 - Physical Disturbance:</p> <p>6.11. Liquid hydrocarbon storage and pipelines must be identified and mapped, and managed to control the risk of land and water contamination.</p> <p>6.12. All new liquid hydrocarbon storage tanks and pipelines must be constructed above ground unless a risk assessment determines below-ground or subaqueous construction will achieve a lower risk. Additionally, a risk assessment must be conducted for all existing below-ground or subaqueous liquid hydrocarbon storage tanks and pipelines to determine the likelihood of containment failure and any required controls.</p>

APPENDIX B: HIERARCHY OF CONTROLS

Table B1 Waste Management Hierarchy of Controls

Hierarchy	Drilling Muds and Drilled Cuttings ^(7,15)	Combustion Emissions ⁽⁵⁾	Flaring, Venting and Fugitive Emissions ⁽⁷⁾	Produced Water ^(7,9)	Formation Wastes ^(2,3,5)
Eliminate	Inject muds and cuttings downhole.	Utilize non-carbon or renewable energy.	Utilize vapor recovery. Reinject gasses into the producing formation.	Shut in high water producing wells. Reinject into a non-fresh water-bearing formation (new projects to be evaluated for zero-discharge options).	Eliminate the waste through process design. Inject wastes underground into an approved, contained formation.
Reduce	Reduce hydrocarbon concentrations in drilling muds. Use WBM or SBM instead of OBM. Substitute alternative chemicals with low toxicity chemicals.	Incorporate higher efficiency equipment and processes. Switch to cleaner fuels (e.g., lower sulphur diesel or natural gas). Use clean-burn technology (e.g., optimize air-to-fuel ratio). Implement preventative maintenance program.	Utilize efficient flare tips. Reduce source gas Modify operating conditions (e.g., minimize flaring from purges & pilots; reduce over-pressure events with high integrity instrument pressure protection systems, etc.) Implement Leak Detection & Repair (Inspection & Maintenance) Program.	Minimize water production by well completion or work over of high water producing wells. Use downhole fluid separation and water shutoff techniques.	Reduce the quantity of the products used or the quantity of the resultant waste (e.g., use bulk containers instead of drums). Use good inventory control and timely product usage are important to avoid loss of product effectiveness or spoilage. Utilize reusable containers Schedule sequential hydro-testing to reduce water demand and volume of water for subsequent management and disposal. Reduce toxicity by using chlorine-free, lead-free and, mercury-free products
Reuse/recycle	Clean and condition muds for use in multiple wells.	Utilize process heat integration or heat recovery.	Utilize natural gas onsite for energy or export to nearby markets.	If freshwater, use for irrigation, dust control or cooling water.	Reuse, recycle or reclaim (e.g., recycle paper goods, drums, scrap metals, glass and lube oil). Return unused products and

Hierarchy	Drilling Muds and Drilled Cuttings ^(7,15)	Combustion Emissions ⁽⁵⁾	Flaring, Venting and Fugitive Emissions ⁽⁷⁾	Produced Water ^(7,9)	Formation Wastes ^(2,3,5)
					containers to vendor. Use oily wastes or cleaned drill cuttings for road construction and stabilization. Recover oil from tank bottoms and produced water.
Treatment	Separate mud from cuttings. Utilize physical, chemical or biological treatment to reduce solids, remove hydrocarbons (e.g., thermal desorption) or adjust pH.	Apply emission control technology (e.g., flue gas treatment).	Maintain burners to control visible smoke Use reliable pilot ignition system. Optimize flare fuel/air rates to maximize combustion efficiency, etc.	Use gravity or mechanical separation and chemical treatment Use multistage separation system - skim tank, parallel plate separator, gas flotation cell or hydrocyclone.	Neutralize the pH of waste liquids destined for disposal. Destruct, detoxify or neutralize residues using biological methods (composting), thermal methods (incineration), chemical (neutralization) or physical methods (filtration, centrifugation, compaction or shredding).
Disposal	Transport to shore for treatment and disposal, or treat and discharge overboard to marine.	Emit via exhaust stack to atmosphere.	Release to atmosphere (flaring is preferable to venting).	Discharge to sea. If onshore, discharge to evaporation pits. If onshore, utilize third party disposal site.	Dispose using an approved process, contractor and site. Possible methods include landfilling, burial, surface discharge, land spreading or land farming.

References provided in References section.

Table B2 Risk Management Hierarchy of Controls

Hierarchy	Physical Disturbance ^(5,7,15)	Marine Noise ⁽¹⁶⁾
Eliminate	Postpone (wait until a more favorable time) or cancel the operation.	Postpone (wait until a more favorable time) or cancel the operation.
Substitute	Replace the material, process or hazard with a less hazardous one (e.g., trench-less pipeline crossings; directional or extended reach drilling; closed loop systems; shot-hole methods in lieu of vibroseis; low impact seismic techniques; etc.)	Replace the material, process or hazard with a less hazardous one
Redesign	Schedule activities to avoid sensitive temporal or breeding, migratory or spawning periods, or periods of heavy rainfall. Reroute to avoid hard bottom, riparian or sensitive habitats. Employ erosion and sediment control, slope stabilization measures and noise reduction measures.	Schedule activity outside sensitive temporal periods. Employ noise reduction measures.
Separate	Isolate the hazard by guarding or enclosing it (e.g., berms, mufflers, noise barriers, enclosures).	Isolate the hazard by guarding or enclosing it, (e.g., sound enclosures, baffles, etc.).
Administrative	Provide training and procedural control.	Employ Passive Acoustic Monitoring (PAM), Marine Mammal Observers (MMO) training, soft start procedures, etc.
Pollution control devices	Use appropriate impact minimization equipment such as spill clean-up material or dust suppression measures.	Use appropriate control equipment to minimize impacts.

References provided in References section.