PETROLEUM CSG

HSE MANAGEMENT STANDARDS

ENVIRONMENT STANDARDS

Petroleum HSEC Standard No: PR09.02	
Reference: HSEC Management Standard 9 – Design, Construction & Commissioning and Standard 10 – Operations and Maintenance	
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Approver: Dave Banks, Vice President HSE	Signature On File

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INTRODUCTION

BACKGROUND

BHP Billiton Petroleum has identified areas where the CSG either has additional different risks with the potential to cause fatal incidents or harm to the environment than the rest of the company. Petroleum developed the Environment Protocols ("Protocols" is now revised to "Standards") in 2004, revised in 2005, which contained prescriptive requirements to eliminate or minimize environmental impacts at Petroleum controlled operations.

The existence of these Standards does not presume coverage of all HSE impacts or risks faced by our operations, but address the key environmental impacts and risks, many of which are the focus of environmental targets and key performance indicators for the CSG and the Company. Other risk areas that fall outside these Standards are addressed through the risk management process that is a key element of the BHP Billiton HSEC Management Standards.

CHANGES SINCE THE LAST VERSION

This updated document reflects changes in practices and more stringent environmental standards used in the oil and gas industry today. It includes two new Standards that are applicable to oil and gas activities: "Physical Disturbance" and "Marine Noise". Additionally, the Standard for Flaring and Venting now includes requirements for Fugitive Emissions.

Several Standards have been deleted that are more appropriately covered in other BHP Billiton documents and would be duplicative, as noted below:

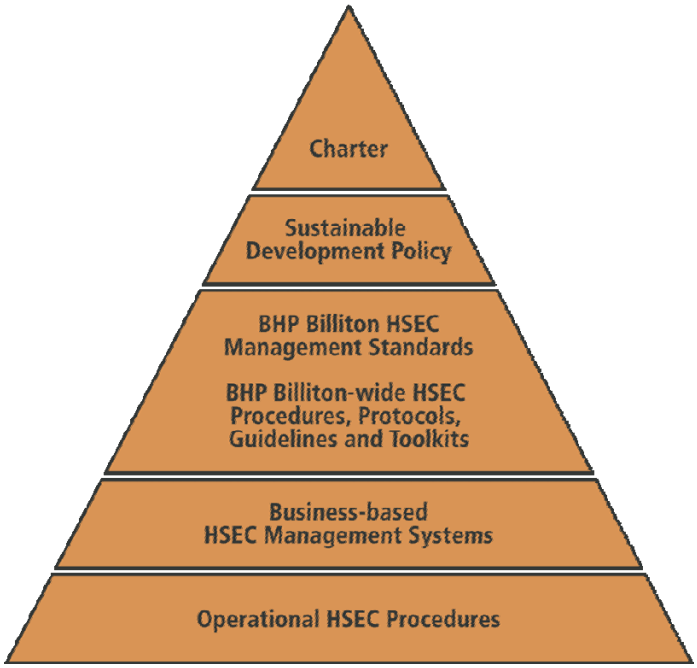
- → Environmental Risk Assessment – covered by the new Risk Management Guideline 1 Management Responsibilities (G01) and Risk Management Guideline 2 Methods and Techniques (G02), Version 1.0 (Aug 2007)[3]
- → Site Selection and Preparation - may be reissued as a stand-alone document in the future
- → Environmental Impact Assessment – covered during the new project investment approval process, and by other HSEC Standards, Guidelines, and Toolkits
- → Environment Plan – covered during the new project investment approval process
- → Environmental Monitoring – developed through Environmental Impact Assessment process
- → Environmental Auditing - covered by other HSEC Standards, Guidelines, Toolkits

The Environment Standards have been formatted similarly to the January 2005 Issue 2 of the Fatal Risk Control Protocols[8] by organizing requirements by plant and equipment, procedures, and people. Additionally, another category, Hierarchy of Controls was added, which specifically reflects a risk management approach[3, 5, 7]. Consequently, when evaluating an environmental risk, the Hierarchy of Controls must be followed consistently with the HSEC Risk Management Guidelines[7].

Each Standard also contains a list of references which provide the basis and additional information on the requirements.

CONTEXT

These Petroleum Environment Standards should be read and used in conjunction with the BHP Billiton Charter[1], Sustainable Development Policy[2], and the HSEC Management Standards[4]. The BHP Billiton HSEC management system, as shown below, is hierarchical where documents and systems must meet and support the requirements of those of higher levels. These Petroleum CSG specific Environment Standards have the same standing as Corporate-wide Standards.



APPLICATION

These Standards apply at all BHP Billiton Petroleum controlled sites and controlled activities, and to all BHP Billiton employees, contractors and visitors when involved in controlled activities. Although these Standards do not apply at uncontrolled sites, they represent sound and prudent environmental practices that would be appropriate to implement, even though not required to do so.

These Standards also apply to Development Projects during design, construction, installation and commissioning phases.

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.

REQUIREMENTS – SHALL VS. SHOULD

The mandatory requirements of these Standards are signified by the use of the word “shall” or “must”. The word “should” indicates a guideline that is strongly recommended.

Petroleum owns and operates a diverse range of assets in different countries and cultures around the world, with varying legal frameworks. The procedures and practices set out in the Standards are to be applied to all controlled Petroleum assets; however, where the laws and regulations applicable to a particular asset impose more stringent standards, Petroleum will comply with such laws and regulations.

RISK MANAGEMENT APPROACH

The risk management approach adopted must be consistent with the BHP Billiton HSEC Risk Management Guideline [7] and follow the **Risk Management Hierarchy of Controls** as shown below.

- → **Eliminate**: The complete elimination of the hazard
- → **Substitute**: Replacing the material or process with a less hazardous one
- → **Redesign**: Redesigning the equipment or work processes
- → **Separate**: Isolating the hazard by guarding or enclosing it
- → **Administrate**: Providing control, such as training, procedures, etc.

A number of these options may be considered and applied individually, or in combination.

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

- → **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**: Reducing the amount of the waste produced
- → **Reuse/recycle**: Reusing or recycling the waste product
- → **Treatment**: Reducing the hazardous nature of the waste, e.g., by incineration
- → **Disposal**: Releasing to atmosphere, marine dumping or landfill of the waste

It is recognised that sound (and formalised) risk management principles are still required (i.e., beyond simple compliance with a mandatory Standard) to identify, quantify, control and reduce either the consequence or likelihood of an impact or risk, through the identification, investigation, assessment and understanding of hazards associated with the activities covered by these Standards.

The nature of hazards and extent of risk may be significantly influenced by changes implemented to operations, processes, equipment, systems, services and people. This requires procedures to assess the effect of these changes and the associated risks. As with any formal risk management process, appropriate change management processes shall be in place at all operations.

The risk management approach adopted for these Standards is consistent with the BHP Billiton Risk Management Guidelines GO1 and G02[3]. The Severity Factor from Appendix 3 “Risk Rating and Ranking Methodology” located in GO2 is included as Table 1 at the end of this section, and is referenced throughout these Standards.

APPROVAL FOR ALTERNATIVE CONTROLS

In circumstances where the specific requirements of these Standards cannot be fully achieved, approval for alternative control measures shall be obtained by providing a comprehensive and documented risk-based management control plan, containing the following:

- → Details of the Standard conformance gap/s;
- → Alternative controls to be implemented;
- → Time frame and associated conditions towards achieving compliance;

- → Assigned single point accountability; and
- → Sign off by the "one up manager" to the most senior line manager of the site/operation/development project

These documented management control plans may take the form of a Decision Sheet, or similar tool.

As stated in section 3.2 of the Risk Management Guideline 2, control improvements are subject to a cost-benefit analysis and require appropriate approval prior to being implemented. Control improvements should follow a Change Management process to ensure that the approved improvements are implemented and managed in a coordinated manner. Business decisions to approve control improvements must consider the balance of risk and reward. This requires an understanding of the risk, the Preventative or Mitigative Controls that are potentially available, the cost-benefit of improving control and the organization's tolerance for this type of risk(3)

SELF ASSESSMENT

The self assessment process is a mandatory requirement of HSEC Management Standards 15 Requirement 4(6). Self assessments shall be conducted against the Environment Standards, at BHP Billiton Petroleum controlled operations, including Global Geophysical Operations (GGO), Worldwide Drilling (WWD), and Production Units (PU). Petroleum Development project activities are excluded as they are independently peer reviewed during the Selection and Definition phases and audited on a regular schedule during Execution phase. Self assessment forms for these Standards are provided on the Petroleum Portal.

STRUCTURE OF THE STANDARDS

The requirements of these Standards are classified into the four broad focus areas:

A Plant and Equipment Requirements

B Procedural Requirements

C People Requirements

D Hierarchy of Controls

These four areas cover the essential controls that are to be in place in order to comprehensively manage these risk categories. The diagram below demonstrates how this approach, combined with committed leadership and supported by our Charter, Sustainable Development Policy, and HSEC Management Standards is designed to deliver our goal of Zero Harm.

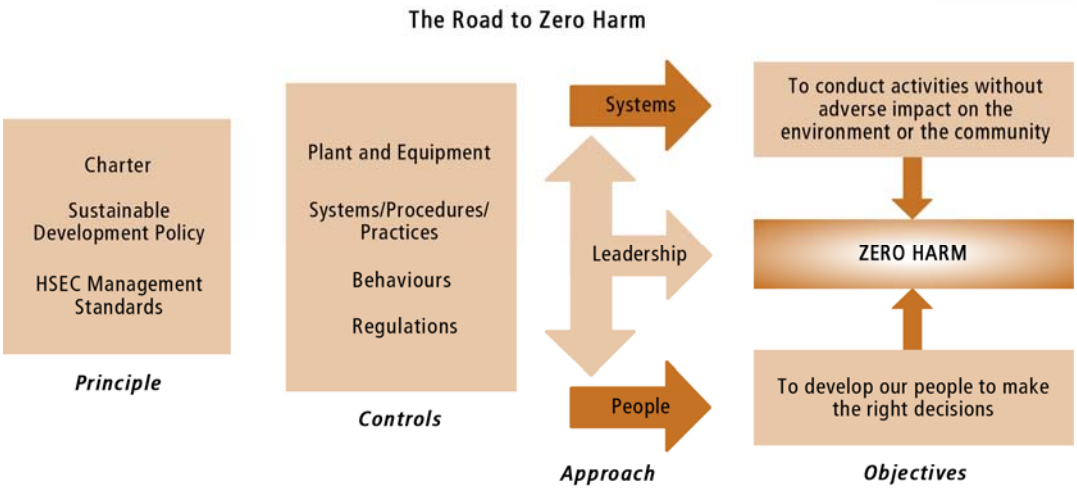


TABLE 1 - SEVERITY FACTOR

Severity Level	Impact Types						Severity Factor
	Financial Impact	Health and safety	Natural environment	Social/cultural heritage	Community/Govt/ Reputation/ Media	Legal	
7	>US$1 billion	> 500 fatalities or very serious irreversible injury to >5000 persons.	Very significant impact on highly valued species, habitat or eco system.	Irreparable damage to highly valued items of great cultural significance or complete breakdown of social order	Prolonged international condemnation.	Potential jail terms for executives and/or very high fines for company. Prolonged, multiple litigation.	1000
6	US$100 million- US$1 billion	>50 fatalities, or very serious irreversible injury to >500 persons.	Significant impact on highly valued species, habitat, or ecosystem.	Irreparable damage to highly valued items of cultural significance or breakdown of social order.	International multi-NGO and media condemnation.	Very significant fines and prosecutions. Multiple litigation.	300
5	US$10 million – US$100 million	Multiple fatalities, or significant irreversible effects to >50 persons.	Very serious, long-term environmental impairment of ecosystem function.	Very serious widespread social impacts. Irreparable damage to highly valued items.	Serious public or media outcry (international coverage).	Significant prosecution and fines. Very serious litigation, including class actions.	100
4	US$1 million – US$10 million	Single fatality and/or severe irreversible disability (>30%) to one or more persons.	Serious medium term environmental effects.	On-going serious social issues. Significant damage to structures/ items of cultural significance.	Significant adverse national media/public/NGO attention.	Major breach of regulation. Major litigation.	30
3	US$100,000 – US$1 million	Moderate irreversible disability or impairment (<30%) to one or more	Moderate, short-term effects but not affecting ecosystem function.	Ongoing social issues. Permanent damage to items of cultural	Attention from media and/or heightened concern for local community.	Serious breach of regulation with investigation or report to authority with	10

		persons.		significance.	Criticism by NGO's.	prosecution and/or moderate fine possible.	
2	US$10,000 – US$100,000	Objective but reversible disability requiring hospitalisation.	Minor effects on biological or physical environment.	Minor medium-term social impacts on local populations. Mostly repairable.	Minor, adverse local public or media attention and complaints.	Minor legal issues, non-compliances and breaches of regulation.	3
1	<US$10,000	No medical treatment required	Limited damage to minimal area of low significance.	Low-level repairable damage to commonplace structures.	Public concern restricted to local complaints.	Low-level legal issue.	1

Source: BHP Billiton. 2007. Risk Management Risk Management Guideline 2, Methods and Techniques (G02), Version 1.0, Appendix 3 - Risk Rating and Ranking Methodology, Table 4 Severity Factor, August 2007

REFERENCES

1. BHP Billiton. 2007. BHP Billiton Charter. October 2007.

2. BHP Billiton. 2007. Contributing to Sustainable Development at BHP Billiton. Policy Guide September 2005, electronic update October 2007.

3. BHP Billiton. 2007. Risk Management Guideline 1 Management Responsibilities (G01) and Risk Management Guideline 2 Methods and Techniques (G02), Version 1.0, August 2007.

4. BHP Billiton. 2005 Health, Safety, Environment and Community (HSEC) Management Standards. Contributing to Sustainable Development. Issue No. 3, September 2005.

5. BHP Billiton. 2005. HSEC Management Standard 3, Risk and Change Management. Issue No. 3, September 2005.

6. BHP Billiton. 2005. HSEC Management Standard 15, Monitoring, Audit and Review. Issue No. 3, September 2005.

7. BHP Billiton. 2005. HSEC Risk Management Guidelines No. G19, Revision No. 2.1, February 2005.

8. BHP Billiton. 2005. Fatal Risk Control Protocols. Protocol 5 Hazardous Materials Management, Issue 2, January 2005.

1 DRILLING MUDS AND DRILLED CUTTINGS

INTENT

To eliminate or minimize the environmental impacts resulting from the discharge of drilling fluids and cuttings.

APPLICATION

This Standard applies to all drilling, completions, or well work over operations where drill fluids or cuttings may be discharged, including extended reach drilling, horizontal directional drilling or horizontal directional boring.

REASON FOR INCLUSION

Drilling fluids and cuttings are the largest volume wastes associated with drilling activities.

Drilling fluids are categorized as water based mud (WBM), oil based mud (OBM) or synthetic base mud (SBM). In formulating drilling fluids, various polymers, weighting agents, gelling agents and chemicals are added to increase specific gravity, improve viscosity, reduce corrosivity and improve well bore stability. During the course of drilling, drill mud also accumulates solids (cuttings) from the well bore and possibly oil, if oil-bearing formations have been penetrated.

Toxicity is a critical characteristic of drill mud and cuttings considering these are often discharged into the sea offshore or may be stored/disposed in earthen pits onshore. Adverse impacts due to toxicity may occur to water quality or marine life offshore or to groundwater, wildlife or local populations onshore 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.

REQUIREMENTS

The mandatory requirements of these Standards are signified by the use of the word “shall”.

The word “should” indicates a guideline that is strongly recommended. However, there will be circumstances where local conditions may demonstrate that the requirement is either not applicable or an alternative approach is necessary. In cases where “shall” has been used in a requirement, variation can only be considered as compliance if the most Senior Line Manager of the operation approves it based on an evaluation of the risk. The risk management approach adopted must be consistent with the BHP Billiton HSEC Risk Management Guideline[5] and follow the appropriate Hierarchy of Controls (Waste Management Hierarchy of Controls and/or Risk Management Hierarchy of Controls)

The requirements of this Standard are:

A PLANT AND EQUIPMENT REQUIREMENTS

1. Where an SBM or 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 shall be used.

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.

3. Onshore, pits associated with drilling and completion operations shall 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 shall be sized to ensure that overflow associated with rainfall will not occur.

B PROCEDURAL REQUIREMENTS

1. Low toxicity WBM should be evaluated for all drilling activities except for hole sections where technical justification for use of SBM or OBM is provided [(1)].

2. No overboard discharge of OBM or OBM contaminated cuttings shall be allowed [(3)].

3. Use of fresh-water WBM shall be used when drilling through known and potential fresh water aquifer formations.

4. The selection of base drilling fluids, drilling muds and completion fluids, including chemicals and additives, shall be based on risk assessments[(4)]. These risk assessments shall compare the HSE performance of the base drilling fluids and/or whole drilling mud systems (utilizing Material Safety Data Sheets (MSDS) and an assessment of ecotoxicity data) against cost, efficiency, capability and availability. Where improved HSE performance of the drilling mud does not come at a grossly disproportionate cost, it shall be selected.

5. Where the severity factor associated with the potential impacts of drilling muds and drilled cuttings management exceeds a residual impact/risk of 30, the drilling muds and drilled cuttings shall be reinjected[(2)].

6. Offshore, excess or surplus dry bulk cement shall not be discharged overboard, unless specifically allowed by local regulations.

7. Ecotoxicity testing (acute, sublethal and/or chronic) shall 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 drilling operation.

8. Hydrodynamic modelling to predict the extent of impacts to offshore habitat shall be conducted or any drilling mud and drilled cuttings discharge that may impact shoreline, near shore areas or areas protected for the purposes of conservation. Baseline benthic monitoring data shall be gathered to predict the extent of impacts of benthic habitat as a result of any drilling mud and drilled cuttings discharge.

C PEOPLE REQUIREMENTS

1. A training program for drilling personnel and contractors associated with equipment or procedures specific to drilling muds or drilled cuttings shall be conducted prior to activities to discuss environmental impacts and proposed management measures to reduce impacts of drilling muds and drilled cuttings. The training program shall include an environmental awareness program to provide awareness of specific temporal or spatial sensitivities (for example, flora, fauna or habitat).

2. The risk assessment process shall include people with relevant subject knowledge expertise. Consideration should be given regarding the use of external people[(4)].

3. Personnel response to an unplanned or unauthorized drilling fluid release shall be immediate in accordance with the site's response plan.

4. A system shall be implemented to ensure that monitoring, recordkeeping and reporting requirements are achieved.

D HIERARCHY OF CONTROLS

1. During design of new facilities, management measures in line with the Waste Management Hierarchy of Controls should be evaluated (e.g., injection is preferable to overboard disposal). A risk-based process shall be used to identify the appropriate options for drilling mud and drilled cuttings management. The risk assessment shall take into account the following factors:

   - → Location of sensitive receptors (flora, fauna);
   - → Water quality (surface, ground or marine);
   - → Temporal sensitivities (for example, coral spawning);
   - → Spatial sensitivities (habitat);
   - → Persistence of the drilling muds;
   - → The potential long-term liabilities for the various disposal alternatives; and
   - → Public perceptions and emerging regulations concerning disposal alternatives.

2. Design of control measures selected should evaluate the highest end of the hierarchy of control. Any deviation to a lower level of control shall demonstrate that the higher option cannot be implemented (e.g., safety considerations, infrastructure restrictions, the cost of implementation is grossly disproportionate to the benefits gained, etc).

3. The Waste Management Hierarchy of Controls that applies to drilling muds and drilled cuttings includes:[6, 7]

Waste Management Hierarchy of Controls	
Eliminate	Injection of muds and cuttings downhole
Reduce	Reduce hydrocarbon concentration of drilling muds; substitute OBM with WBM or SBM. Reduce/ minimize volumes. Substitute alternative chemicals with low toxicity chemicals.
Reuse/recycle	Recirculate and recover drilling mud
Treatment	Separate mud from cuttings; utilize chemical or biological treatment to reduce solids, remove hydrocarbons, adjust pH
Disposal	Ship to shore for treatment & disposal, or treat and discharge to sea

REFERENCES

1. Australian Petroleum Production and Exploration Association Limited (APPEA). 1996. Code of Environmental Practice. Drilling Program Planning Section 4.3.1, p. 22 and Section 5.3.1, p. 50.

2. BHP Billiton. 2007. Risk Management Guidelines 2 Methods and Techniques (G02), Version 1.0, August 2007.

3. BHP Billiton Petroleum. 2007. Waste Management Manual Gulf of Mexico, Revision 10. August 8, 2007.

4. BHP Billiton. 2005. HSEC Management Standard 3, Risk and Change Management. Issue No. 3, September 2005.

5. BHP Billiton. 2005. HSEC Risk Management Guidelines No. G19, Revision No. 2.1, February 2005.

6. International Finance Corporation (IFC). 2007. Environmental, Health, and Safety Guidelines for Offshore Oil and Gas Development. World Bank Group, April 30, 2007, pp. 7-8.

7 IFC. 2007. Environmental, Health, and Safety Guidelines for Onshore Oil and Gas Development. World Bank Group, April 30, 2007, pp. 8-10.

2 COMBUSTION EMISSIONS

INTENT

To eliminate or minimize the environmental impacts resulting from the emission of products of combustion.

APPLICATION

This Standard applies to the combustion of all fuels in engines, turbines and process equipment. Marine vessel engines associated with exploration, development and production are included. Combustion emissions associated with flaring are addressed in Standard 3.

REASON FOR INCLUSION

Products of combustion include water vapour, carbon dioxide (CO_2), carbon monoxide, sulphur dioxide (SO_2), nitrogen oxides (NO_x), particulates and unburned hydrocarbons. These emissions may lead to degradation of local air quality if discharged in excessive amounts. Some of these emissions (CO_2 and unburned hydrocarbons) also contribute to the atmospheric greenhouse gas load, which will result in global warming.

BHP Billiton's corporate Climate Change Policy (October 2007)[1] states that we will improve management of energy and greenhouse gas emissions from production at our sites. Further, the intent of BHP Billiton's HSEC Management Standard No. 12 (Stewardship)[3] is that lifecycle HSEC impacts associated with resources, materials, processes and products are minimised and managed.

Additionally, the Climate Change Policy states that carbon pricing sensitivity analyses and Greenhouse Gas (GHG) Emissions Management Plans are required of all sites with GHG emissions greater than 100,000 tonnes per year of CO_2 equivalent. The control and reduction of combustion emissions will have a direct impact in the reduction and management of GHG emissions.

REQUIREMENTS

The mandatory requirements of these Standards are signified by the use of the word "shall".

The word "should" indicates a guideline that is strongly recommended. However, there will be circumstances where local conditions may demonstrate that the requirement is either not applicable or an alternative approach is necessary. In cases where "shall" has been used in a requirement, variation can only be considered as compliance if the most Senior Line Manager of the operation approves it based on an evaluation of the risk. The risk management approach adopted must be consistent with the BHP Billiton HSEC Risk Management Guideline[6] and follow the appropriate Hierarchy of Controls (Waste Management Hierarchy of Controls and/or Risk Management Hierarchy of Controls).

The requirements for this Standard are:

A PLANT AND EQUIPMENT REQUIREMENTS

1. Carbon pricing sensitivity analyses shall be conducted in capital decisions on assets of US$100 million or more or those that emit greater than 100,000 tonnes of CO_2 equivalent per year[1].

2. Natural gas shall be the preferred fuel at production facilities. Where natural gas is not available, diesel may be used for fuel.

3. Where diesel or fuel oil are used as the fuel source, low sulphur diesel or fuel oil (containing sulphur equal to or less than 500 ppm)[8] shall be used. If low sulphur diesel or fuel oil is unavailable, SO_2 controls (e.g., flue gas desulphurization equipment) should be considered for major emissions sources (equipment operated continuously, e.g., power generator turbines or engines).

4. Where energy is required from power grid sources, power from renewable sources should be evaluated[1, 5].

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 life cycle fuel costs and the relative contributions to the overall environmental impact from atmospheric pollutants, GHG, and fuel efficiency).

6. Waste heat recovery shall be undertaken for new facilities or opportunistic retrofit[1, 3, 5] and carbon pricing sensitivity analyses shall be conducted if GHG emissions are greater than 100,000 tonnes per year of CO_2 equivalent[1].

7. Non-carbon energy sources should be evaluated for use for non-critical equipment on fixed or permanent installations.

8. Electronic controls should be evaluated for use to optimize air-to-fuel ratios on Petroleum-owned engines.

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, carbon monoxide and volatile organic compounds.

10. On engines rated 3MWth-50MWth (megawatt thermal, i.e., heat input based on high heating value) owned by Petroleum, NO_x emissions shall not exceed the following: 200 mg/m^3 from spark ignition gas engines; 400 mg/m^3 from dual fuel engines; or 1600 mg/m^3 from compression ignition gas engines (at dry gas oxygen content of 15 percent)[7].

11. Variable speed drivers should be considered to optimize mechanical and energy efficiency in BHP Billiton-owned equipment.

B PROCEDURAL REQUIREMENTS

1. Where the severity factor associated with the potential impacts of combustion emissions exceeds a residual impact/risk of 30 (based on Risk Management Severity Factor), additional controls shall be implemented[2].

2. An assessment of energy efficiency shall be conducted during the selection of new or replacement equipment for fixed or permanent installations[1, 3, 5]. Energy efficiency evaluations are case-specific for the selection of the required parameters to conduct a life cycle analysis. Carbon pricing sensitivity analyses shall be undertaken on assets of US$100 million or more or those that emit greater than 100,000 tonnes of CO_2 equivalent per year[1].

3. A risk-based maintenance program shall be utilized in all operations to ensure that equipment is operating properly. Personnel working at Petroleum sites shall 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.

4. The following leading management practices shall be implemented for combustion sources:

   → Reduce emissions of diesel particulate matter and other air pollutants by using particle traps and other technological or operational methods;

- → 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 (schools, day care centres, and hospitals);
- → Require that vehicles purchased and on long term lease shall be less than 10 years old and operate using "clean energy," e.g., a minimum of 75 percent of the equipment's total horsepower, to the extent feasible; and
- → Use engine types such as electric, liquefied gas, hydrogen fuel cells, and/or alternative diesel formulations, where available.

5. Energy efficiency improvement goals and action plans shall be established annually to reduce emission levels from operations on a normalized year-by-year basis[1, 3, 5].

6. Carpool shuttles and vans should be evaluated for transport of construction workers to and from construction sites, and 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.

C PEOPLE REQUIREMENTS

1. A training program for personnel and contractors associated with equipment or procedures specific to combustion emissions shall be conducted prior to and during activities to discuss environmental impacts and proposed management measures to reduce impacts of combustion emissions. The training program shall include incorporate an environmental awareness program to provide awareness of the effects of atmospheric emissions, such as GHG and its associated relationship with climate change.

2. Personnel shall be competent in the use and maintenance of equipment resulting in combustion emissions.

3. The risk assessment process shall include people with relevant subject knowledge expertise. Consideration should be given regarding the use of external people.

4. A system shall be implemented to ensure that monitoring, recordkeeping and reporting requirements are achieved.

D HIERARCHY OF CONTROLS

1. During design of new facilities, management measures in line with the Waste Management Hierarchy of Controls should be evaluated (e.g., renewable energy sources are preferable to hydrocarbon energy sources). The risk assessment shall take into account the following factors:

   - → location of sensitive receptors (flora, fauna)
   - → water quality (surface, ground or marine) and land quality
   - → temporal sensitivities (for example whale migration or coral spawning)
   - → spatial sensitivities (habitat)
   - → persistence, toxicity and volume of the waste

2. Design of control measures selected should evaluate the highest level in the hierarchy of controls consistent with achieving the best energy efficiency / combustion emissions abatement outcomes. Any deviation to a lower level of control shall demonstrate that the higher option cannot be implemented (e.g., safety considerations, infrastructure restrictions, the cost of implementation is grossly disproportionate to the benefits gained, etc).

3. The Waste Management Hierarchy of Controls that applies to combustion emissions includes:[7]

Waste Management Hierarchy of Controls	
Eliminate	Utilize non-carbon or renewable energy
Reduce	Higher efficiency equipment and process; process modification; fuel switching (lower sulphur content of fuel); cleaner fuels (e.g., natural gas); clean burn technology; modification of operating conditions (e.g., reducing peak temperature); preventative maintenance program (e.g., optimize air-to-fuel ratio)
Reuse/recycle	Process heat integration / process heat recovery
Treatment	Apply emission control technology (e.g., flue gas treatment)
Disposal	Exhaust stack or vent to atmosphere

REFERENCES

1. BHP Billiton. 2007. Climate Change Policy. October 2007.

2. BHP Billiton. 2007. Risk Management Guideline 2, Methods and Techniques (G02), Version 1.0, Appendix 3, Table 4: Severity Factor. August 2007.

3. BHP Billiton. 2007. HSEC Management Standards, No. 12, Stewardship. Electronic update October 2007.

4. BHP Billiton. 2007. Greenhouse Gas Emissions, HSEC Toolkit No. 10, May 23, 2007.

5. BHP Billiton. 2005. Energy and Greenhouse. HSEC Guideline No. G17, December 16, 2005.

6. BHP Billiton. 2005. HSEC Risk Management Guidelines No. G19, Revision No. 2.1, February 2005.

7. International Finance Corporation. 2007. Environmental, Health, and Safety General Guidelines. World Bank Group, April 30, 2007.

3 FLARING, VENTING AND FUGITIVE EMISSIONS

INTENT

To eliminate or minimize the environmental impacts resulting from the flaring, venting, or fugitive release of natural gas or liquid hydrocarbons, or CO_2 venting from acid gas removal system at LNG processing facilities.

APPLICATION

This Standard applies to all 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.

REASON FOR INCLUSION

The combustion emissions from flares and unburned natural gas from vents and leaks (fugitive gases) associated with well testing, production and processing operations, and ship/tanker loading and loading, can result in personnel exposure, may lead to local air quality degradation and contribute to global atmospheric greenhouse gas levels.

BHP Billiton's corporate Climate Change Policy (October 2007)[2] states that we will improve management of energy and greenhouse gas emissions from production at our sites. Further, the intent of BHP Billiton's HSEC Management Standard No. 12 (Stewardship)[3] is that lifecycle HSEC impacts associated with resources, materials, processes and products are minimised and managed.

Additionally, BHP Billiton's Climate Change Policy states that carbon pricing sensitivity analyses and Greenhouse Gas (GHG) Emissions Management Plans are required of all sites with GHG emissions greater than 100,000 tonnes per year of CO_2 equivalent. The control and reduction of flaring, venting, and fugitive emissions will have a direct impact in the reduction and management of energy and GHG emissions.

Identified sources of flaring, venting and fugitive releases include:

- → flare/vent stacks
- → process upsets
- → tank vents
- → pressure relief valves
- → routine low-pressure venting from instruments and controls
- → leaking valves, flanges, connections and pumps

REQUIREMENTS

The mandatory requirements of these Standards are signified by the use of the word "shall".

The word "should" a guideline that is strongly recommended. However, there will be circumstances where local conditions may demonstrate that the requirement is either not applicable or an alternative approach is necessary. In cases where "shall" has been used in a requirement, variation can only be considered as compliance if the most Senior Line Manager of the operation approves it based on an evaluation of the risk. The risk management approach adopted must be consistent with the BHP Billiton HSEC Risk Management Guideline[8] and follow the appropriate Hierarchy of Controls (Waste Management Hierarchy of Controls and/or Risk Management Hierarchy of Controls)

The requirements for this Standard are:

A PLANT AND EQUIPMENT REQUIREMENTS

1. Carbon pricing sensitivity analyses shall be conducted in capital decisions on assets of US$100 million or more or those that emit greater than 100,000 tonnes of CO_2 equivalent per year[(2)].

2. Where flaring is undertaken on facilities or drilling rigs, high efficiency flare equipment shall be utilized[(9)].

3. Smokeless flare equipment should be evaluated for use at all production facilities[(9)] 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[(11)], or equivalent measurement.

4. Use of ground flares should be evaluated as an alternative to tower flares. Utilization of ground flare vs. tower flare shall be weighed alongside safety factors when considering it as an alternative.

5. Vapour recovery equipment should be evaluated for new facilities or opportunistic retrofit for all planned or steady state venting sources.

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.

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.

8. Compressed air should be evaluated for use instead of natural gas for powering instruments and controllers.

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 system 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.

B PROCEDURAL REQUIREMENTS

1. Where the severity factor associated with the potential impacts of flaring or venting exceeds a residual impact/risk of 30 (based on Risk Management Severity Factor), additional controls shall be implemented[(4)].

2. There shall 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. The quantities of gas vented and flared, excluding fugitive emissions, shall be measured (preferably) or estimated (alternatively), recorded and reported internally[(3, 9, 10)].

4. Where flared well tests are anticipated, drilling contractors shall be selected on the basis of flare control equipment on the drilling rig being available.

5. In the absence of any regulatory requirements, a decision process on whether to conduct flared well tests should evaluate the environmental impacts.

6. A preventive maintenance program shall include procedures to ensure that gas leaks are not occurring and that control and flare equipment are working properly[9, 10].

7. If the volatile organic compound (VOC) emissions from tankers are regulated in ports or terminals under the jurisdiction of a party to the MARPOL 73/78 Protocol of 1997, selection of shipping / tanker contractors shall ensure vessels are equipped with vapour return systems [10].

8. Carbon offsets should be evaluated and considered for any planned GHG emissions associated with flared, vented, or fugitive emissions[6,7]

C PEOPLE REQUIREMENTS

1. A training program for site personnel and contractors associated with equipment or procedures specific to flaring, venting or fugitive emissions shall be conducted prior to activities to discuss environmental impacts and proposed management measures to reduce the impacts of flaring, venting and fugitive emissions. The training program shall include an environmental awareness program to provide awareness of specific temporal or spatial sensitivities (for example, air quality).

2. The risk assessment process shall include people with relevant subject knowledge expertise. Consideration should be given regarding the use of external people.

3. Personnel response to an emergency upset resulting in unplanned flaring or venting shall be immediate in accordance with the site operating procedures and/or response plan.

4. A system shall be implemented to ensure that monitoring, recordkeeping and reporting requirements are achieved.

D HIERARCHY OF CONTROLS

1. During design of new facilities, management measures in line with the Waste Management Hierarchy of Controls should be evaluated[3] (e.g., reinjection of gas is preferable to flaring[9]). The BHP Billiton Carbon Price Protocol shall be applied to the selected decision[5]. The risk assessment shall take into account the following factors:

   - location of sensitive receptors (flora, fauna)
   - water quality (surface, ground or marine) and land quality
   - temporal sensitivities (for example whale migration or coral spawning)
   - spatial sensitivities (habitat)
   - persistence, toxicity and volume of the waste

2. Design of control measures selected should evaluate the highest end of the hierarchy. Any deviation to a lower level of control shall demonstrate that the higher option cannot be implemented (e.g., safety considerations, infrastructure restrictions, the cost of implementation is grossly disproportionate to the benefits gained, etc).

3. The Waste Management Hierarchy of Controls that applies to flaring, venting and fugitive emissions includes:[1, 9]

Waste Management Hierarchy of Controls	
Eliminate	Reinjection of uncombusted hydrocarbon gas into a contained formation
Reduce	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.) Leak Detection & Repair (Inspection & Maintenance) Program
Reuse/recycle	Utilize gas onsite for energy, or export to nearby markets.
Treatment	Utilize wind guards; burner maintenance; control of visible smoke; utilize reliable pilot ignition system; optimize flare fuel/air/stream flow rates to maximize combustion efficiency, etc.
Disposal	Release to atmosphere (flaring is preferable to venting)

REFERENCES

1. Australian Petroleum Production and Exploration Association Limited (APPEA). 1996. Code of Environmental Practice.

2. BHP Billiton. 2007. Climate Change Policy. October 2007.

3. BHP Billiton. 2007. HSEC Management Standards, No. 12, Stewardship. Electronic update October, 2007.

4. BHP Billiton. 2007. Risk Management Guideline 2, Methods and Techniques (G02), Version 1.0, Appendix 3, Table 4: Severity Factor. August 2007.

5. BHP Billiton. 2007. Carbon Price Protocol. August 6, 2007.

6. BHP Billiton. 2007. Greenhouse Gas Emissions, HSEC Toolkit No. 10, May 23, 2007.

7. BHP Billiton. 2005. Energy and Greenhouse. HSEC Guideline No. G17, December 16, 2005.

8. BHP Billiton. 2005. HSEC Risk Management Guidelines No. G19, Revision No. 2.1, February 2005.

9. International Finance Corporation. 2007. Environmental, Health, and Safety Guidelines for Offshore Oil and Gas Development. World Bank Group, April 30, 2007.

10. International Maritime Organization. 2006. International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78), Annex VI, Regulation 15 Volatile Organic Compounds.

11. U.S. Department of Interior, Bureau of Mines. 1967. Ringelmann Smoke Chart (Revision of IC 7718). May 1967.

12. U.S. Department of Interior, Minerals Management Service (MMS). 2007. Flaring or venting gas and burning liquid hydrocarbons. Code of Federal Regulations, Title 30 Part 250.1105 (30 CFR 250.1105). July 1, 2007.

4 PRODUCED FORMATION WATER

INTENT

To eliminate or minimize the environmental impact resulting from the discharge of produced formation water (PFW).

APPLICATION

This Standard applies to the onshore and offshore treatment and discharge of all PFW co-produced with oil and gas. This Standard does not apply to other potential water discharge sources including deck drainage, sanitary wastewater and surface run-on/run-off at onshore sites.

REASON FOR INCLUSION

PFW is the largest liquid waste material from production operations, and typically increases in volume as an oil and gas reservoir is depleted.

In many operating sites, the PFW is injected into the reservoir to maintain reservoir pressures. However, at some point in most oil and gas production operations, it becomes necessary to discharge/dispose of PFW.

Offshore and onshore discharges of PFW may have significant impact on localized water quality, leading to potential harm to flora and fauna. Additionally, onshore disposal must also consider the potential for land and water contamination.

The physical characteristics and chemical composition of PFW give rise to the concerns for potential water and land degradation. The aspects of concern associated with PFW typically include hydrocarbon content (e.g., total hydrocarbons, polycyclic aromatic hydrocarbons (PAH), and benzene, toluene, ethyl benzene and xylenes, or BTEX), heavy metal concentrations, hypersalinity, temperature, pH, presence of Naturally Occurring Radioactive Materials (NORMs), and residual chemical concentrations co-mingled with the PFW (e.g., corrosion inhibitors, scale inhibitors, emulsion and reverse emulsion breakers, biocides and hydrate inhibitors).

REQUIREMENTS

The mandatory requirements of these Standards are signified by the use of the word “shall”.

The word “should” indicates a guideline that is strongly recommended. However, there will be circumstances where local conditions may demonstrate that the requirement is either not applicable or an alternative approach is necessary. In cases where “shall” has been used in a requirement, variation can only be considered as compliance if the most Senior Line Manager of the operation approves it based on an evaluation of the risk. The risk management approach adopted must be consistent with the BHP Billiton HSEC Risk Management Guideline[(2)] and follow the appropriate Hierarchy of Controls (Waste Management Hierarchy of Controls and/or Risk Management Hierarchy of Controls)

The requirements for this Standard are:

A PLANT AND EQUIPMENT REQUIREMENTS

1. Offshore, inline oil-in-water analysers with shut-downs/auto-bypasses, or manual sampling and testing, shall be used for all PFW overboard discharges to minimize the possibility of off-spec water being discharged.

2. Onshore, storage of produced water should be evaluated. Preference should be given to storage in tanks over pits/ponds.. If tanks are used they shall be bunded such that 110% of the volume of the largest single tank, or 25% of the total storage capacity (whichever is greater)[3] is capable of being contained in the event of a tank release. If pits/ponds are used, they shall 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.

B PROCEDURAL REQUIREMENTS

1. The selection of an appropriate option shall demonstrate consistency with the Waste Management Hierarchy of Controls; however where the severity factor associated with the potential impacts of PFW management exceeds a residual impact/risk of 30 (based on Risk Management Severity Factor), the PFW shall be reinjected[1].

2. The selection and usage of chemicals associated with PFW should be evaluated, based on risk assessments and cost benefit analysis. These risk assessments shall compare the HSE performance of the chemicals (utilizing Material Safety Data Sheets (MSDS) and an assessment of ecotoxicity data) against cost, efficiency, capability and availability. Where improved HSE performance of the chemical does not come at a grossly disproportionate cost, it shall be selected.

3. Prior to initiating disposal or discharge of PFW, the baseline condition of the receiving medium and surrounding environment shall be established. Modelling of the zone of effect from produced water shall be undertaken and the results shall be included in the environmental impact/ risk assessment for the facility.

4. Baseline testing or annual monitoring shall 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 shall 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 shall trigger a review of the environmental risk assessment for the facility (including re-running modelling).

5. For offshore discharges of PFW, the 24-hour average oil and grease concentration shall not exceed 30 mg/l[4]. In cases where local regulations stipulate lower limits, the lower figure shall apply. This requirement shall be implemented for new facilities or for existing facilities, at the next scheduled opportunity for equipment replacement or retrofit.

6. Sampling procedures and laboratory tests shall comply with internationally accepted standards and protocols, such as ISO 9377-2 (Mod) for determination of oil in PFW[5].

7. The volumes of PFW discharges and oil-in-water concentrations shall be recorded and reported internally, and externally as required by local regulatory requirements.

8. On a daily basis, PFW treatment and disposal systems shall be monitored and checked for proper performance to ensure compliance with regulations and applicable company standards.

9. Where chemicals are used for PFW treatment, and PFW is discharged overboard, records of usage shall be maintained, including hazard class, concentrations, and volumes discharged.

10. Ecotoxicity testing (acute and sublethal and/or chronic) shall be conducted on PFW as part of any impact/risk assessment associated with PFW discharge. Ecotoxicity testing shall 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.

C PEOPLE REQUIREMENTS

1. A training program for site personnel and contractors associated with equipment or procedures specific to PFW shall be conducted prior to activities to discuss environmental impacts and proposed management measures to reduce impacts of PFW discharge. The training program shall include an environmental awareness program to provide awareness of specific temporal or spatial sensitivities (for example, flora, fauna or habitat).

2. The risk assessment process shall include people with relevant subject knowledge expertise. Consideration should be given regarding the use of external people.

3. Personnel shall be competent in the use and maintenance of equipment used for monitoring, sampling, analysis and discharge of PFW.

4. A system shall be implemented to ensure that monitoring, recordkeeping and reporting requirements are achieved.

D HIERARCHY OF CONTROLS

1. During design of new facilities, management measures in line with the Waste Management Hierarchy of Controls should be evaluated (e.g., reinjection of PFW is preferred to overboard discharge). A risk-based process shall be used to identify the appropriate options for PFW management. The risk assessment shall take into account the following factors:

    a. location of sensitive receptors (flora, fauna)
    b. water quality (surface, ground or marine) and land quality
    c. temporal sensitivities (for example whale migration or coral spawning)
    d. spatial sensitivities (habitat)
    e. persistence of the PFW (including associated production chemicals)

2. Design of control measures selected should evaluate the highest end of the hierarchy. Any deviation to a lower level of control shall demonstrate that the higher option cannot be implemented (e.g., safety considerations, infrastructure restrictions, the cost of implementation is grossly disproportionate to the benefits gained, etc.).

3. The Waste Management Hierarchy of Controls that applies to PFW includes[4]:

Waste Management Hierarchy of Controls	
Eliminate	Shut in high water producing wells Reinject into a non-fresh water bearing formation (new projects to be evaluated for zero-discharge options).
Reduce	Minimize water production by adequate well management during well completion, or work over of high water producing wells; use down hole fluid separation techniques and water shutoff techniques.
Reuse/recycle	Utilize for irrigation; dust control; waste heat recovery; cooling water
Treatment	Gravity/mechanical separation and chemical treatment; multistage system - skim tank, parallel plate separator, gas flotation cell or hydrocyclone
Disposal	Discharge to sea (maximum one day oil and grease discharge should not exceed 30 mg/l[4]. Onshore discharge to lined evaporation pits; third party disposal

REFERENCES

1, BHP Billiton. 2007. Risk Management Guideline 2, Methods and Techniques (G02), Version 1.0, Appendix 3, Table 4: Severity Factor. August 2007.

2. BHP Billiton. 2005. HSEC Risk Management Guidelines No. G19, Revision No. 2.1, February 2005.

3. International Finance Corporation (IFC). 2007. Environmental, Health, and Safety Guidelines for Offshore Oil and Gas Development. World Bank Group, April 30, 2007.

4. Oslo and Paris Commission (OSPAR). 2006. OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic. OSPAR Recommendation 2001/1 adopted by OSPAR 2001 (OSPAR 01/18/1, Annex 5), Amended by OSPAR Recommendation 2006/4 (OSPAR 06/23/1, Annex). OSPAR Recommendation 2001/1 for the Management of Produced Water from Offshore Installations.

5. OSPAR. 2005. Agreement 2005/15. OSPAR Reference Method of Analysis for the Determination of the Dispersed Oil Content in Produced Water. (Reference number: 2005-15). Replaces Agreement 1997-16 from 1 January 2007.

5 WASTES

INTENT

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

APPLICATION

This Standard applies to a 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 FRCP Protocol 5 shall be in effect[3]. FRCP Protocol 5 also includes guidance around storage, handling, and transport of hazardous waste. This Environment Standard on waste applies across the life cycle of a waste material, both hazardous and non-hazardous.

REASON FOR INCLUSION

A waste is a by-product of a process with no further applicability to the process, or is a substance or material that is no longer required by the activity or operation. Based on the physical and chemical characteristics of the waste or its constituents, it may be categorized as hazardous or non-hazardous.

Non-hazardous waste is defined as a waste which by its characteristics is considered as inert and having no direct impact on the environment. Generally, a non-hazardous waste is accepted at normal municipal landfills. Non-hazardous waste includes:

- office waste
- paper and cardboard
- wood and metal scrap
- plastic
- rubber
- glass
- green wastes
- builders wastes
- sanitation waste from toilets and urinals (black water)
- waste water from showers, sinks, laundries, and canteen or kitchen wastewater from dishwashing and food grinding (grey water)

Hazardous waste is defined as a waste which by its characteristics (e.g., corrosivity, reactivity, toxicity, radioactivity, etc.) poses a threat to the environment. Hazardous waste includes:

- spent hazardous chemicals
- used batteries
- used lubrication, oil and grease
- biohazard
- used solvents
- produced sand
- paint waste
- pesticides
- sludge and solids removed from tanks, vessels and pipelines
- naturally occurring radioactive materials (NORM)
- asbestos
- hazardous acids and alkalis
- contaminated water

Improper discharge or disposal of wastes may create a nuisance or a hazard to the environment, and can increase the cost of disposal. Offshore, improper disposal or spillage of wastes can cause harm to marine life and degrade water quality. Onshore, improper disposal may contaminate surface waters, groundwater or the land surface.

Specific wastes in certain jurisdictions may be classified as hazardous, while in other jurisdictions the same wastes may be classified as non-hazardous. In cases where definitions of hazardous and non-hazardous waste as defined by regulations, or as provided in this Standard are contradictory, the more stringent requirements shall apply.

REQUIREMENTS

The mandatory requirements of these Standards are signified by the use of the word "shall".

The word "should" indicates a guideline that is strongly recommended. However, there will be circumstances where local conditions may demonstrate that the requirement is either not applicable or an alternative approach is necessary. In cases where "shall" has been used in a requirement, variation can only be considered as compliance if the most Senior Line Manager of the operation approves it based on an evaluation of the risk. The risk management approach adopted must be consistent with the BHP Billiton HSEC Risk Management Guideline[5] and follow the appropriate Hierarchy of Controls (Waste Management Hierarchy of Controls and/or Risk Management Hierarchy of Controls)

The requirements for this Standard are:

A PLANT AND EQUIPMENT REQUIREMENTS

1. The design and layout of plant facilities shall include physical requirements for the handling, storage, treatment, and transportation of waste.

2. Wastes in storage shall be identified, segregated and stored according to waste, e.g., oily wastes, inert, putrescible (decaying / decomposing matter), recyclable, etc.

3. Hazardous material and hazardous waste storage areas shall have secondary containment that are at least 110% of the largest single waste container, or 25% of the total storage capacity (whichever is greater)[9].

4. Onshore, the pits used for the collection of rubbish or non-hazardous wastes shall 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 shall be used to prevent rubbish from blowing from the pit.

5. To prevent corrosion and leakage into the environment, waste drums and containers of metal construction shall be placed such that water will not collect on tops and resting surfaces.

B PROCEDURAL REQUIREMENTS

1. Where the severity factor associated with the potential impacts of waste exceeds a residual impact/risk of 30 (based on Risk Management Severity Factor), additional controls shall be implemented[2].

2. Hazardous wastes shall 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" [12].

3. A waste management plan shall be developed for all operated facilities. This waste management plan shall include a description and review of the wastes expected from the

operation and prescribes practices for minimization, handling, storage and proper disposal of waste. The plan shall also provide the names, locations and specific procedures regarding waste contractors, including handlers, transporters and disposal sites.

4. 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.

5. Audits or assessments shall 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 shall include the chain of custody of waste handling to ensure the final disposal point is at an approved and appropriate location.

6. Offshore, blackwater and grey water shall be treated according to MARPOL 73/78 Annex IV[10], and MARPOL 73/78 Annex V[11] respectively, or applicable permits prior to discharge, or otherwise treated in a marine sanitation unit.

7. The selection and usage of process and production chemicals, materials, and products should be evaluated using risk assessments and cost benefit analysis. The cost benefit analysis should consider BATNEEC (best available techniques not entailing excessive cost) and should consider environmental impacts throughout the product cycle from purchase of the material, through its use and ultimately to its discharge or disposal. These risk assessments shall compare the HSE performance of the chemical, material, or product (utilizing Material Safety Data Sheets (MSDS) and include assessment of ecotoxicity data) against cost, efficiency, capability and availability. Where improved HSE performance of the chemical, material, or product does not come at a grossly disproportionate cost, it shall be selected.

8. In absence of more stringent state or local regulations, onshore hydrostatic test water shall be injected into a disposal well, or discharged to surface waters or land after meeting the following requirements[8]:

   - Total hydrocarbon content <10 mg/l
   - pH 6 – 9
   - Biological Oxygen Demand (BOD) 25 mg/l
   - Chemical Oxygen Demand (COD) 125 mg/l
   - Total suspended solids (TSS) 35 mg/l
   - Phenols 0.5 mg/l
   - Sulphides 1 mg/l
   - Heavy metals total 5 mg/l
   - Chlorides 60 mg/l, average; 1200 mg/l max

9. For offshore hydrostatic testing of pipelines, a hydrotest water disposal plan shall 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.

10. Sediment control methods shall be used to protect aquatic biota and water quality during discharge of hydrostatic test waters. For discharge to land, a site shall be selected to prevent flooding, erosion or diminished agricultural capacity[8].

11. At each facility, records of waste generation, transportation, storage, elimination, reduction, reuse, recycling, treatment and disposal shall be maintained and reported internally[4].

12. A review of the cost-effectiveness of materials and products used in the production process shall be conducted every two years; the review shall include an evaluation of disposal costs and potential long-term liabilities.

C PEOPLE REQUIREMENTS

1. A training program for site personnel and contractors associated with equipment or procedures specific to waste management shall be conducted prior to activities to discuss environmental impacts and proposed management measures to reduce impacts of waste discharge/ disposal. The training program shall include an environmental awareness program to provide awareness of specific temporal or spatial sensitivities (for example, flora, fauna or habitat).

2. The risk assessment process shall include people with relevant subject knowledge expertise. Consideration should be given regarding the use of external people.

3. Personnel shall be competent in the use and maintenance of equipment used for monitoring, sampling, analysis, discharge and disposal of waste.

4. A system shall be implemented to ensure that monitoring, recordkeeping and reporting requirements are achieved.

D HIERARCHY OF CONTROLS

1. During design of new facilities, management measures in line with the Waste Management Hierarchy of Controls should be evaluated (elimination of the waste is preferable to waste disposal). A risk-based process shall be used to identify the appropriate options for waste management. The risk assessment shall take into account the following factors:

   - location of sensitive receptors (flora, fauna)
   - water quality (surface, ground or marine) and land quality
   - temporal sensitivities (for example whale migration or coral spawning)
   - spatial sensitivities (habitat)
   - persistence, toxicity and volume of the waste

2. Design of control measures selected should evaluate the highest end of the hierarchy. Any deviation to a lower level of control shall demonstrate that the higher option cannot be implemented (e.g., safety considerations, infrastructure restrictions, the cost of implementation is grossly disproportionate to the benefits gained, etc).

3. The Waste Management Hierarchy of Controls that applies to waste includes[1, 4, 6]:

Waste Management Hierarchy of Controls	
Eliminate	Complete elimination of the waste through process design Injection of wastes underground into a contained formation
Reduce	Reduce the quantity of the products used or the quantity of the resultant waste. For example, reduce the number of drums and other containers for disposal by using bulk containers provided and maintained by the vendor. Also, if fewer products are used, the product costs will decrease. Good inventory control and timely product usage are important. More efficient practices include: • Inventory control and management • Material substitution • Process modification • Improved housekeeping
Reuse/recycle	Reuse, recycle or reclaim (e.g., recycle paper goods, glass, lube oil); recover spilled oil; return unused products and containers to vendor. Additional use of materials or products that are reusable in their original form include, or that can be converted into useable materials include: • Chemical containers • Oily wastes for road construction and stabilization • Recycling scrap metal • Reprocessing used lubricants • Recycling drilling mud • Using cleaned drill cuttings for road construction materials • Recovering oil from tank bottoms and produced water
Treatment	Reduce the toxicity of the waste. An example would be to neutralize the pH of waste liquids destined for disposal. Treatment includes the destruction, detoxification and /or neutralization of residues through processes such as: • Biological methods – composting, tank based degradation • Thermal methods –thermal desorption • Physical methods – filtration, centrifugation
Disposal	Dispose the waste properly, in a manner that is legally permissible, protects human health, with minimum environmental impact and long-term liability. Disposal methods include: • Land filling • Burial • Surface discharge • Land spreading or land farming • Incineration

REFERENCES

1. Australian Petroleum Production and Exploration Association Limited (APPEA). 1996. Code of Environmental Practice.

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4. BHP Billiton. 2007. HSEC Management Standards, No. 12, Stewardship. Electronic update October 2007.

5. BHP Billiton. 2005. HSEC Risk Management Guidelines No. G19, Revision No. 2.1, February 2005.

6. E&P Forum. 1993. Exploration and Production (E&P) Waste Management Guidelines. Report No. 2.58/196. September 1993.

7. International Finance Corporation (IFC). 2007. Environmental, Health, and Safety Guidelines for Offshore Oil and Gas Development. April 30, 2007.

8. IFC. 2007. Environmental, Health, and Safety Guidelines for Onshore Oil and Gas Development. April 30, 2007.

9. IFC. 2007. Environmental, Health, and Safety General Guidelines. April 30, 2007.

10. International Maritime Organization (IMO). 2006. International Convention for the Prevention of Pollution from Ships (MARPOL). MARPOL Annex IV: Regulations for the Prevention of Pollution by Sewage from Ships. London: IMO, consolidation edition, 2006.

11. International Maritime Organization (IMO). 2006. International Convention for the Prevention of Pollution from Ships (MARPOL). MARPOL Annex V: Regulations for the Prevention of Pollution by Garbage from Ships. London: IMO, consolidation edition, 2006.

12. United Nations Environment Programme. 1992. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal.

6 PHYSICAL DISTURBANCE

INTENT

To minimize the impact, or footprint to terrestrial and submerged lands generated by onshore and offshore oil and gas activities.

APPLICATION

This Standard applies to all onshore and offshore oil and gas exploration, construction, installation and production activities, and all associated infrastructure (e.g., roads, shore bases).

REASON FOR INCLUSION

Physical disturbance has the potential to be a significant impact in both onshore and offshore activities, and can impact land use, flora, fauna, habitat, and air and water quality through clearing, smothering or sedimentation. Activities immediately adjacent to designated terrestrial or marine sensitive or protected areas may require additional mitigation. Identified causes of physical disturbance include:

- clearing (of sites, pads and infrastructure corridors)
- trenching and jetting
- pipelay
- anchoring
- physical presence (of plant and equipment)
- onshore seismic activities

REQUIREMENTS

The mandatory requirements of these Standards are signified by the use of the word “shall”.

The word “should” indicates a guideline that is strongly recommended. However, there will be circumstances where local conditions may demonstrate that the requirement is either not applicable or an alternative approach is necessary. In cases where “shall” has been used in a requirement, variation can only be considered as compliance if the most Senior Line Manager of the operation approves it based on an evaluation of the risk. The risk management approach adopted must be consistent with the BHP Billiton HSEC Risk Management Guideline[4] and follow the appropriate Hierarchy of Controls (Waste Management Hierarchy of Controls and/or Risk Management Hierarchy of Controls)

The requirements for this Standard are:

A PLANT AND EQUIPMENT REQUIREMENTS

1. Vehicles, plant or equipment that will cause ground or seabed disturbance shall be sized for minimum disturbance[2] (meeting operational requirements and allowing safe operation).

B PROCEDURAL REQUIREMENTS

1. Where the severity factor associated with the potential impacts of physical disturbance exceeds a residual impact/risk of 30 (based on Risk Management Severity Factor), re-siting or re-routing shall occur[3].

2. Physically disturbed sites or routes shall be restored, remediated and/or rehabilitated to pre-disturbance condition (or better) as soon as practicable after physical disturbance occurs. 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 (for example restoration of a pad site once a gas plant has been removed)[5]. Minor seabed disturbances, such as grab samples, piston cores, and seabed deep borings, are excluded from this requirement.

3. Hydrodynamic modelling to predict the extent of impacts to offshore habitat shall be conducted for any physical disturbance that may impact shoreline, near shore areas or areas protected for the purposes of conservation. Baseline benthic monitoring shall be gathered to predict the extent of impacts of benthic habitat as a result of any physical disturbance.

C PEOPLE REQUIREMENTS

1. A training program for construction personnel and contractors associated with equipment or procedures specific to physical disturbance shall be conducted prior to activities to discuss environmental impacts and proposed management measures to reduce impacts of physical disturbance. The training program shall include an environmental awareness program to provide awareness of specific temporal or spatial sensitivities (for example flora, fauna or habitat).

2. The risk assessment process shall include people with relevant subject knowledge expertise[1]. Consideration should be given regarding the use of external people.

3. Baseline surveys shall be conducted by qualified personnel and/or contractors at appropriate times of the year.

4. A system shall be implemented to ensure that monitoring, recordkeeping and reporting requirements are achieved.

D HIERARCHY OF CONTROLS

1. A risk-based process shall be used to identify site and/or route selection prior to physical disturbance occurring[1]. The risk assessment shall take into account the results of baseline survey results that cover the following areas:

   - location of sensitive receptors (flora, fauna)
   - water quality (surface, ground or marine)
   - temporal sensitivities (for example whale migration or coral spawning)
   - spatial sensitivities (habitat)

2. Design of control measures selected should evaluate the highest end of the hierarchy. Any deviation to a lower level of control shall demonstrate that the higher option cannot be implemented (e.g., safety considerations, infrastructure restrictions, the cost of implementation is grossly disproportionate to the benefits gained, etc).

3. The Risk Management Hierarchy of Controls that applies to physical disturbance includes: [6, 7, 8]

Risk Management Hierarchy of Controls	
Eliminate	N/A
Substitute	Replace the material or process 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.)
Redesign	Redesign the equipment or work processes (e.g., schedule activities to avoid breeding, migratory, or spawning periods, or periods of heavy rainfall; re-route to avoid hard bottom, riparian, or sensitive habitats)
Separate	Isolate the hazard by guarding or enclosing it (.e.g., berms, mufflers, noise barriers, enclosures)
Administrate	Provide control, such as training, procedures, etc. (e.g. dust suppression; spill prevention and control measures; erosion and sediment control; noise reduction measures; pre-construction wildlife surveys; employee awareness training; slope stabilization; etc.)

REFERENCES

1. BHP Billiton. 2007. HSEC Management Standard 3: Risk and Change Management. Electronic update October 2007.

2. BHP Billiton. 2007. HSEC Management Standards, No. 12, Stewardship. Electronic update October 2007.

3. BHP Billiton. 2007. Risk Management Guideline 2, Methods and Techniques (G02), Version 1.0, Appendix 3, Table 4: Severity Factor. August 2007.

4. BHP Billiton. 2005. HSEC Risk Management Guidelines No. G19, Revision No. 2.1, February 2005.

5. BHP Billiton. 2004. Closure Standard. July 2004.

6. International Finance Corporation (IFC). 2007. Environmental, Health, and Safety Guidelines General Guidelines. World Bank Group, April 30, 2007.

7. IFC. 2007. Environmental, Health, and Safety Guidelines Onshore Oil and Gas Development. World Bank Group, April 30, 2007.

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7 MARINE NOISE

INTENT

To minimize the impact to marine fauna from underwater noise generated by oil and gas operations such as seismic evaluations, piling, drilling units, marine vessel and operating facilities.

APPLICATION

This Standard applies to all offshore oil and gas activities and operations.

REASON FOR INCLUSION

Anthropogenic (man-made) sound in the oceans may have adverse effects on marine fauna ranging from minimal impacts to harmful, depending upon the species and sound source, and may impact the ability of some marine fauna to communicate, navigate, migrate, feed or reproduce.

REQUIREMENTS

The mandatory requirements of these Standards are signified by the use of the word “shall”.

The word “should” indicates a guideline that is strongly recommended. However, there will be circumstances where local conditions may demonstrate that the requirement is either not applicable or an alternative approach is necessary. In cases where “shall” has been used in a requirement, variation can only be considered as compliance if the most Senior Line Manager of the operation approves it based on an evaluation of the risk. The risk management approach adopted must be consistent with the BHP Billiton HSEC Risk Management Guideline([2]) and follow the appropriate Hierarchy of Controls (Waste Management Hierarchy of Controls and/or Risk Management Hierarchy of Controls)

The requirements for this Standard are:

A PLANT AND EQUIPMENT REQUIREMENTS

1. All source vessels involved in seismic acquisition should consider the use of passive acoustic monitoring (PAM), particularly for use in areas where sensitive species are likely to inhabit the proposed survey location, or if visual observations discussed in this section can be obscured by darkness or poor visibility, such as fog[(3).]

B PROCEDURAL REQUIREMENTS

1. Where the severity factor associated with the potential impacts of marine noise exceeds a residual impact/risk of 30 (based on Risk Management Severity Factor), re-siting or re-routing shall occur[(1)].

2. Timing of offshore seismic, drilling, construction, installation or other activities shall be such that known marine mammal calving areas are avoided during marine mammal calving periods.

3. Timing of offshore seismic, construction, drilling, installation or other activities should be such that known migratory pathways are avoided wherever practicable during known marine mammal migratory periods.

4. Where seismic activities and/or operations take place in known (i.e., regulated, designated, or otherwise indicated by regulatory authorities) marine mammal migratory pathways seismic vessel crews shall continually watch for marine mammals during passage. All operational seismic vessels shall carry at least one qualified Marine Mammal Observer (MMO) to provide

a 360-degree view and watch for and alert vessel crews of the presence of marine mammals during seismic activities[4].

5. For seismic operations the MMO shall begin watch 30 minutes prior to the soft start[3, 4], and shall carefully make a visual check from a suitable high observation platform to see if there are any marine mammals within 500 meters (measured from the centre of the array).

    a. If marine mammals are seen within 500 meters of the centre of the array, the seismic source shall be shut down until they have moved away, allowing adequate time after the last sighting for the animals to move away, at least 20 minutes[3].

    b. After shut down of the seismic source, or if all airguns have stopped and not restarted for at least 5 minutes, the soft start procedures shall be conducted, including visual check for marine mammals within 500 meters of the centre of the array[3].

    c. Where marine mammals are congregating around a drilling or production platform, seismic activities shall begin at least 500 meters from the platform.

    d. Two MMOs should be utilized when daylight hours exceed 12 hours per day to ensure cetacean monitoring is undertaken during all daylight hours and that an observer is always available to undertake a pre-start up search for the required 30 minutes[3].

6. During seismic operations, the sound power intensity of seismic shots shall be built up gradually ("soft start") over a 20 to 40 minute period[3,4] when entering a new area for acquisition.

7. During seismic operations, soft start of the source array shall not begin unless conditions allow the sea surface to be visually inspected for marine mammals for 30 minutes prior to commencement of soft start (unless PAM is used). Thus, soft start shall not begin after dark or in conditions that prohibit visual inspection (fog, rain, etc.) of the 500 meter area[4] unless PAM is in use and it can be determined that no marine mammals are present within the 500 meter area.

8. Contractors should address noise reduction measures in their bid proposals. This should include details on the extent to which they will use engines with lower noise ratings, how activities will be phased to reduce simultaneous operations of engines, and all other practices to reduce equipment noise emissions.

C PEOPLE REQUIREMENTS

1. A prerequisite for an MMO shall include attendance of a short course on implementing the guidelines and recording procedure[3].

2. Alternatively, the course can be taught by third parties or operators may develop their own training program, which shall be equivalent to the following requirements:[4]

    - → brief overview of the marine mammal protection and endangered species regulations for the region of operations as they relate to seismic acquisition and protection of marine mammals for the region of operations);
    - → brief overview of seismic acquisition operations in the region of operations);
    - → overview of seismic mitigation measures and the MMO program in the region of operations);
    - → discussion of the role and responsibilities of the MMO, including legal requirements; professional behaviour; integrity; authority to call for shut-down of seismic acquisition operations; assigned duties; and reporting of violation and coercion;
    - → identification of marine mammals and sea turtles, with emphasis on whales;
    - → cues and search methods for locating marine mammals; and
    - → data collection and reporting requirements

3. During observations the following personnel requirements shall be followed:[4]

- Other than brief alerts to bridge personnel of maritime hazards, no additional duties shall be assigned to the MMO during the observation watch.
- If conditions warrant more vigilant look-outs when navigating around or near maritime hazards, additional personnel shall be used to ensure that watching for protected species remains the primary focus of the MMO
- No observer shall be allowed more than 4 consecutive hours on watch
- A break time of no less than 2 hours shall be allowed before an MMO begins another watch rotation (break time means no assigned observational duties
- No person (crew or third party) on watch as an MMO shall be assigned a combined watch schedule of more than 12 hours in a 24-hour period. Due to the concentration and diligence required during visual observation watches, operators who chose to use trained crew members in these positions shall select only those crew members who demonstrate willingness and ability to perform these duties.

4. A training program for site personnel and contractors associated with equipment or procedures specific to marine noise shall be conducted prior to activities to discuss environmental impacts and proposed management measures to reduce impacts of marine noise. The training program shall include an environmental awareness program to provide awareness of specific temporal or spatial sensitivities (for example, flora, fauna or habitat).

5. The risk assessment process shall include people with relevant subject knowledge expertise. Consideration should be given regarding the use of external people.

6. Personnel shall be competent in the use and maintenance of equipment used for monitoring, sampling, and analysis of marine acoustics.

7. A system shall be implemented to ensure that monitoring, recordkeeping and reporting requirements are achieved.

D HIERARCHY OF CONTROLS

1. A risk-based process shall be used to identify site and/or route selection prior to marine noise occurring. The risk assessment shall take into account the results of baseline survey results that cover the following areas:

   - location of sensitive receptors (flora, fauna)
   - water quality (surface, ground or marine)
   - temporal sensitivities (for example whale migration or coral spawning)
   - spatial sensitivities (habitat)

2. Design of control measures selected should evaluate the highest end of the hierarchy. Any deviation to a lower level of control shall demonstrate that the higher option cannot be implemented (e.g., safety considerations, infrastructure restrictions, the cost of implementation is grossly disproportionate to the benefits gained, etc.)

3. The Risk Management Hierarchy of Controls that applies to marine noise includes:

Risk Management Hierarchy of Controls	
Eliminate	Postponement (wait for a more favourable time) or cancellation (residual risks are too high)
Substitute	Replace the equipment or process with a less hazardous one
Redesign	Redesign the equipment or work processes Schedule activity outside sensitive temporal periods
Separate	Isolate the hazard by guarding or enclosing it, e.g., sound enclosures, baffles, etc.
Administrate	Provide control, such as Passive Acoustic Monitoring (PAM), Marine Mammal Observers (MMO), training, procedures, etc.

REFERENCES

1. BHP Billiton. 2007. Risk Management Guideline 2, Methods and Techniques (G02), Version 1.0, Appendix 3, Table 4: Severity Factor. August 2007.

2. BHP Billiton. 2005. HSEC Risk Management Guidelines No. G19, Revision No. 2.1, February 2005.

3. Joint Nature Conservation Committee (JNCC). 2004. Guidelines for Minimising Acoustic Disturbance to Marine Mammals from Seismic Surveys. April 2004.

4. U.S. Department of the Interior. 2007. Minerals Management Service (MMS) Gulf of Mexico (GOM) OCS Region. Notice to Lessees and Operations (NTL) of Federal Oil, Gas, and Sulphur Leases in the Outer Continental Shelf, Gulf of Mexico OCS Region. Implementation of Seismic Survey Mitigation Measures and Protected Species Observer Program. NTL No. 2007-G02. February 7, 2007.

DEFINITIONS AND TERMINOLOGY

Audit:	A systematic and independent examination to determine whether activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives.
Best Available Techniques Not Entailing Excessive Cost (BATNEEC)	*'best'* means the most effective in 'preventing, minimizing or rendering harmless polluting emissions'. Hence a number of processes can be considered 'best', although each would have to demonstrate its effectiveness. *'available'* does not necessarily imply that the technology is in general use but that it is generally accessible *'techniques'* refers both to technology or process and how it is operated "NEEC" is to be considered independently in its application to new and existing processes. In relation to new processes the presumption is that the best available techniques will be used. If there is only modest gain for disproportionate costs, then that can be considered. The effectiveness of a chosen technology must be demonstrated by the operator, embracing not only the technology but also the manner in which the process is operated, including adequate personnel and premises.
Biological Diversity (often shortened to Biodiversity)	The variability among living organisms from all sources, including inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part. This includes diversity within species, between species, and of ecosystems (U.N. Convention on Biological Diversity, Article 2).
Carbon Price Protocol	Benchmark carbon pricing, in which the reference price is the average expected cost impact of offsetting greenhouse gas emissions liabilities, based on carbon dioxide (CO_2) equivalent emissions, or the cost of buying a Kyoto Protocol compliant emission credit.
CO_2e	Carbon dioxide equivalent – the universal measurement to indicate the global warming potential (GWP) of each of the six greenhouse gases, expressed in terms of the GWP of one unit of carbon dioxide. It is used to evaluate release of different greenhouse gases against a common basis. The six greenhouse gases are: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorcarbons (HFCs) perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6).
Discharge	A spilling, leaking, pumping, pouring, emitting, emptying or dumping of a waste, typically onto the land or sea surface
Ecosystem	A complex set of relationships among living resources, habitats and residents of a region. An ecosystem may includes people, wildlife, fish, birds, trees, plants, wetlands, water, and other living and non-living entities that are necessary for the ecosystem to function.

Ecotoxicity	The potential for chemical, physical, or biological stressors to affect the environment and the organisms living in it. Ecotoxicity studies measure the effects of chemicals on fish, wildlife, plants, and other wild organisms. If a chemical affects some of the organisms, other organisms in the ecosystem may suffer since all organisms depend on one another. The goal of ecotoxicity is to understand the concentration of chemicals at which organisms in the environment will be affected. This concentration should be avoided in order to protect the environment.
Emission	Typically refers to airborne pollutants entering the atmosphere
Fauna	Animal life in a particular region
Flora	Plant life, particularly native or indigenous
Greenhouse Gas	Gas that contributes to the greenhouse effect, possibly resulting in global warming. Includes carbon dioxide and methane. See CO_2e
Habitat	The locality in which a plant or animal naturally lives
Hazardous Material	Substances that have the potential to pose a significant risk to the health and safety of people or the environment
Hazardous Waste	A waste may be considered hazardous if: 1. It is defined as hazardous by a regulator or 2. It exhibits one or more hazardous characteristics, such as flammability, reactivity, corrosivity, radioactivity, ecotoxicity or 3. It is poisonous or infectious.
Hierarchy of Controls (also Risk Management Hierarchy of Controls)	Risk control strategy to identify, evaluate and select potential control options and cost-effective strategies and action plans that increase potential benefits and reduce potential costs. The Hierarchy of Controls should be applied in the following order: **Eliminate**: The complete elimination of the hazard **Substitute**: Replacing the material or process with a less hazardous one **Redesign**: Redesigning the equipment or work processes **Separate**: Isolating the hazard by guarding or enclosing it **Administrate**: Providing control, such as training, procedures, etc **Personal Protective Equipment**: Using appropriate and properly fitted PPE where other controls are not practical
Hypersalinity	Water that is saltier than seawater
Leading Management Practices	Application of best available technology plus implementation of environmental management practices designed to minimize discharges, emissions and wastes to the best practicable level

Non-hazardous waste	A waste which by its characteristics is considered as inert and having no direct impact on the environment (e.g., paper, wood, glass, green wastes, etc.)
Petroleum	BHP Billiton Petroleum
Policy	BHP Billiton corporate level documents describing commitment to HSEC excellence
Preference, preferred	Given priority to one over another; favoured; ideal; chosen; more desirable
Risk	The risk of an activity/product/service is the product of the likelihood of an impact on the health and safety of people, the environment, the community or property, and the severity of that impact. A significant risk is a risk that results in or has the potential to result in a significant HSEC impact.
Risk Assessment	A systematic process of comprehending the nature of the risk and deducing the level of risk. It is a systematic, consistent and comprehensive means to anticipate how people could be harmed, the environment impacted and surrounding communities threatened.
Risk Management Severity Factor	A measure of the expected degree of gain, harm, injury or loss (impact) from the most severe event associated with a risk issue. That impact could either negatively affect BHP Billiton, its brand and its stakeholders or be the expected level of unrealised opportunity for gain that could be missed. A severity factor of 30 upon the natural environment indicates serious medium term environmental effects, where a severity factor of 1 indicates limited damage to minimal area of low significance.
Senior Line Manager	Production Unit Manager, Worldwide Drilling Manager, Project Director, Exploration Manager.
“Shall” or “Must”	Means a mandatory requirements
Should	Means a guideline which is strongly recommended
Spill	An unplanned release of a solid, liquid or gaseous substance from its primary container (process vessel, piping, tank, pit, pond, etc.)
Standards	Mandatory at all BHP Billiton sites and operations and form the basis for the development and application of HSEC management systems at all levels of BHP Billiton.
Toxicity	The extent to which a substance is poisonous to people, plants or animals
Volatile Organic Compound	Smog forming components that derive from petroleum processing operations
Waste	Substances or objects that are by-products of a process and have no further use in the process, which are disposed or are intended to be disposed or are required to be disposed by the provisions of law.

Waste Management Hierarchy of Controls	Methods of control, or control technologies that are applied to minimize or mitigate waste impacts to the environment. When discussing emissions, discharges and wastes, the Waste Management Hierarchy of Controls should be applied in the following order: **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**: Reducing the amount of the waste produced **Reuse/recycle**: Reusing or recycling the waste product **Treatment**: Reducing the hazardous nature of the waste, e.g., thermal desorption **Disposal**: Releasing to atmosphere, marine dumping or land filling of the waste

ABBREVIATIONS

APPEA	Australian Petroleum Production and Exploration Association
BATNEEC	Best Available Techniques Not Entailing Excessive Cost
BOD	Biological oxygen demand
BTEX	Benzene, toluene, ethyl benzene and xylene
CO_2	Carbon dioxide
COD	Chemical oxygen demand
CSG	Customer Sector Group
E&P	Exploration and production
FRCP	Fatal Risk Control Protocols
GHG	Greenhouse gas
HSE	Health, Safety, and Environment
HSEC	Health, Safety, Environment and Community
IFC	International Finance Corporation, a member of the World Bank Group
I&M	Inspection & Maintenance
JNCC	Joint Nature Conservation Committee
MARPOL	International Convention for the Prevention of Pollution from Ships
mg/m^3	Milligrams per cubic meter
MMO	Marine Mammal Observer
MMS	Minerals Management Service
MSDS	Material Safety Data Sheet
MWth	Megawatt thermal – 1 MWth is roughly equivalent to 1360 horsepower (metric)
NORM	Naturally Occurring Radioactive Material
NO_x	Nitrogen oxides
OBM	Oil based muds

ABBREVIATIONS

OEM	Original Equipment Manufacturer
PAH	Polycyclic aromatic hydrocarbons
PFW	Produced formation water
PM	Particulate matter
PPM	Parts per million
SBM	Synthetic (oil) Based Muds
SCR	Selective catalytic reduction
SO_2	Sulphur dioxide
TSS	Total suspended solids
VOC	Volatile Organic Compound
WBM	Water Based Muds