

## Glossary of Terms

In these guidelines, the following terms mean

a) *Work period*: The period of time during which an employee is engaged in work for an employer in the course of 24 hours.

b) *Health related matters*: Matters concerning health services, preparedness in connection with health care and health services, transport of sick and injured persons, matters of hygiene and public health, potable water supply, the production and marketing of food as well as other matters of importance to health and hygiene. The term also comprises qualification requirements for and training of personnel in relation to the abovementioned matters.

c) *Facility*: Installation, plant and other equipment for petroleum activities, however not supply and support vessels or ships that transport petroleum in bulk. The term facility also comprises pipeline and cable unless otherwise provided.

d) *Operator*: means any person who carries out, or may reasonably be taken to propose the carrying out of, a relevant project or anyone executing on behalf of the licensee the day to day management of the petroleum activities.

e) *Period of stay*: The continuous period of time which an employee spends on facilities or vessels.

f) *Licensee*: Physical person or body corporate, or several such persons or bodies corporate, holding a license according to a Petroleum Agreement or any legislation to carry out exploration, production, transportation or utilisation activities. If a license has been granted to several such persons jointly, the term licensee may comprise the licensees collectively as well as the individual licensee.

g) *Safety zone* A geographically delimited area with prohibition against or limitations with regard to stay, passage or operations of unauthorised vessels, i.e. vessels not included in the licensee's petroleum activities or which have not been granted full or limited access by authorities or licensees, including also aircraft.

Unless otherwise decided by the Parliament, the zone extends from the sea bed to maximum 500 meters above the highest point of a facility in the vertical plane. Horizontally the zone extends 500 meters out from the extremities of the facility, where it may be located at any time.

The safety zone does not constitute any limitation in respect of activities specifically allowed according to an Act relating to petroleum activities or which constitute the exercise of public authority.

h) *the 1994 Act*: means the Environmental Protection Agency Act 1994;

i) *application*: means, an application in writing;

j) *appropriate particulars*: means the name and address of the operator, the location of the project in question, the nature and purpose of the project and what the operator considers would be likely to be the main environmental consequences of the execution of the project;

*k) approval* means an approval of proposals for the carrying out of relevant project;

*l) consent* means, -

(a) in relation to any relevant project comprising the drilling of an exploration well, any consent required by or under a licence to the commencement or re-commencement of the drilling of that well;

(b) in relation to a relevant project comprising a development-

(i) any consent required by or under a licence in respect of the erection of any structure;  
(ii) any consent required by or under a licence to the getting of more than 500 tonnes of oil per day or 500,000 cubic metres of gas per day otherwise than as a by-product of the drilling or the testing of any well;

(iii) any consent required to use of floating installation;

(iv) any consent required by or under a licence in respect of the commencement or re-commencement of the drilling of any well used for the purposes of, or in connection with, the development; or

(v) any authorisation for the execution of works for the construction of a pipe-line for the conveyance of petroleum, being a pipe-line which is to form an integral part of the development;

(c) in relation to any relevant project comprising a pipe-line for the conveyance of petroleum other than a pipe-line which is to form an integral part of a development, any authorisation for the execution of works for the construction of that pipe-line; or

(d) in relation to any relevant project comprising the use of a mobile installation for the extraction of petroleum where the principal purpose of the extraction is the testing of any well,

*m) development* means any project which has as its main object the getting of petroleum as opposed to the establishment of its existence, the appraisal of its quantity, characteristics or quality or the characteristics or extent of any reservoir in which it occurs;

*n) effect* includes, except where the context otherwise requires, any direct, indirect, secondary, cumulative, short, medium or long-term, permanent or temporary, or positive or negative effect;

*o) environmental authority* means any person on whom environmental responsibilities are conferred by or under any enactment other than these guidelines and the Environmental Protection Agency Act of 1994, Act 490;

*p) environmental statement* means a statement prepared in respect of a relevant project and which includes the matters specified in these guidelines;

*q) exploration well* means any well other than a well drilled for the purposes of, or in connection with, a development;

*r) floating installation* means any floating construction or device maintained on a station by whatever means but does not include a structure;

s) *gas*, except in the definition of "petroleum" below, means natural gas existing in its natural condition in strata;

t) *notice* means notice in writing;

u) *oil*, except in the definition of "petroleum" below, includes any mineral oil or relative hydrocarbon existing in its natural condition in strata, but does not include coal or bituminous shales or other stratified deposits from which oil can be extracted by destructive distillation;

v) *petroleum* includes any mineral oil or relative hydrocarbon and natural gas existing in its natural condition in strata, but does not include coal or bituminous shales or other stratified deposits from which oil can be extracted by destructive distillation;

w) *the relevant area* means that area comprising-

(a) tidal waters and parts of the sea adjacent to Ghana from the low water mark up to the seaward limits of territorial waters;

(b) the seabed and subsoil under the waters referred to in paragraphs (a) above;

x) *relevant project* means a project comprising-

(a) the drilling of an exploration well;

(b) a development;

(c) the construction of a pipe-line for the conveyance of petroleum other than one which is to form an integral part of any development, or

(d) the use of a mobile installation for the extraction of petroleum where the principal purpose of the extraction is the testing of any well,

wholly or partly within the relevant area;

y) *relevant requirement* means any requirement, imposed under a licence or permit;

z) *structure* means any structure used for or, as the case may be, to be used for the purpose of getting petroleum or conveying petroleum to land (including any structure for the storage of petroleum) which is intended to be permanent and is neither designed to be moved from place to place without major dismantling nor to be used only for searching for petroleum;

aa) *well* means any well or borehole drilled for the purposes of, or in connection with, the getting of petroleum, the exploration for petroleum or the establishment of the existence of, or appraisal of, the quantity, characteristics or quality of, petroleum in a particular location but does not include any well drilled in connection with the exploration for petroleum to a depth of 350 metres or less below the surface of the seabed for the purpose of obtaining geological information about strata or any drilling operation, the main purpose of which is the testing of the stability of the seabed.

## **ABBREVIATIONS AND ACRONYMS**

BOD –	Biological Oxygen Demand
EA –	Environmental Assessment
EIA –	Environmental Impact Assessment
EIS -	Environmental Impact Statement
EPA -	Environmental Protection Agency
GHG -	Green House Gases
GNPC –	Ghana National Petroleum Corporation
HOCNF –	Harmonised Offshore Chemical Notification Format
ICAO –	International Civil Aviation Organization
IMO –	International Maritime Organisation
MARPOL –	the International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978
NORM –	Naturally Occurring Radioactive Material
OPRC –	Oil Pollution Response Cooperation
OSPAR –	Oslo and Paris Convention for the Protection of the Marine Environment of the North-East Atlantic
PLONOR –	Posing Least Or No Risk
SCADA –	Supervisory Control and Data Acquisition systems
UNCLOS –	United Nations Convention on the Law of the Seas

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## **SECTION 1: INTRODUCTION**

## **1.0 INTRODUCTION**

### ***1.1 Background***

In the past four (4) decades there has been increasing concerns over the unsustainable economic growth paths being pursued by many developing and developed countries due to the disregard for the environmental effects of development activities and decision making.

Ghana has since 1989 made considerable advances in shifting from its past unsustainable path of development and the main tool in this endeavor is Environmental Assessment (EA).

In 1990 Ghana's Environmental Policy was formulated to put environmental issues on the priority agenda. The Policy aims included the need to ensure that a preventive approach is adopted in the pursuit of sound environmental management. The main preventive tool envisaged in the policy is environmental impact assessment (EIA). Specifically the policy intended to institute and implements an environmental quality control programme by requiring prior environmental impact assessment of all new investments that has the potential to significantly impact on the environment.

Subsequent to this, an Environmental Action Plan (EAP) was drawn up which identified specific actions to be carried out to protect the environment and ensure better management of natural resources. The plan addresses itself to sustainable development issues, defined a set of policy actions, related investments and institutional strengthening activities to make Ghana's development strategy more environmentally sustainable.

The implementation of the plan resulted in the establishing of an Environmental Impact Assessment system which is backed by an Environment Assessment Regulations, Legislative Instrument (LI) 1652, which sets out procedures for ensuring that environmental issues are integrated into project development decision-making and an environmental permit is obtained before commencement. .

The regulations require that all development activities likely to impact adversely on the environment must be subject to environmental assessment. This is to ensure that such development activities are carried out in an environmentally sound and sustainable manner.

The Regulations provide for two categories of projects (schedule 1 and 2) Undertakings in Schedules "1 & 2" which are required to register with the Environmental Protection Agency at an early stage in the planning schedule and obtain permits before commencement. Schedule 1 project are required to register and obtain permits before commencement. Schedule 2 projects are required to be subject to mandatory Environmental Impact Assessment to serve as the basis for the grant of environmental permits. The schedule includes the development of oil and gas fields among others. (See Appendix 1 for schedules).

Key objectives of Environmental Assessment in Ghana are to:

- Provide avenues for public involvement (affected by a proposed undertaking) and other stakeholder institutions (including governmental, financial/banks and others) in all relevant decision making areas of the undertaking
- Predict the potential consequence of a proposed investment/development from the environmental, social, economic, etc. perspective and to introduce mitigation measures for significant adverse impacts.
- Integrate environmental consideration with economic/financial at the earliest stages of planning and undertaking.
- Ensure that proposed investments/developments are executed or implemented in sustainable manner.
- Support the goals of sound environmental management of proposed investments and developments.

## ***1.2 The Oil and Gas Sector***

Ghana is endowed with four sedimentary basins where hydrocarbon accumulation can be found. These basins are offshore Western Basin, Central Basin, Eastern Basin and onshore Voltaian Basin

Hydrocarbon exploration in Ghana started in 1896. The development so far can be grouped into four distinct phases. These are:

- The initial phase- spanning the period 1896 to 1969 – was primarily based on seepages observed along the onshore portions of the Western Basin without the hindsight of geology. The first documented discovery well produced 5 BOPD between 1896 & 1897
- The second phase - spanning the period 1970 to 1984 – marked the beginning of offshore exploration with the first well drilled offshore Saltpond in the Central Basin. A total of Thirty-seven (37) wells were drilled with two (2), in 1970, resulting in discoveries. This phase ended with the promulgation of the PNDCL 64( 1984) establishing Ghana National Petroleum Corporation (GNPC)
- The third phase – spanning 1985 to 2000 – brought into being the operations of GNPC which accelerated the exploration process and led to the acquisition, processing and interpretation of first 3D seismic over the South Tano Field and subsequently to the drilling of three wells over the field by GNPC between 1991 and 1994.
- The fourth phase is the period between 2001 to date. This period marks a significant and historic milestone in oil and gas exploration in Ghana. It also heralds the dawn of a new era for the country. There was a gradual and systematic shift of focus from the shallow water (depth of 0-200metres) to the deepwater (depths of over 200metres) areas. The spate of activity in the deepwater areas was occasioned by other deepwater discoveries in the region and more importantly, by the results of four deepwater wells drilled between 1999 and 2003. The results of these wells proved the existence of an active petroleum system in the deepwater area.

The most significant result crowning years of concerted efforts finally arrived in 2007 with the Mahogany and Hyedua discoveries by a consortium of Kosmos, Tullow and Anadarko in the

West Cape Three Points concession area. The Mahogany well is located about 65 km from Half Assini, 84 km from Axim, 95 Km from Cape Three Points. Preliminary evaluation proved that these discoveries, lying in two separate concession blocks, are of common origin. The discoveries were therefore unitized to be developed as a single field named Jubilee Field to mark the coincidence of the discoveries with Ghana's Golden Jubilee year.

This discovery has resulted in intense interest in the country's oil and gas potential and there are currently about twelve (12) offshore licenses granted for exploration and over 20 companies have either submitted applications or have expressed interest and are reviewing data.

Apart from the Jubilee discoveries, the GNPC and its other partners have also announced discoveries of other fields, such as Odum, Tweneboa and Tano. Some of these fields are currently under appraisal and would soon add up to the Jubilee reserves.

GNPC has also adopted the policy of monetization of all gas discovered in the country. This policy means operators would have to re-inject produced gas into the reservoir until the country has put infrastructure in place to utilize it. In line with this policy, the Corporation is looking at the production of associated gas from Jubilee on a large scale – 120 million cubic feet per day (mmcf), rising to 240 mmcf, and later gas from other offshore fields, as an important opportunity to increase gas utilization in Ghana by replacing imported and more expensive crude oil for power generation. Existing and planned power stations at Takoradi and Tema (both public and private), with a capacity in excess of 1000MW are either already capable of or can be switched from oil to gas firing, generating important economic and environmental benefits.

Apart from the offshore basins that are currently being explored for petroleum resources, Ghana has a large sedimentary basin onshore, which could be opened up in the near future for oil and gas exploration activities. All these activities when successful will increase the potential of Ghana becoming a major oil and gas producing country.

In line with government policy to guide petroleum operations so that the path of sustainable development is followed, these guidelines have been developed to regulate the offshore activities.

The main purpose of the guidelines is to mainstream environment, health, safety and community issues into the offshore oil and gas operations

The Guidelines are intended to help in the oil and gas industry and more specifically, oil and gas development planners, administrators, contractors of oil and gas industry, oil and gas resources managers, environmental specialists and project managers engaged in offshore oil and gas exploitation activities to:

- Examine whether a statutory EIA process and detailed EIA studies are required, according to national statutes and regulations.

- Define the focus and the extent of environmental appraisal for oil and gas projects, including the effect of the projects on the marine environment and other natural resources as well as on human well being, and
- Classify the environmental components resulting from the various oil and gas development activities in a systematic manner.
- Identify, predict and evaluate the environmental impacts of proposed petroleum activities
- Develop appropriate mitigation and monitoring measures

### **1.3 Scope**

The Environmental Assessment Regulations 1999 defines "environmental assessment as the process for the orderly and systematic identification, prediction and evaluation of the likely environmental, socio-economic, cultural and health effects of an undertaking; and the mitigation and management of those effects".

Consequently, this guidelines consider the effects on ecosystem (the environment), the well-being of the people involved in the oil and gas operations (health and safety) and those who the oil and gas operations may affect directly or indirectly (Community issues). These guidelines for the offshore oil and gas development include information relevant to seismic shooting, exploratory and production drilling, development and production activities, offshore pipeline operations, offshore transportation, tanker loading and unloading, ancillary and support operations, and decommissioning. It also addresses potential onshore impacts that may result from offshore oil and gas activities.

This document is organized according to the following sections:

1. Section 1.0 — Introduction
2. Section 2.0 — Summary of the Ghana Environmental Assessment (EA) system
3. Section 3.0 — General Description of the Industry Activities
4. Section 4.0 — Industry-Specific Impacts and Management
5. Section 5.0 — Performance Indicators and Monitoring
6. Section 6.0 — Specific Guidelines
7. Section 7.0 — Annex 1: Tables
8. Section 8.0 — Appendices
9. Section 9.0 — References and Literature Sources

Copies of the EA Regulation and additional information on the EA process can be obtained directly from the address below.

**The Executive Director  
Environmental Protection Agency  
Starlet 91 Road, Ministries  
P.O. Box M326, Accra  
Telephone: (+233) 21-6697/8, Fax: (+233) 21-662690**

**E-mail support@epaghana.org**

**or from the following web sites:**

EPA Website: <http://www.epa.gov.gh>

## **SECTION 2: THE GHANA ENVIRONMENTAL ASSESSMENT PROCESS**

## **2.0 SUMMARY OF THE GHANA ENVIRONMENTAL ASSESSMENT PROCESS**

### ***2.1 Preamble***

Environmental Assessments are required to be carried out on specific undertakings in Ghana as a means of ensuring environmental soundness and sustainability in the development of undertakings. The definition of “undertaking” is any enterprise, activity, scheme of development, construction, project, structure, building, work, investment, plan, programme and any modifications, extension, abandonment, demolition, rehabilitation or decommissioning, and the implementation of which may have significant impact on the environment.

The Environmental Assessment systems refer to the relevant procedures for ensuring that:

- i. The planning phase follows and satisfies the provision for environmental soundness and sustainability in the various decision-making processes, alternatives and options for the eventual preferred scheme of development.
- ii. The operational phase follows the required management provisions to achieve environment soundness and sustainability in the implementation of the undertaking.

The planning phase of an undertaking is covered by an Environmental Assessment, while the operational phase is covered by Environment Management Plan. The scope of the Environmental Assessment process covers both large and significant impacting undertakings and cumulative impacts of small and medium scale impact undertakings. The Ghana Environmental Assessment Procedures involve a logical step-wise system (See figure 1) with provisions for:

- registration
- Screening
- Scoping/Terms of Reference
- EIA Study
- Review & Public Hearing
- Appeals
- Timelines for decision-making

Public Participation is expected to occur at all levels of the process (screening, scoping, EIA study and Review stages)



### ADMINISTRATIVE FLOW CHART OF THE EA PROCEDURE

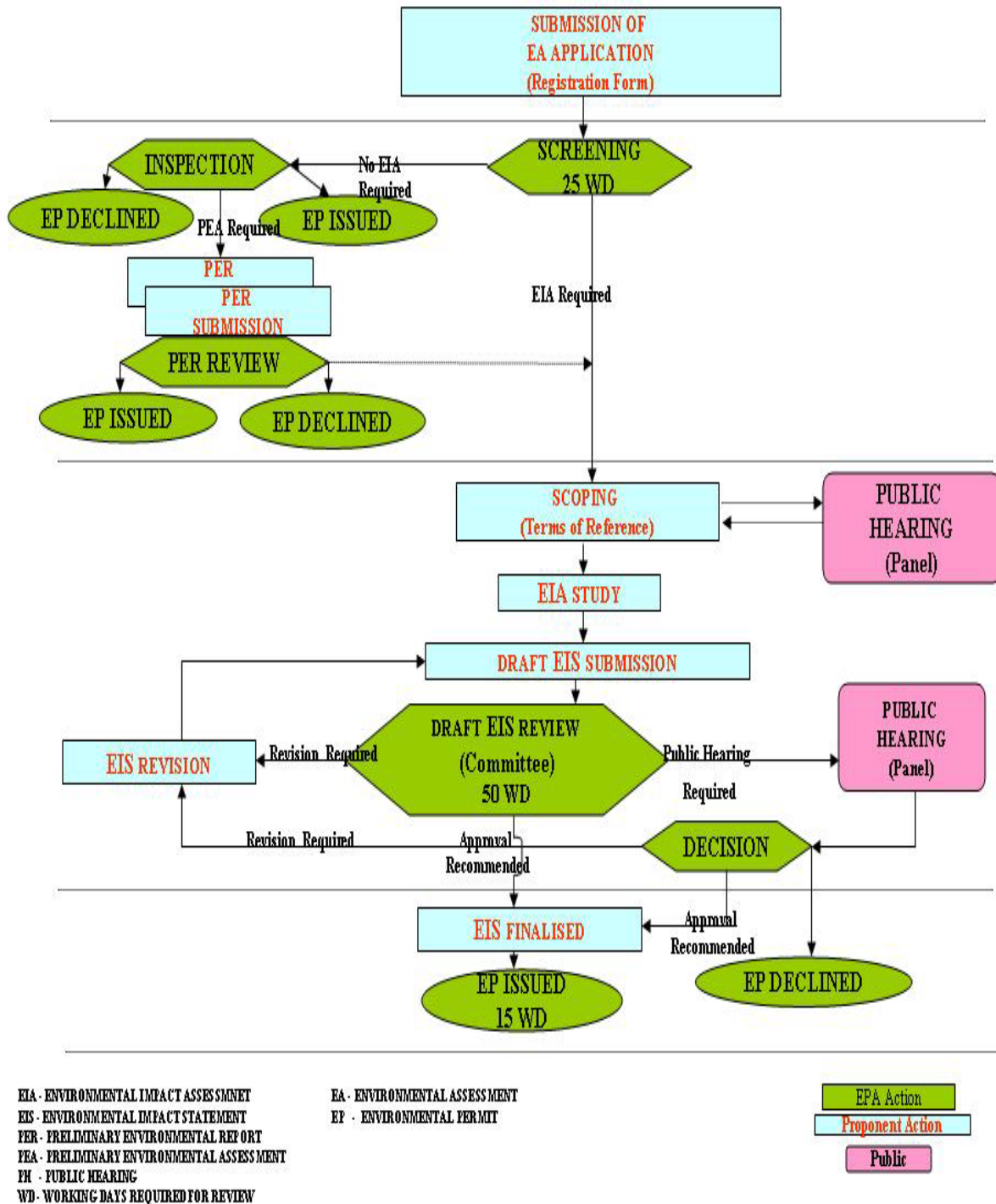


Figure 1: Flow Chart of Ghana EA Process

## ***2.2 The Requirement for Registration***

Compliance with the Environmental Assessment Systems commences with registration of undertakings as presented in Figure 1, by completing the relevant Environmental Assessment Registration Form. In the case of oil and gas Form PO 1 is the appropriate form to complete. (See Appendix 2 for a copy of Form PO1).

The Environmental Assessment Regulations 1999, Legislative Instrument 1652 provides an official list of undertakings requiring registration and mandatory EIA in schedules 1 and 2. In addition where any activity is to be located in environmentally sensitive sites (listed in Schedule 5) EIA is mandatory. Regulation 3 (12) indicates that the following petroleum developments require EIA before an environmental permit is granted:

1. oil and gas fields development;
2. construction of off-shore and on-shore pipelines;
3. construction of oil and gas separation, processing, handling and storage facilities.
4. construction of oil refineries;
5. construction of product depots for the storage of petrol, gas or diesel which are located within 3 kilometers of any commercial, industrial or residential areas.

The project proponent (Licensee) is responsible for registration, which is done by filling out an Environmental Assessment Registration Form provided by EPA. This form should be submitted to the relevant EPA Regional Office or to EPA Head office for screening.

It is important to note that the requirement for registration also includes projects that would modify, rehabilitate, extend, abandon or decommission previously approved undertakings.

It is the licensee's responsibility to accurately provide all relevant information concerning the proposal by preparing and submitting a registration document that addresses all the requirements. Full and accurate descriptions of the project location, proposed activities, the existing environment, potential impacts, and proposed mitigation are required.

It is in the best interest of the proponent to submit the registration document early in the planning process so that maximum flexibility to modify the project to address government and stakeholder concerns is maintained.

For all oil and gas sector applications, the applicant must have the GNPC's consent for the relevant area.

## **2.3 Screening**

Upon submission of a registration form, EPA screens the undertaking to determine whether a proposed development should be subject to further assessment and the level of assessment that will be required. This exercise normally involves visit to proposed sites to verify information in the registration form and to consult with relevant stakeholders within the likely area of influence of the undertaking. Within 25 days from the time of receiving an application, a screening decision must be made. Key consideration must be given to among other:

- Appropriate particulars
- The size and output of the proposed undertaking in relation to the location
- The technology to be used
- Concerns of the general public
- Land use considerations
- Other factors relevant to the particular undertaking

The output of screening is a screening report, which makes one of the following 5 decisions:

- i. Approval may be given for the undertaking to proceed
- ii. Objection to undertaking and therefore cannot proceed as proposed
- iii. Additional information/clarification required.
- iv. Preliminary Environmental Assessment required
- v. Environmental Impact Assessment required.

Consultations with relevant stakeholders particularly regulators responsible for land use zoning, fire, planning permits and persons and communities likely to be affected are important in arriving at the screening decision.

## **2.4 Preliminary Environmental Assessment**

The proponent is required to undertake Preliminary Environmental Assessment for small to medium impact scale undertakings. The findings of the Preliminary Environmental Assessment are compiled into Preliminary Environmental Report (PER). The Preliminary Environmental Report provides sufficient information on the undertaking as a basis for decision-making on the Environmental Permit

## **2.5 Scoping / Terms of Reference**

The proponent shall be required to undertake a scoping study when (i) the screening decision on the undertaking indicate that Environmental Impact Assessment is required or (ii) when a registration form is submitted on schedule 2 undertaking or (iii) undertaking is located in an environmentally sensitive area for which EIA is mandatory.

Scoping involves the identification and the consultation with all relevant stakeholders (interested and affected parties/communities such as the government departments, ministries, local authorities, etc) who must make an input in the Environmental Impact Assessment.

The purpose of scoping is to help focus the Environmental Impact Assessment to be carried out on the key areas/issues of concern or impact. The output of scoping is the terms of reference (TOR) for the Environmental Impact Assessment.

The proponent submits scoping report with draft TOR. Ten (10) copies are submitted for consideration and agreement, prior to using the TOR to conduct the actual Environmental Impact Assessment. A scoping report shall set out the scope or extent of the environmental impact assessment to be carried out by the applicant, and shall include a draft terms of reference, which shall indicate the essential issues to be addressed in the environmental impact statement.

The draft terms of reference shall stipulate that the environmental impact statement on the proposed undertaking will deal with matters including the following:

- a. description of the undertaking;
- b. an analysis of the need for the undertaking;
- c. alternatives to the undertaking including alternative situations where the undertaking is not proceeded with;
- d. matters on site selection including a statement of the reasons for the choice of the proposed site and whether any other alternative site was considered;
- e. an identification of existing environmental conditions including social, economic and other aspects of major environmental concern;
- f. information on potential, positive and negative impacts of the proposed undertaking from the environmental, social, economic and cultural aspect in relation to the different phases of development of the undertaking;
- g. the potential impact on the health of people;
- h. proposals to mitigate any potential negative socio-economic, cultural and public health impacts on the environment;
- i. proposals to be developed to monitor predictable environmental impact and proposed mitigating measures;
- j. contingency plans existing or to be evolved to address any unpredicted negative environmental impact and proposed mitigating measures;
- k. consultation with members of the public likely to be affected by the operations of the undertaking;

- l. maps, plans, tables, graphs, diagrams and other illustrative material that will assist with comprehension of the contents of the environmental impact statement;
- m. a provisional environmental management plan;
- n. proposals for payment of compensation for possible damage to land or property arising from the operation of the undertaking; and
- o. an indication whether any area outside Ghana is likely to be affected by the activities of the undertaking.

Scoping involves widespread and comprehensive consultations with interested and/or affected parties, in order to identify all key issues and to determine how the concerns of all parties will be addressed in the Terms of Reference (ToR) for the EIA study. During the scoping the proponent is expected to:

- give notices of the proposed undertaking to all relevant Ministries, Department and Agencies as well as Metropolitan, Municipal or District Assembly.
- Advertise in at least one national newspaper and a newspaper circulating in the locality where the proposed project is to be located
- make available for inspection by the general public in the locality of the proposed undertaking copies of the scoping report.

The Form in Appendix 3 shall be used for purpose of the advertisement required during the scoping process.

EPA with the assistance of a cross-sectoral Technical Review Committee reviews the draft ToR, and communicates its comments to the proponent within 15 days. The draft ToR can be rejected or approved or revisions/modifications can be required.

## ***2.6 Environmental Impact Assessment***

The proponent commissions the actual Environmental Impact Assessment based on the agreed TOR. Environmental Impact Assessment normally involves baseline survey and inventory, development proposal options, potential impact identification, prediction, mitigation and alternative considerations and other requirements of the TOR.

During the study, the proponent is required to initiate a public information programme for the area likely to be affected by the undertaking. Copies of all reports of the study shall be made available to EPA and relevant stakeholders. Public concerns shall be recorded and must be addressed in the EIS.

The findings of the Environmental Impact Assessment are compiled into an Environmental Impact Statement, which shall form the basis for the required decision-making on the undertaking for an Environment Permit. Twelve (12) copies of the draft EIS are submitted to the EPA for review and decision making. In certain cases the EPA may request for additional copies of the draft EIS in order to distribute to key stakeholders.

### **2.6.1 Review of Environmental Impact Statement**

The Agency upon receipt of an environmental impact statement, publish for 21 days a notice (which shall be in accordance with the form specified in Appendix 3) of the environmental impact statement in the mass media and also post at appropriate places such parts of the environmental impact statement as it considers necessary. The applicant shall also submit such copies of the environmental impact statement as the Agency shall direct to sector Ministries, government departments and organisations of relevance to the undertaking.

Copies of the EIS are also placed at vantage points including the EPA Library, relevant District Assembly, EPA Regional Offices and the Sector Ministry responsible for a particular undertaking. The general public, relevant public agencies, organisations, NGOs, Metropolitan, Municipal and District Assemblies and local communities may review and make any comments, and suggestions on any matter in the draft EIS within 21 days of issuance of the public notice.

The draft EIS is also reviewed by a cross- sectoral Environmental Impact Assessment Technical Review Committee (EIA/TRC) made up of representatives of various Ministries, Departments and Agencies. The review committee is expected to assist the Agency in reviewing the EIS and make recommendations to the Executive Director as to whether the undertakings as proposed must be accepted and under what conditions, or not to be accepted and the reasons, as well as provide guidance on how any outstanding issues/areas may be satisfactorily addressed. In certain instances the support of international EIA institutions and experts may be solicited to review EISs.

### **2.6.2 Public Hearing**

Upon receipt of the draft EIS the Agency may hold a public hearing on the undertaking as part of the review where:

- a notice issued under regulation 16 of the LI 1652 results in great public reaction to the commencement of the proposed undertaking;
- the undertaking will involve the dislocation, relocation or resettlement of communities and

- the Agency considers that, the undertaking could have extensive and far -reaching effects on the environment.

The outcome of the public hearings are expected to be addressed by the proponent and considered in decision making by the Agency. Where a public hearing is held, the review of the draft EIS may extend beyond the prescribed timeline of 25 days required for EPA's actions and decision-making on the report.

### **2.6.3 Environmental Permitting Decision (EPD)**

Where the draft EIS is found acceptable, the proponent is notified to finalize the report and submit eight hard copies and an electronic copy. Following submission to EPA, the proponent shall be issued an Environmental Permit within 15 working days and a gazette notice published. Environment Permits are issued always with a set of conditions. Among the key conditions are the requirements to:

- i. Submit Annual Environmental Reports every 12 months
- ii. Submit Environmental Management Plans within 18 months of issuance of permit and revised every three years
- iii. Submit periodic monitoring reports (frequency to be specified)
- iv. Give notice of commencement of operation of the undertaking and
- v. Obtain Environment Certificate within 24 months of satisfactory operations and compliance with environmental permitting conditions

## **2.7 Annual Environment Report**

Any undertaking approved for implementation is required to submit an Annual Environmental Report (AER) on the undertaking. The first AER must be submitted after twelve (12) months from the date of "notice of commencement" of the undertaking and subsequently after every 12 months as stated in the LI 1652.

The AER is a report on the relevant aspects of the development at the operational stage of the undertaking. The relevant aspects include (but not limited to) monitoring results, adequacy and appropriateness of mitigation measures adopted, environmental standards and measures pursued, as well as targets that were set.

## **2.8 Environmental Management Plan**

Operating undertakings covered by Preliminary Environmental Reports and EIS are required to submit Environmental Management Plans within 18 months of commencement of operation and thereafter every 3 years.

The Environmental Management Plan shall set out the steps and approaches to be taken to manage the operating undertaking in order to ensure environmental soundness and sustainability.

## **2.9 Environmental Certificate**

Within 24 months of commencement of operations an undertaking covered by a Preliminary Environmental Report or an Environmental Impact Statement (EIS) must obtain an environmental certificate. The conditions to satisfy to secure environment certificate for an undertaking include:

- i. Confirmation of actual commencement of operations
- ii. Evidence of acquisition of other permits/approvals/concerns applicable to the sector and undertaking
- iii. Evidence of compliance with relevant mitigation commitments
- iv. Evidence of compliance with other environment permit conditions
- v. Submission of a current annual environment report on the undertaking (verified and considered satisfactory)
- vi. Submission of an accepted Environmental Management Plan for the undertaking
- vii. Payment of an environment certificate fee

## **2.10 Fees**

Where the undertaking is approved, the proponent shall pay processing and permitting fees prior to collection of the permit. The fees are determined based on the Environmental Assessment Fees Regulations, 2002, LI 1703.

## **2.11 Appeal Process**

The 1994 Act makes provision for a person aggrieved by any decision or action of the Agency to submit a complaint in writing to the Minister of Environment. The complaint shall be submitted to the Minister within 30 days of the complainant becoming aware of the decision or action to which the complaint relates. The complaint shall state the issues objected to; have attached a copy of the decision objected to and have attached all documents relevant for considering and determining the complaint.



## **SECTION 3: DESCRIPTION OF OIL AND GAS EXPLOITATION ACTIVITIES**

### **3.0 General Description of Industry Activities**

The main activities of the offshore oil and gas industry are:

1. Exploration (seismic surveys and drilling of exploratory and appraisal wells)
2. Field development, and
3. Decommissioning and Abandonment

The primary products of the offshore oil and gas industry are crude oil, natural gas liquids, and natural gas. Crude oil consists of a mixture of hydrocarbons having varying molecular weights and properties. Natural gas can be produced from oil wells, or wells can be drilled with natural gas as the primary objective. Methane is the predominant component of natural gas, but ethane, propane, and butane are also significant components. The heavier components, including propane and butane, exist as liquids when cooled and compressed and these are often separated and processed as natural gas liquids.

#### **3.1 Exploration Activities**

##### **3.1.1 Seismic surveys**

Seismic surveys are conducted to pinpoint potential hydrocarbon reserves in geological formations deep below the seafloor. Seismic technology uses the reflection of sound waves to identify subsurface formations. In modern marine seismic surveys, as many as 16 “streamers” (cables containing the hydrophones used to detect the sound reflected from the subsurface) are towed behind the seismic vessel, at a depth of 5 to 10 meters (m). Each cable can be as long as 8 to 10 kilometers (km). In addition to the hydrophone array, the vessel tows seismic source arrays comprising a number of airguns which discharge sound bursts of between 200–250 decibels (dB) downward. The sound bursts, repeated on average every 6 to 10 seconds, are reflected off deep geological formations and recorded by the hydrophone array.

##### **3.1.2 Exploration drilling**

Exploratory drilling activities offshore follow the analysis of seismic data to verify and quantify the amount and extent of oil and gas resources from potentially productive geological formations. If oil or gas is encountered, then additional development drilling may be undertaken.

There are various types of offshore drilling rigs, including:

- Jack-up rigs: Suitable for shallower water up to around 100 m and transported to location either under their own propulsion, or towed by tugs. Once there, electric or hydraulic jacks lower three or four legs to the seafloor to support the drilling platform above water.
- Semi-submersible rigs: Suitable for deep waters and transported to location either under their own propulsion, or towed by tugs. The hull is partially submerged and the rig held in place by a series of anchors.

- Submersible rigs: Limited to shallow waters and towed onto location. Consisting of two hulls: an upper hull, or platform, and lower hull that is filled with water and submerged to the seafloor.
- Drilling barges as floating platform: Suitable for shallow waters, estuarine areas, lakes, marshes, swamps and rivers. Not suitable for open or deep water. Towed onto location.
- Drillships: Designed for drilling in deep water locations. Drilling takes place from a drilling platform and derrick positioned in the middle of the deck, from which drill stems are lowered through a hole in the hull (moonhole).

Once on location, a series of well sections of decreasing diameter are drilled from the rig. A drill bit, attached to the drill string suspended from the rig's derrick, is rotated in the well. Drill collars are attached to add weight and drilling fluids are circulated through the drill string and pumped through the drill bit. The fluid has a number of functions. It imparts hydraulic force that assists the drill bit cutting action, and it cools the bit, removes cuttings rock from the wellbore and protects the well against formation pressures. When each well section has been drilled, steel casing is run into the hole and cemented into place to prevent well collapse.

When the reservoir is reached the well may be completed and tested by running a production liner and equipment to flow the hydrocarbons to the surface to establish reservoir properties in a test separator.

### ***3.2 Field Development***

Field development may occur after exploration (and additional appraisal well drilling) has located and confirmed economically recoverable reserves of hydrocarbons. In many cases, this will involve the installation of an offshore drilling and production platform that is self sufficient in terms of energy and water needs for the workforce and for drilling wells and processing hydrocarbons ready for export.

There are many types of offshore platforms, including:

- Fixed platforms: Used in water depths of up to around 500 m and consisting of steel or concrete legs (jacket) secured directly to the seabed by steel piles that support a steel deck. Drilling equipment, production facilities and accommodation are typically housed on the deck.
- Compliant towers: Used in water depths ranging from around 500 m up to 1,000 m and consisting of a narrow, flexible tower on a piled foundation supporting a conventional deck.
- Tension leg platforms: Used in water depths of up to about 2,000 m and consists of a floating facility moored to the seabed and fixed in place by anchors. Mini tension leg platforms (Seastars) exist that are used in water depths of between 200 m and 1,000 m.
- Jack-up platforms: Used in shallower water up to around 100m and transported to location where the legs are lowered by hydraulic jacks into position to support the deck.
- Spar platforms: Used in water depths of between 500 m and 1,700 m and consisting of a cylindrical hull supporting a floating platform.

- Floating production systems: Ships equipped with processing facilities and moored on location with a series of anchors. Frequently converted oil tankers, the main types of floating production systems are Floating, Production, Storage and Offloading (FPSO) systems, Floating, Storage and Offloading (FSO) systems, and Floating Storage Units (FSU).
- Production platforms will provide facilities for the separation of formation fluids into oil, gas, and water. Depending on the project, the platform may only be used for production as drilling can be conducted from a separate drilling rig brought alongside.

Some platforms are only used to bring the hydrocarbons to surface and directly export them for processing, whilst some gas platforms may be unmanned during routine production operations. Typically, multiple wells are drilled from the platform location using directional drilling techniques. In some cases, where field extremities not reachable by directional drilling from the fixed location or where small reservoirs exist, subsea production units are installed on the seabed following drilling and the produced hydrocarbons are tied into a nearby platform facility by a system of risers.

Following development drilling and well completion in readiness for the flow of formation fluids, a “Christmas tree”, which allows the control of flow to the surface, is placed onto the well head. The oil and / or gas are produced by separation of the formation fluid mixture into oil and gas and water, or gas and condensates at the platform. Oil is exported from the platform by either pumping into a sub-sea pipeline to shore, or to a floating storage unit offshore, or directly to a tanker. Typically, gas is exported through a pipeline.

Most fields produce in a predictable pattern, called a decline curve, where production increases relatively rapidly to a peak, and then follows a long slow decline. Water or gas injection is often used to maintain reservoir pressure and enhance production. In other cases Enhanced Oil Recovery techniques, such as the injection of steam, nitrogen, carbon dioxide or surfactants, may be used to enhance recovery.

Operators may periodically perform workovers to clean out the wellbore, allowing oil or gas to move easily to the surface. Other measures to increase production include fracturing and treating the bottom of the wellbore with acid to create better pathways for oil and gas to move to the surface.

### ***3.3 Decommissioning and Abandonment***

The decommissioning of offshore facilities occurs when the reservoir is depleted or the production of hydrocarbons from that reservoir becomes unprofitable. Parts of the offshore facility, such as platforms, are treated to remove contaminants and are usually removed, while other production components are rendered safe and left in place.

Wells are plugged and abandoned to prevent fluid migration within the wellbore, which could contaminate the surface environment. The downhole equipment is removed and the perforated parts of the wellbore are cleaned of sediment, scale, and other debris. The wellbore is then

plugged to prevent the inflow of fluids. Fluids with an appropriate density are placed between the plugs to maintain adequate pressure. During this process, the plugs are tested to verify their correct placement and integrity. Finally, the casing is cut off below the surface and capped.

### ***3.4 Screening Levels for Oil and Gas Undertaking***

<b>Type of Activity</b>	<b>Screening Level</b>	<b>Remarks</b>
Surveys	Registration	Issuance of Permit if form is well completed
Drilling of Wells	Preliminary Environmental Assessment	Issuance of Permit after successful review of PER
Production of Petroleum (All activities under Field Development excluding construction of pipelines)	Full EIA	Should go through the full EA Process
Construction of off-shore and on-shore pipelines for the purpose of carrying crude oil	Full EIA	Should go through the full EA Process
Decommissioning and Abandonment	Plan to be submitted by proponent and approved by EPA	Submission of Decommission/Abandonment Plan prior to commencement of production, thereafter revised every three years and the current copy submitted.

## **SECTION 4: INDUSTRY-SPECIFIC IMPACTS AND MANAGEMENT**

## 4.0 Industry-Specific Impacts and Management

These impact management guidelines will use the following principles as a guide:

- a. the precautionary principle;
- b. that preventive action should be taken;
- c. that environmental damage should, as a priority, be rectified at source; and
- d. that the polluter should pay.

Once an oil company decides it wants to develop an oil or gas reserve, it is required to conduct an Environmental Impact Assessment (EIA) (See Section 2). The EIA outlines the expected impacts from the activities and how the operator will avoid, reduce, mitigate or compensate for them. It should consider alternative design options or technologies which will reduce impacts. Comprehensive baseline data should be collected, and a monitoring programme outlined to ensure impacts do not exceed those expected. A Social Impact Assessment should be carried out alongside the EIA and integrated with the EIA. This should look at the inter-relationships with local livelihoods, cultures, indigenous groups, etc, many of which may depend on the local natural resources.

This section provides a summary of Environmental Management, Health and Safety, and Community Issues (EMHSCI) associated with offshore oil and gas development, which must be addressed in the EIA, along with recommendations for their management. These issues may be relevant to any of the activities listed as applicable to these guidelines, however they should not be regarded as exhaustive.

### 4.1 Environment

The following environmental issues should be considered as part of a comprehensive assessment and management program that addresses project-specific risks and potential impacts. Potential environmental issues associated with offshore oil and gas development projects include the following:

- Air emissions
- Wastewater discharges
- Solid and liquid waste management
- Noise generation
- Spills

#### 4.1.1 Air Emissions

The main sources of air emissions (continuous or noncontinuous) resulting from offshore activities include: combustion sources from power and heat generation, and the use of compressors, pumps, and reciprocating engines (boilers, turbines, and other engines) on

offshore facilities including support and supply vessels and helicopters; emissions resulting from flaring and venting of hydrocarbons; and fugitive emissions.

Principal pollutants from these sources include nitrogen oxides (NO<sub>x</sub>), sulfur oxides (SO<sub>x</sub>), carbon monoxide (CO), and particulates. Additional pollutants can include: hydrogen sulfide (H<sub>2</sub>S); volatile organic compounds (VOC) methane and ethane; benzene, ethyl benzene, toluene, and xylenes (BTEX); glycols; and polycyclic aromatic hydrocarbons (PAHs).

Greenhouse gas (GHG) emissions (CO<sub>2</sub> equivalent) from all facilities and offshore support activities should be quantified as aggregate emissions in accordance with EPA reporting procedures.

All reasonable attempts should be made to maximize energy efficiency and design facilities for lowest energy use. The overall objective should be to reduce air emissions and evaluate cost-effective options for reducing emissions that are technically feasible.

#### **4.1.1.1 Exhaust Gases**

Exhaust gas emissions produced by the combustion of gas or liquid fuels in turbines, boilers, compressors, pumps and other engines for power and heat generation, or for water injection or oil and gas export, can be the most significant source of air emissions from offshore facilities. During equipment selection, air emission specifications should be considered.

#### **4.1.1.2 Venting and Flaring**

Associated gas brought to the surface with crude oil during oil production is sometimes disposed of at offshore facilities by venting or flaring to the atmosphere. This practice is now widely recognized to be a waste of a valuable resource, as well as a significant source of Green House Gas (GHG) emissions. The policy of the Ghana Government on flaring is that “there shall be no flaring of gas in oil and gas development” (Fundamental Petroleum Policy for Ghana, June 2008). Consequently, flaring of gas should be avoided.

However, flaring or venting is also an important safety measure used on offshore oil and gas facilities to ensure gas and other hydrocarbons are safely disposed of in the event of an emergency, power or equipment failure, or other plant upset condition.

If flaring is necessary, continuous improvement of flaring through implementation of best practices and new technologies should be demonstrated. The following pollution prevention and control measures should be considered for gas flaring:

- Implementation of source gas reduction measures to the extent possible;
- Use of efficient flare tips, and optimizing the size and number of burning nozzles;
- Maximizing flare combustion efficiency by controlling and optimizing flare fuel/air/steam flow rates to ensure the correct ratio of assist stream to flare stream;



- Minimizing flaring from purges and pilots, without compromising safety, through measures including installation of purge gas reduction devices, flare gas recovery units, inert purge gas, soft seat valve technology where appropriate, and installation of conservation pilots;
- Minimizing risk of pilot blow-out by ensuring sufficient exit velocity and providing wind guards;
- Use of a reliable pilot ignition system;
- Installation of high integrity instrument pressure protection systems, where appropriate, to reduce over pressure events and avoid or reduce flaring situations;
- Minimizing liquid carry over and entrainment in the gas flare stream with a suitable liquid separation system;
- Minimizing flame lift off and/or flame lick;
- Operating flare to control odor and visible smoke emissions (no visible black smoke);
- Locating flare at a safe distance from accommodation units;
- Implementation of burner maintenance and replacement programs to ensure continuous maximum flare efficiency;
- Metering flare gas.

In the event of an emergency or equipment breakdown, or plant upset conditions, excess gas should not be vented but should be sent to an efficient flare gas system. Emergency venting may be necessary under specific field conditions where flaring of the gas stream is not possible, or where a flare gas system is not available, such as a lack of sufficient hydrocarbon content in the gas stream to support combustion or a lack of sufficient gas pressure to allow it to enter the flare system. Justification for excluding a gas flaring system on offshore facilities should be fully documented before an emergency gas venting facility is considered.

To minimize flaring events as a result of equipment breakdowns and plant upsets, plant reliability should be high (>95 percent) and provision should be made for equipment sparing and plant turn down protocols.

Flaring volumes for new facilities should be estimated during the initial commissioning period so that fixed volume flaring targets can be developed. The volumes of gas flared for all flaring events should be recorded and reported.

#### **4.1.1.3 Well Testing**

During well testing, flaring of produced hydrocarbons should be avoided, especially in environmentally sensitive areas. Feasible alternatives should be evaluated for the recovery of these test fluids, while considering the safety of handling volatile hydrocarbons, for transfer to a processing facility or other alternative disposal options. An evaluation of alternatives for produced hydrocarbons should be adequately documented, recorded and submitted to the EPA.

If flaring is the only option available for the disposal of test fluids, only the minimum volume of hydrocarbons required for the test should be flowed and well test durations should be

reduced to the extent practical. An efficient test flare burner head equipped with an appropriate combustion enhancement system should be selected to minimize incomplete combustion, black smoke, and hydrocarbon fallout to the sea. Volumes of hydrocarbons flared should be recorded.

#### 4.1.1.4 Fugitive Emissions

Fugitive emissions in offshore facilities may be associated with cold vents, leaking tubing, valves, connections, flanges, packings, open-ended lines, pump seals, compressor seals, pressure relief valves, tanks or open pits / containments, and hydrocarbon loading and unloading operations.

Methods for controlling and reducing fugitive emissions should be considered and implemented in the design, operation, and maintenance of offshore facilities. The selection of appropriate valves, flanges, fittings, seals, and packings should consider safety and suitability requirements as well as their capacity to reduce gas leaks and fugitive emissions. Additionally, leak detection and repair programs should be implemented.

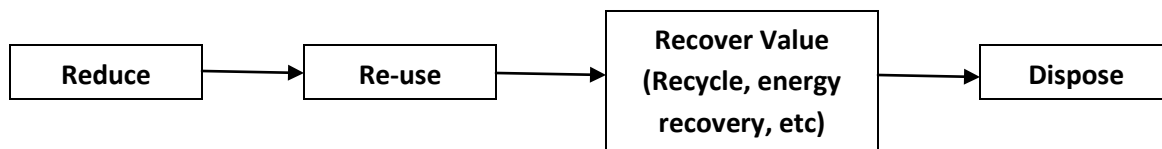
### 4.1.2 Waste

#### 4.1.2.1 Waste Management

Typical non-hazardous and hazardous wastes<sup>1</sup> routinely generated at offshore facilities include general office and packaging wastes, waste oils, oil contaminated rags, hydraulic fluids, used batteries, empty paint cans, waste chemicals and used chemical containers, used filters, fluorescent tubes, scrap metals, and medical waste, among others.

These waste materials should be segregated offshore into nonhazardous and hazardous wastes at a minimum, and shipped to shore for re-use, recycling, or disposal. A waste management plan for the offshore facility should be developed that contains a clear waste tracking mechanism to track waste consignments from the originating location offshore to the final waste treatment and disposal location onshore and submitted to the Agency for approval.

Waste management is an activity whereby the application of the Reduce, Reuse, Recycle principle should always be applied. In effect each waste stream must be addressed to determine the optimum disposal option. The sequence of evaluation is as follows:



That is, all efforts should be made to eliminate, reduce, or recycle wastes at all times.

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<sup>1</sup> As defined by local legislation or international conventions.

#### **4.1.2.1.1 Waste Transfer Notes (WTN)**

Waste Transfer Notes (Waste Declaration Forms, Waste Transfer and Disposal Waybills) are fundamental to ensuring that waste is transferred from the producer, through transportation chain to the disposer and provide a record of due diligence and 'Duty of Care'.

It is a paper or hard copy waste consignment / transfer system that tracks the waste stream from the point of origin to the disposal location. Transfer notes should accompany all waste consignments originating from all operational sites and should be duly completed with the details required within the WTN and appropriate signatories. A sample WTN is provided in Appendix 4 and 5.

#### **4.1.2.1.2 Audits and Inspections**

Audits and inspections are performed according to the operators' audit programme and include both in-house and external auditing. External audits may be commissioned on an annual basis by the operator. Key outcomes from review and audit activities are tracked to ensure that waste minimization opportunities are identified to help establish goals and objectives and to improve the Waste Management Strategy.

#### **4.1.2.2 Waste Water Streams**

The oil industry generates significant quantities of water streams such as produced water, hydrotest water, cooling water and desalinated brine. These waste water streams must be treated before discharge into the marine environment as described below.

##### **4.1.2.2.1 Produced Water**

Oil and gas reservoirs contain water (formation water) that becomes produced water when brought to the surface during hydrocarbon production. Oil reservoirs can contain large volumes of this water whereas gas reservoirs typically produce smaller quantities. In many fields, water is injected into the reservoir to maintain pressure and / or maximize production.

The total produced water stream can be one of the largest waste products, by volume, disposed of by the offshore oil and gas industry. Produced water contains a complex mixture of inorganic (dissolved salts, trace metals, suspended particles) and organic (dispersed and dissolved hydrocarbons, organic acids) compounds, and in many cases, residual chemical additives (e.g. scale and corrosion inhibitors) that are added into the hydrocarbon production process.

Feasible alternatives for the management and disposal of produced water should be evaluated and integrated into production design. These alternatives may include injection along with seawater for reservoir pressure maintenance, injection into a suitable offshore disposal well, or export to shore with produced hydrocarbons for treatment and disposal. If none of these alternatives are technically or financially feasible, produced water should be treated according to discharge guidelines provided in Table 3 of Section 7 before disposal into the marine environment.

Treatment technologies to consider include combinations of gravity and / or mechanical separation and chemical treatment, and may include a multistage system, typically including a skim tank or a parallel plate separator, followed by a gas flotation cell or hydrocyclone. There are also a number of treatment package technologies available that should be considered depending on the application and particular field conditions.

Sufficient treatment system backup capability should be in place to ensure continual operation and for use in the event of failure of an alternative disposal method, for example, produced water injection system failure.

Where disposal to sea is necessary, all means to reduce the volume of produced water should be considered, including:

- Adequate well management during well completion activities to minimize water production;
- Use of downhole fluid separation techniques, where possible, and water shutoff techniques, when technically and economically feasible;
- Recompletion of high water producing wells to minimize water production
- Shutting in high water producing wells.

To minimize environmental hazards related to residual chemical additives in the produced water stream, where surface disposal methods are used, production chemicals should be selected carefully by taking into account their volume, toxicity, bioavailability, and bioaccumulation potential.

#### **4.1.2.2.2 Hydrostatic Testing Water**

Hydrostatic testing of offshore equipment and marine pipelines involves pressure testing with water (typically filtered seawater, unless equipment specifications do not allow it) to verify equipment and pipeline integrity. Chemical additives (corrosion inhibitors, oxygen scavengers, and dyes) may be added to the water to prevent internal corrosion or to identify leaks. In managing hydrotest waters, the following pollution prevention and control measures should be considered:

- Minimizing the volume of hydrotest water offshore by testing equipment at an onshore site before the equipment is loaded onto the offshore facilities;
- Using the same water for multiple tests;
- Reducing the need for chemicals by minimizing the time that test water remains in the equipment or pipeline;
- Careful selection of chemical additives in terms of dose concentration, toxicity, biodegradability, bioavailability, and bioaccumulation potential;
- Sending offshore pipeline hydrotest water to shore facilities for treatment and disposal, where practical.

If discharge of hydrotest waters to the sea is the only feasible alternative for disposal, a hydrotest water disposal plan should be prepared that considers points of discharge, rate of

discharge, chemical use and dispersion, environmental risk, and monitoring. Hydrotest water disposal into shallow coastal waters should be avoided.

#### **4.1.2.2.3 Cooling Water**

Antifoulant chemical dosing to prevent marine fouling of offshore facility cooling water systems should be carefully considered. Available alternatives should be evaluated and the seawater intake depth should be optimized to reduce the need for use of chemicals. Appropriate screens should be fitted to the seawater intake if safe and practical.

The cooling water discharge depth should be selected to maximize mixing and cooling of the thermal plume to ensure that the temperature is within 3 degrees Celsius of ambient seawater temperature at the edge of the defined mixing zone or within 100 meters of the discharge point, as noted in Table 3 of Section 7 of this Guideline.

#### **4.1.2.2.4 Desalination Brine**

Operators should mix desalination brine from the potable water system with the cooling water or sewage water discharge. If mixing with other discharge waste streams is not feasible, the discharge location should be carefully selected with respect to potential environmental impacts.

All these alternatives must be carefully explored, documented and demonstrated in the EIS that the best feasible alternative is the one selected.

#### **4.1.2.2.5 Other Waste Waters**

Other waste waters routinely generated at offshore facilities are listed below, along with appropriate treatment measures:

- **Sewage:** Gray and black water from showers, toilets, and kitchen facilities should be treated in an appropriate on-site marine sanitary treatment unit in compliance with MARPOL 73/78 requirements.
- **Food waste:** Organic (food) waste from the kitchen should, at a minimum, be macerated to acceptable levels and discharged to sea, in compliance with MARPOL 73/78 requirements.
- **Storage displacement water:** Water pumped into and out of storage during loading and off-loading operations should be contained and treated before discharge to meet the guidelines provided in Table 3 in Section 7.
- **Bilge waters:** Bilge waters from machinery spaces in offshore facilities and support vessels should be routed to the facility closed drainage system, or contained and treated before discharge to meet the guidelines provided in Table 3 in Section 7. If treatment to this standard is not possible, these waters should be contained and shipped to shore for disposal.
- **Deck drainage water:** Drainage water generated from precipitation, sea spray, or routine operations, such as deck and equipment cleaning and fire drills, should be routed

to separate drainage systems on offshore facilities. This includes drainage water from process areas that could be contaminated with oil (closed drains) and drainage water from non-process areas (open drains). All process areas should be bunded to ensure drainage water flows into the closed drainage system. Drip trays should be used to collect run-off from equipment that is not contained within a bunded area and the contents routed to the closed drainage system. Contaminated drainage waters should be treated before discharge to meet the guidelines provided in Table 3 of Section 7.

#### **4.1.2.3 Other Waste Streams**

Significant additional waste streams specific to offshore development activities include:

- Drilling fluids and drilled cuttings
- Produced sand
- Completion and well work-over fluids
- Naturally occurring radioactive materials (NORM)

##### **4.1.2.3.1 Drilling Fluids and Drilled Cuttings**

The primary functions of drilling fluids used in oil and gas field drilling operations include removal of drilled cuttings (rock chippings) from the wellbore and control of formation pressures. Other important functions include sealing permeable formations, maintaining wellbore stability, cooling and lubricating the drill bit, and transmitting hydraulic energy to the drilling tools and bit. Drilled cuttings removed from the wellbore and spent drilling fluids are typically the largest waste streams generated during oil and gas drilling activities.

Various drilling fluids are available, but they can generally be categorized into one of two fluid systems:

- **Water-Based Drilling Fluids (WBDF):** Fluids where the continuous phase and suspending medium for solids is seawater or a water miscible fluid. There are many WBDF variations, including gel, salt-polymer, salt-glycol and salt-silicate fluids;
- **Non-Aqueous Drilling Fluids (NADF):** The continuous phase and suspending medium for solids is a water immiscible fluid that is oil-based, enhanced mineral oil-based, or synthetic-based. Diesel-based fluids are also available, but the use of systems that contain diesel as the principal component of the liquid phase is not considered current good practice for offshore drilling programs and should be avoided entirely.

Typically, the solid medium used in most drilling fluids is barite (barium sulfate) for weight, with bentonite clays as a thickener. Drilling fluids also contain a number of chemicals that are added depending on the downhole formation conditions.

Drilling fluids are either circulated downhole with direct loss to the seabed along with displaced cuttings, particularly while drilling well sections nearest to the surface of the seabed, or are

recirculated to the offshore facility where they are routed to a solids control system. In the solids control system, the drilling fluids are separated from the cuttings so that they may be recirculated downhole leaving the cuttings behind for disposal. These cuttings contain a proportion of residual drilling fluid. The volume of cuttings produced will depend on the depth of the well and the diameter of the hole sections drilled.

The drilling fluid is replaced when its rheological properties or density of the fluid can no longer be maintained or at the end of the drilling program. These spent fluids are then contained for reuse or disposal. Disposal of spent NADF by discharge to the sea must be avoided. Instead, they should be transferred to shore for recycling or treatment and disposal.

Feasible alternatives for the disposal of spent WBDF and drilled cuttings from well sections drilled with either WBDF or NADF should be evaluated. Options include injection into a dedicated disposal well offshore, injection into the annular space of a well, containment and transfer to shore for treatment and disposal and, when there is no other option available, discharge to sea.

When discharge to sea is the only demonstrated alternative, a drilled cuttings and fluid disposal plan should be prepared taking into account cuttings and fluid dispersion, chemical use, environmental risk, and necessary monitoring. Discharge of cuttings to sea from wells drilled with NADF should be avoided. If discharge is necessary cuttings should be treated before discharge to meet the guidelines provided in Table 3 in Section 7.

Pollution prevention and control measures to consider prior to the discharge of spent drilling fluids and drilled cuttings should include:

- Minimizing environmental hazards related to residual chemicals additives on discharged cuttings by careful selection of the fluid system. WBDFs should be selected whenever appropriate;
- Careful selection of fluid additives taking into account their concentration, toxicity, bioavailability and bioaccumulation potential;
- Use of high efficiency solids control equipment to reduce the need for fluid change out and minimizing the amount of residual fluid on drilled cuttings;
- Use directional drilling (horizontal and extended reach) techniques to avoid sensitive surface areas and to gain access to the reservoir from less sensitive surface areas;
- Use of slim-hole multilateral wells and coiled tubing drilling techniques, when feasible, to reduce the amount of fluids and cuttings.
- Drilling fluids to be discharged to sea (including as residual material on drilled cuttings) are subject to tests for toxicity, barite contamination, and oil content that are provided in Table 3 in Section 7. (See also Section 6, Articles 12-15). All discharges should be made via a caisson at least 15 meters below the sea surface.

#### **4.1.2.3.2 Produced Sand**

Produced sand originating from the reservoir is separated from the formation fluids during hydrocarbon processing. The produced sand can be contaminated with hydrocarbons, but the oil

content can vary substantially depending on location, depth, and reservoir characteristics. Well completion should aim to reduce the production of sand at source using effective downhole sand control measures.

Whenever practical, produced sand removed from process equipment should be transported to shore for treatment and disposal, or routed to an offshore injection disposal well if available. Discharge to sea is not considered to be current good practice. If discharge to sea is the only demonstrable feasible option then the discharge should meet the guideline values in Table 3 in Section 7.

Any oily water generated from treatment of produced sand should be recovered and treated to meet the guideline values for produced water in Table 3 in Section 7. (See also Section 6, Article 7)

#### **4.1.2.3.3 Completion and Well Work-over Fluids**

Completion and well work-over fluids (including intervention fluids and service fluids) can typically include weighted brines or acids, methanol and glycols, and many other chemical systems. These fluids are used to clean the wellbore and stimulate the flow of hydrocarbons, or simply used to maintain downhole pressure. Once used these fluids may contain contaminants including solid material, oil, and chemical additives. The use of methanol is not considered to be current good practice and must be avoided.

Feasible disposal options should be considered, where practical, including:

- Collection of the fluids if handled in closed systems and shipping to shore to the original vendors for recycling;
- Injection in an available injection disposal well, where available;
- Shipping to shore for treatment and disposal;

If discharge to sea is the only demonstrated feasible option:

- Chemical systems should be selected in terms of their concentration, toxicity, bioavailability and bioaccumulation potential;
- Consideration should be given to routing these fluids to the produced water stream for treatment and disposal, if available;
- Spent acids should be neutralized before treatment and disposal;
- The fluids should meet the discharge levels in Table 3 in Section 7 of this Guideline.

(See also Section 6, Articles 9-11)

#### **4.1.2.3.4 Naturally Occurring Radioactive Materials**

Depending on the field reservoir characteristics, naturally occurring radioactive material (NORM) may precipitate as scale or sludges in process piping and production vessels. Where NORM is present, a NORM management program should be developed so that appropriate handling procedures are followed.



If removal of NORM is required for occupational health reasons (Section 4.2.2), disposal options may include: canister disposal during well abandonment; injection into the annular space of a well; shipping to shore for disposal to landfill in sealed containers; and, depending on the type of NORM and when there is no other option available, discharge to sea with the facility drainage.

Sludge, scale, or NORM-impacted equipment should be treated, processed, or isolated so that potential future human exposures to the treated waste would be within internationally accepted risk-based limits. Recognized industrial practices should be used for disposal. If waste is sent to an external onshore facility for disposal, the facility must be licensed to receive such waste.

#### **4.1.2.4 Hazardous Materials Management**

There are many hazardous materials used in offshore oil and gas operations.

The following principles should be followed for offshore chemicals:

- Use of chemical hazard assessment and risk management techniques to evaluate chemicals and their effects;
- Selected chemicals should be previously tested for environmental hazards;
- Offshore drilling and production chemicals should be selected based on the OSPAR<sup>2</sup> Harmonised Offshore Chemical Notification Format (HOCNF) or similar internationally recognized system;
- Chemicals with least hazard and lowest potential environmental impact, and lowest potential health impact, should be selected, whenever possible;
- Use of chemicals suspected to cause taint or known endocrine disruptors should be avoided;
- Use of Ozone Depleting Substances<sup>3</sup> should be avoided;
- Chemicals known to contain heavy metals, other than in trace quantities, should be avoided.

(See also Section 6, Articles 9-11)

#### **4.1.3 Noise**

Oil and gas development activities generating marine noise include seismic operations, drilling and production activities, offshore and nearshore structural installation (especially pile driving) and construction activities, and marine traffic. Noise from offshore activities (especially from seismic operations) can temporarily affect fish and marine mammals. Recommended measures to reduce the risk of noise impact to marine species include:

- Identifying areas sensitive for marine life such as feeding, breeding, calving, and spawning areas;

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<sup>2</sup> Oslo and Paris Convention for the Protection of the Marine Environment of the North-East Atlantic

<sup>3</sup> As defined by the Montreal Protocol on substances that deplete the ozone layer.

- Planning seismic surveys and offshore construction activities to avoid sensitive times of the year;
- Identifying fishing areas and reducing disturbance by planning seismic surveys and construction activities at less productive times of the year, where possible;
- Maximize the efficiency of seismic surveys to reduce operation times, where possible;
- If sensitive species are anticipated in the area, monitor their presence before the onset of noise creating activities, and throughout the seismic program or construction. In areas where significant impacts to sensitive species are anticipated, experienced observers should be used;
- When marine mammals are observed congregating close to the area of planned activities, seismic start-up or construction should begin at least 500 meters away;
- If marine mammals are sighted within 500 meters of the proposed seismic array or construction area, start-up of seismic activities or construction should be postponed until they have moved away, allowing adequate time after the last sighting;
- Soft-start procedures, also called ramp-up or slow buildup, should be used in areas of known marine mammal activity. This involves a gradual increase in sound pressure to full operational levels;
- The lowest practicable power levels should be used throughout the seismic surveys, and their use should be documented;
- Methods to reduce and/or baffle unnecessary high-frequency noise produced by air guns or other acoustic energy sources should be used, where possible.

#### 4.1.4 Spills

Spills from offshore facilities can occur due to leaks, equipment failure, accidents, or human error. Spill prevention and control measures specific to offshore oil and gas facilities include:

- Conducting a spill risk assessment for offshore facilities and support vessels;
- Design of process, utility, and drilling systems to reduce the risk of major uncontained spills;
- Install valves, including subsea shutdown valves, to allow early shutdown or isolation in the event of an emergency;
- Ensure adequate corrosion allowance for the lifetime of the facilities and / or installation of corrosion control and prevention systems in all pipelines, process equipment, and tanks;
- Develop maintenance and monitoring programs to ensure the integrity of well field equipment. For export pipelines, maintenance programs should include regular pigging to clean the pipeline, and intelligent pigging should also be considered as required;
- Install leak detection systems. Use of sub-sea pipelines measures, such as telemetry systems, SCADA<sup>4</sup> systems, pressure sensors, shut-in valves, and pump-off systems, as well as normally unattended installations (unmanned) facilities to ensure rapid detection of loss of containment;

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<sup>4</sup> SCADA refers to supervisory control and data acquisition systems, which may be used in oil and gas and other industrial facilities to assist in the monitoring and control of plants and equipment.

- For facilities with potentially significant releases, install an Emergency Shutdown System that initiates automatic shutdown actions to bring the offshore facility to a safe condition; ;
- Adequate personnel training in oil spill prevention, containment and response.
- Ensure spill response and containment equipment is deployed or available as necessary for response;
- All spills should be documented and reported. All operators should note that non-reporting of an incident is an offense and severe penalties shall be imposed for non-reporting.
- Following a spill, a root cause investigation should be carried out and corrective action taken. A Spill Response Plan is required, along with the capability to implement the plan. The Spill Response Plan should address potential oil, chemical, and fuel spills from offshore facilities, support vessels including tankers, and pipeline ruptures. The plan should also include:
  1. A description of operations, site conditions, current and wind data, sea conditions and water depth, and logistical support;
  2. Identification of persons responsible for managing spill response efforts, their responsibility, authority, roles and contact details;
  3. Cooperative measures with government agencies, if appropriate;
  4. Spill risk assessment, defining expected frequency and size of spills from different potential release sources; including assessment of foreseeable scenarios and resources that might be at risk;
  5. Oil spill trajectory modeling with oil fate and environmental impact prediction for a number of spill simulations (including worst case scenario, such as blowout from an oil well) using an adequate and internationally recognized computer model with the ability to input local current and wind data;
  6. Clear demarcation of spill severity, according to the size of the spill using a clearly defined Tier I, Tier II and Tier III approach;
  7. Strategies for managing Tier I spills at a minimum, from the offshore installation and support vessels;
  8. Arrangements and procedures to mobilize external resources for responding to larger spills and strategies for deployment (i.e. Tier II and III spills);
  9. Full list, description, location, and use of on-site and off-site response equipment, and the response times for deployment;
  10. Strategies for containment and recovery of floating oil, including use (and limitations) of chemical dispersants;
  11. Maps identifying sensitive ecological areas (seasonal / monthly) prepared using sensitivity mapping of the environment at risk;
  12. Identified priorities for response (with input from potentially affected or concerned parties);
  13. Shoreline cleanup strategies;
  14. Handling instructions for spilled oil, chemicals, fuels or other recovered contaminated materials, including their transportation, temporarily storage, and disposal.

(See also Section 6, Articles 21-24)

### **4.1.5 Decommissioning**

Internationally-recognized guidelines and standards issued by the International Maritime Organization (IMO) and decisions issued by OSPAR<sup>5</sup> should be followed for the decommissioning of offshore facilities.<sup>6</sup>

IMO standards state that installations or structures of less than 4,000 tonnes, excluding the deck and superstructure, and in less than 75 meters of water should be removed entirely at decommissioning. Additionally, no installation or structure should be installed after January 1, 1998 unless the facility is designed to be entirely removed.

An OSPAR decision recognizes entire removal of the facility from the offshore locations for re-use, recycling, or final disposal on land as the preferred option for the decommissioning of offshore facilities. Alternative disposal options may be considered if justified on the basis of an alternative options assessment. This assessment should consider facility type, disposal methods, disposal sites, and environmental and social impact, including interference with other sea users, impacts on safety, energy and raw material consumption, and emissions.

A preliminary decommissioning plan for offshore facilities should be developed that considers well abandonment, removal of oil from flowlines, facility removal, and sub-sea pipeline decommissioning along with disposal options for all equipment and materials. This plan can be further developed during field operations and fully defined in advance of the end of field life.

The plan should include details on the provisions for the implementation of decommissioning activities and arrangements for post decommissioning monitoring and aftercare. All decommissioning plans should be submitted to the EPA for approval before the commencement of any plan of development of petroleum operations.

## **4.2 Occupational Health and Safety**

Occupational Health and Safety (OHS) issues should be considered as part of a comprehensive hazard or risk assessment, for example, a hazard identification study [HAZID], hazard and operability study [HAZOP], or other risk assessment studies. The results should be used for health and safety management planning, in the design of the facility and safe working systems, and in the preparation of safe working procedures. Health and safety management planning should demonstrate that a systematic and structured approach to managing offshore health and safety will be adopted and that controls are in place to reduce risks to as low as reasonably practical.

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<sup>5</sup> Oslo-Paris Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR), <http://www.ospar.org/>

<sup>6</sup> Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone, 1989 (Resolution A.672 (16)), International Maritime Organization (IMO); and the OSPAR Decision 98/3 on the "Disposal of Disused Offshore Installations, and OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic. Ministerial meeting of the OSPAR Commission, Sintra 22-23 July 1998.

It should be noted that all OHS issues also have direct and/or indirect link to environmental consequences. Therefore offshore facilities should be designed to eliminate or reduce the potential for injury or risk of accident. The following issues should be considered in the design of offshore facilities:

- Environmental conditions at the offshore location (e.g. seismicity, extreme wind and wave events, currents, bottom geohazards);
- Adequate living accommodation appropriate to outside environmental conditions;
- Temporary refuge or safe havens located in a protected area at the facility for use by personnel in the event of an emergency;
- A sufficient number of escape routes leading to designated personnel muster points, and escape from the facility;
- Handrails, toeboards, and non-slip surfaces on elevated platforms and walkways, stairways and ramps to prevent man overboard incidents;
- Crane and equipment laydown area positioning to avoid moving loads over critical areas and reducing the impacts from dropped objects. Alternatively, structural protection measures should be provided. Occupational health and safety risk management should include hazard identification and communication, conducting work activities in a safe and skillful manner, appropriate staff training and maintaining equipment in a safe condition. Safety cases for offshore facilities should be developed where appropriate.

A formal Permit to Work (PTW) system should be developed for offshore facilities and work period clearly specified. The PTW will ensure that all potentially hazardous work is carried out safely and ensures effective authorization of designated work, effective communication of the work to be carried out including hazards involved, and safe isolation procedures to be followed before commencing work. A lockout / tagout procedure for equipment should be implemented to ensure all equipment is isolated from energy sources before servicing or removal. Operators' period of stay programmes should be strictly enforced.

Operators should carefully consider health related matters in their plans including but not limited to the following:

- Offshore facilities should be equipped, at a minimum, with specialized first aid providers (industrial pre-hospital care personnel) and the means to provide short-term remote patient care.
- Depending on the number of personnel present and complexity of the facility, provision of an on-site medical unit and doctor should be considered. In specific cases, telemedicine facilities may be an alternative option.

An alarm system should be installed which can be heard throughout the offshore facility. Alarms for fire, gas leak and man overboard should be provided.

The formation of a health and safety committee for the facility is recommended. Health and safety inductions should be provided to the entire workforce prior to mobilization to the offshore facilities.

Occupational health and safety issues for consideration in offshore oil and gas operations include:

- Fire and explosion prevention and control
- Air quality
- Hazardous materials
- Personnel transfer and vessels
- Well blowouts
- Ship collision
- Emergency preparedness and response
- Fire and Explosion Prevention and Control

The most effective way of preventing fires and explosions in offshore facilities is by preventing the release of flammable material and gas, and the early detection and interruption of leaks. Potential ignition sources should be kept to a minimum and adequate separation distance between potential ignition sources and flammable materials should be in place. Offshore facilities should be classified into hazard areas, based on international standards<sup>7</sup>, and in accordance with the likelihood of release of flammable gases and liquids.

Appropriate fire and explosion prevention and control measures for offshore facilities should include:

1. Provision of passive fire protection on the facility to prevent the spread of fire in the event of an incident:
  - a. Passive fire protection on load-bearing structures and fire-rated walls should be provided and fire-rated partitions should be provided between rooms
  - b. Design of load-bearing structures should take into account explosion load, or blast-rated walls should be installed
  - c. Design of items and structures against explosion and the need for blast walls should be based on an assessment of likely explosion characteristics
  - d. Blast panel or explosion venting should be considered, and fire and explosion protection should specifically consider wellheads, safe areas, and living areas
2. Accommodation areas should be protected by distance or by fire walls. The ventilation air intakes should prevent smoke from entering accommodation areas;
3. All fire systems (for example, firewater pumps or control room) should be located in a safe area of the facility, protected from the fire by distance or by fire walls. If the system or item is located within a fire area, it should be passive fire protected or fail-safe;

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<sup>7</sup> Such as API 500/505, International Electrotechnical Commission, or British Standards (BS)

4. Explosive atmospheres in confined spaces should be avoided by making spaces inert;
5. For unmanned facilities, occurrence of fire or explosion should be signaled to the remote control center to ensure that appropriate action is taken;
6. A combination of automatic and manual fire alarm systems should be available on offshore facilities. Active fire protection systems should be installed on offshore facilities and should be strategically located to enable rapid and effective response. A combination of active fire suppression mechanisms can be used, depending on the type of fire and the fire impact assessment (for example, fixed foam system, fixed fire water system, CO<sub>2</sub> extinguishing system, and portable fire extinguishing equipment). The installation of halon-based fire systems is not considered current good practice and should be avoided. Firewater pumps should be available and designed to deliver water at an appropriate rate. Regular checks and maintenance of fire fighting equipment is essential.
7. Fire safety training and response should be provided as part of workforce health and safety induction / training, with advanced fire safety training provided to a designated fire fighting team.

#### **4.2.1 Air Quality**

Due to the risk of gas releases at offshore oil and gas facilities caused by leaks or emergency events, adequate ventilation in closed or partially closed spaces is required. Air intakes should be installed to ventilate facility safe areas and areas that should be operable during emergency situations. If necessary, means to detect dangerous gas concentrations in the intakes, and automatic shut-down in the event of dangerous gas levels should be installed. A dangerous concentration of flammable gas can be considered to be a fraction (approximately 20 percent) of the Lower Explosive Limit of the substance.

The facilities should be equipped with a reliable system for gas detection that allows the source of release to be isolated and the inventory of gas that can be released to be reduced. Blowdown of pressure equipment should be initiated to reduce system pressure and consequently reduce the release flow rate. Gas detection devices should also be used to authorize entry and operations into enclosed spaces.

Wherever hydrogen sulfide (H<sub>2</sub>S) gas may accumulate, monitors should be installed and set to activate warning signals whenever detected concentrations of H<sub>2</sub>S exceed 7 milligrams per cubic meter (mg/m<sup>3</sup>). Personnel should also be provided with personal H<sub>2</sub>S detectors and response training in the event of a leak. A self-contained breathing apparatus should be provided and the apparatus designed and conveniently located to enable personnel to safely interrupt tasks and reach a temporary refuge or safe haven.

#### **4.2.2 Hazardous Materials**

The design of the offshore facilities should reduce exposure of personnel to chemical substances, fuels, and products containing hazardous substances. Use of substances and

products classified as very toxic, carcinogenic, allergenic, mutagenic, teratogenic, or strongly corrosive should be identified and substituted by less hazardous alternatives, wherever possible. For each chemical used, a Material Safety Data Sheet (MSDS) should be available and readily accessible on the facility.

A procedure for the control and management of radioactive sources used offshore should be prepared along with a designated shielded container for storage when the source is not in use. The container should be locked in a secure store that is exclusively used for this purpose.

In locations where naturally occurring radioactive material (NORM) may precipitate as scale or sludges in process piping and production vessels, facilities and process equipment should be monitored for the presence of NORM at least every five years, or whenever equipment is to be taken out of service for maintenance. Where NORM is detected, a NORM management program should be developed so that appropriate handling procedures are followed. Procedures should determine the classification of the area where NORM is present and the level of supervision and control required. Facilities are considered impacted when surface levels are greater than 4.0 Bq/cm<sup>2</sup> for gamma/beta radiation and 0.4 Bq/cm<sup>2</sup> for alpha radiation.<sup>8</sup> The operator should determine whether to leave the NORM in-situ, or clean and decontaminate by removal for disposal as described in Section 4.1.3.4 of this Guideline.

### **4.2.3 Personnel Transfer and Vessels**

Personnel transfer to and from offshore facilities is typically by helicopter or boat. Specific safety procedures for helicopter and vessel transport of personnel are required and a safety briefing for passengers should be provided systematically along with safety equipment.

Helicopter decks (helideck) onboard offshore facilities should follow the requirements of the Ghana Civil Aviation Authority and International Civil Aviation Organization (ICAO). Facilities for mooring boats during the transfer of personnel should consider adverse sea conditions to protect the boat and the facility structure from heavy impacts.

If personnel are transferred from the boat to the facility by crane, only cranes, cables, and baskets certified for personnel transfer should be used.

Support vessels should have the relevant permits and certifications to comply with the requirements of the Ghana Maritime Authority and International Maritime Organization. A Vessel Safety Management System should be implemented.

### **4.2.4 Well Blowouts**

A blowout can be caused by the uncontrolled flow of reservoir fluids into the wellbore and will result in an uncontrolled release of hydrocarbons to the sea.

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<sup>8</sup> US Environmental Protection Agency (EPA) 49 CFR 173: Surface Contaminated Object (SCO) and International Atomic Energy Agency (IAEA) Safety Standards Series No. ST-1, §508



Blowout prevention measures should focus on maintaining wellbore pressure by effectively estimating formation fluid pressures and strength of subsurface formations. This can be achieved with techniques such as: proper pre-well planning, drilling fluid logging; using sufficient hydrostatic head of weighted drilling fluid or completion fluid to balance the pressures in the wellbore; and installing a Blow Out Preventor (BOP) system that can be closed rapidly in the event of an uncontrolled influx of formation fluids and which allows the well to be circulated to safety by venting the gas at surface and routing oil so that it may be contained. The BOP should be operated hydraulically and triggered automatically, and tested at regular intervals. Facility personnel should conduct well control drills. Blow out contingency measures should be included in the facility's emergency response plan.

#### **4.2.5 Ship Collision**

To avoid accidental collisions with third party and support vessels, offshore facilities should be equipped with navigational aids that meet national and international requirements. Navigational aids include radar and lights on facility structures and, where appropriate, on support vessels. A 500 meter radius facility exclusion zone, at a minimum, should be implemented around permanent offshore facilities. The facility should monitor and communicate with vessels approaching the facility to reduce the risk of vessel collision.

The Ghana Maritime Authority, Ghana Ports & Harbours Authority, Ghana Shippers Council and the Ghana Navy should be notified of all permanent offshore facilities as well as exclusion zones and routine shipping routes to be used by project related vessels. Permanent facility locations should be marked on nautical charts. The Ghana Maritime Authority and the Ghana Navy should be notified of the schedule and location of activities when there will be a significant increase in vessel movement, such as during facility installation, rig movements, and seismic surveys.

A subsea pipeline corridor safety zone (typically, 1,000 meters wide) should be established to define anchoring exclusion zones and provide protection for fishing gear. In shallower waters with high shipping activity, consideration should be given to burying the pipeline below the seabed.

#### **4.2.6 Emergency Preparedness and Response**

Offshore facilities should establish and maintain emergency preparedness to ensure incidents are responded to effectively and without delay. Potential worst case accidents should be identified by risk assessment and appropriate preparedness requirements designed. An emergency response team should be established for the offshore facility that is trained to respond to potential emergencies, rescue injured persons, and perform emergency actions. The team should coordinate actions with other agencies and organizations that may be involved in emergency response.

Personnel should be provided with adequate and sufficient equipment that is located appropriately for the evacuation of the facility. Lifeboats should be available in sufficient

numbers for the entire workforce. These lifeboats should be enclosed fire-resistant crafts with trained lifeboat operators.

Sufficient lifejackets, lifebuoys, and survival suits should also be provided.

Evacuation by helicopter should not be considered as the primary means of escape.

Exercises in emergency preparedness should be practiced at a frequency commensurate with the project risk. At a minimum, the following practice schedule should be implemented:

- Quarterly drills without equipment deployment;
- Evacuation drills and training for egress from the platform under different weather conditions and time of day;
- Annual mock drills with equipment deployment;
- Updating training, as needed, based on continuous evaluation.
- An emergency response plan should be prepared that contains the following measures, at a minimum:
  - A description of the response organization (structure, roles, responsibilities, and decision makers);
  - Description of response procedures (details of response equipment and location, procedures, training requirements, duties, etc.);
  - Descriptions and procedures for alarm and communications systems;
  - Precautionary measures for securing the well(s);
  - Relief well arrangements, including description of equipment, consumables, and support systems to be utilized;
  - Description of on-site first aid supplies and available backup medical support;
  - Description of other emergency facilities such as emergency fueling sites;
  - Description of survival equipment and gear, alternate accommodation facilities, and emergency power sources;
  - Procedures for man overboard;
  - Evacuation procedures;
  - Emergency Medical Evacuation (MEDIVAC) procedures for injured or ill personnel;
  - Policies defining measures for limiting or stopping events, and conditions for termination of action.

(See also Section 6, Articles 21-24)

### **4.3 Community Issues**

Impacts to community livelihood, health and safety from typical offshore oil and gas facility operations relate to potential interaction with other sea users, primarily ship operators and fishermen.

Activities such as offshore drilling and construction, pipeline installation, seismic operations, and decommissioning may result in temporary impacts to other users of the sea. Permanent

installations and structures, including production and drilling facilities and sub-sea pipelines, have a potential long-term impact, at least until the end of the life of the field. Notification of the location of offshore facilities (including sub-sea hazards) and timing of offshore activities should be provided to local and regional maritime authorities, including fishery groups. The position of fixed facilities and safety exclusion zones should be marked on nautical charts. Clear instructions regarding access limitations to exclusion zones should be communicated to other sea users. Sub-sea pipeline routes should be regularly monitored for the presence of pipeline spans and identified spans repaired.

In areas where significant impacts to fishermen are anticipated, a fisheries liaison officer should be appointed to provide a direct link with the fishing community. Arrangements for the management of potential community or amenity impacts resulting from shoreline impacts caused by oil, chemical, or fuel spills are to be included in the spill response plans.

Ancillary works onshore in support of offshore oil and gas development could result in significant impacts, such as displacement of people, resettlement and payment of compensations. Environmental assessment programmes for offshore developments should consider these onshore developments and assess their overall impacts as part of the offshore development impacts. This would help resolve issues that could have significant impact on the offshore developments, such as timing of offshore activities and disruption of supply to offshore activities.

## **4.4 Security**

Unauthorized access to offshore facilities should be avoided by means of gates located in the stairs from the boat landings to the deck level. Means for detecting intrusion (for example, closed-circuit television) may be considered, allowing the control room to verify the conditions of the facility.

A facility standby vessel should be considered for all offshore facilities. This vessel should support security operations, management of supply vessel approach to the facility, and the intrusion of third party vessels into the exclusion zone, as well as supporting operations during emergency situations.

## **SECTION 5: PERFORMANCE INDICATORS AND MONITORING**

## **5.0 Performance Indicators and Monitoring**

### ***5.1 Environment Emissions and Effluent Guidelines***

Section 7, Table 3 presents effluent guidelines for offshore oil and gas development. Guideline values for process effluents in this sector are indicative of good international industry practice and are a reflection of standards of countries with recognized regulatory frameworks. The guidelines are assumed to be achievable under normal operating conditions in appropriately designed and operated facilities through the application of pollution prevention and control techniques discussed in the preceding sections of this document.

The effluent guidelines are primarily applicable to discharges in off-shore locations (e.g. greater than 12 nautical miles from shore). Discharge water quality to near-shore waters should (and would) be established on a case-specific basis taking into account the environmental sensitivities and assimilative capacity of receiving waters.

### ***5.2 Environmental Monitoring***

Environmental monitoring should not be regarded as a means of satisfying relevant requirements only but as a means of improving management systems of the operators.

Environmental monitoring programs for the oil and gas sector should be implemented to address all activities that have been identified to have potentially significant impacts on the environment, during normal operations and upset conditions. Environmental monitoring activities should be based on direct or indirect indicators of emissions, effluents, and resource use applicable to the particular project.

Monitoring frequency should be sufficient to provide representative data for the parameter being monitored. Monitoring should be conducted by trained individuals following monitoring and record-keeping procedures and using properly calibrated and maintained equipment. Monitoring data should be analyzed and reviewed at regular intervals and compared with the operating standards so that any necessary corrective actions can be taken.

Monthly monitoring results should be submitted to the EPA using the EPA reporting format for the oil and gas sector or any other internationally recognized reporting format such as OSPAR.

Operators shall make relevant provisions for an environmental authority to conduct routine inspections, investigations, audits, etc of their facilities.

### ***5.3 Occupational Health and Safety***

Occupational health and safety performance should be evaluated against internationally published exposure guidelines, of which examples include the Threshold Limit Value (TLV®)

occupational exposure guidelines and Biological Exposure Indices (BEIs®) published by American Conference of Governmental Industrial Hygienists (ACGIH),<sup>9</sup> the Pocket Guide to Chemical Hazards published by the United States National Institute for Occupational Health and Safety (NIOSH),<sup>10</sup> Permissible Exposure Limits (PELs) published by the Occupational Safety and Health Administration of the United States (OSHA),<sup>11</sup> Indicative Occupational Exposure Limit Values published by European Union member states,<sup>12</sup> or other similar sources. Particular attention should be given to the occupational exposure guidelines for hydrogen sulfide (H<sub>2</sub>S).

For guidelines on occupational exposure to Naturally Occurring Radioactive Material (NORM), operators should consult the average and maximum values published by the Canadian NORM Waste Management Committee, Health Canada, and the Australian Petroleum Production and Exploration Association or other internationally recognized sources.

### **5.3.1 Accident and Fatality Rates**

Projects should try to reduce the number of accidents among project workers (whether directly employed or subcontracted) to a rate of zero, especially accidents that could result in lost work time, different levels of disability, or even fatalities. Facility rates may be benchmarked against the performance of facilities in this sector in developed countries through consultation with published sources (e.g. US Bureau of Labor Statistics and UK Health and Safety Executive)<sup>13</sup>.

### **5.3.2 Occupational Health and Safety Monitoring**

The working environment should be monitored for occupational hazards relevant to the specific project. Monitoring should be designed and implemented by accredited professionals<sup>14</sup> as part of an occupational health and safety monitoring program. Facilities should also maintain a record of occupational accidents and diseases and dangerous occurrences and accidents.

Operators of oil and gas fields should submit monthly record of these occupational accidents and diseases and dangerous occurrences and accidents to the EPA to enable the Agency meet its reporting obligations.

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<sup>9</sup> Available at: <http://www.acgih.org/TLV/> and <http://www.acgih.org/store/>

<sup>10</sup> Available at: <http://www.cdc.gov/niosh/npg/>

<sup>11</sup> Available at: [http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9992](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9992)

<sup>12</sup> Available at: [http://europe.osha.eu.int/good\\_practice/risks/ds/oel/](http://europe.osha.eu.int/good_practice/risks/ds/oel/)

<sup>13</sup> Available at: <http://www.bls.gov/iif/> and <http://www.hse.gov.uk/statistics/index.htm>

<sup>14</sup> Accredited professionals may include Certified Industrial Hygienists, Registered Occupational Hygienists, or Certified Safety Professionals or their equivalent.

## **SECTION 6**

### **ANNEX 1: INDUSTRY SPECIFIC REQUIREMENTS**

## **6.0 Annex 1: Specific Requirements**

### ***CHAPTER I: THE EXTERNAL ENVIRONMENT***

#### **1.1 MONITORING OF THE EXTERNAL ENVIRONMENT**

##### **Article 1: Cooperation on and planning of monitoring of the external environment**

- a) The operators shall cooperate in the monitoring of the external environment in defined areas. The monitoring shall be adapted to the existing pollution risk, and shall be able to discover and map pollution of the external environment. The monitoring shall furthermore identify development trends and provide basis for prognoses of anticipated development.
- b) Plans shall be established for the conduct of monitoring in connection with action against acute pollution on the open sea, at the coast and in the shore zone.
- c) Plans shall be established for monitoring of the environment in connection with pollution from operational discharges in accordance with these guidelines (See also SECTION 7 Table 3) on requirements to environmental monitoring of the petroleum activities. Provision shall be made for personnel with monitoring functions to be able to acquire and handle information on such matters efficiently at all times. The operator shall contribute to the further development of monitoring tools.

The EPA may on a case by case basis define the geographical extent of areas and may in specific cases impose additional requirements regarding environmental monitoring.

##### **Article 2: Remote measurement of acute pollution**

The operator shall establish a remote measurement system that provides sufficient information to ensure that acute pollution from the facility is quickly discovered and mapped.

##### **Article 3: Baseline surveys**

In order to map the environmental status the operator shall carry out baseline surveys

- a) prior to exploration drilling in deep waters,
- b) prior to exploration drilling in areas where the presence of particularly vulnerable environmental resources has been established or where the presence of such resources is probable,
- c) prior to development drilling. Baseline surveys of the water column and the sea bed shall be carried out in accordance with these guidelines. It shall be possible to use data acquired through the baseline surveys in environmentally oriented risk and emergency preparedness analyses.



#### **Article 4: Environmental monitoring**

Environmental monitoring of pollution resulting from operational discharges shall be carried out in accordance with these guidelines. The monitoring shall cover the sea bed as well as the water column. The EPA may in specific cases order surveys of the environment covering other parts of the influence area than those covered by these guidelines.

#### **Article 5: Follow-up surveys**

Follow-up surveys shall be carried out in the event of acute pollution in order to identify and describe the pollution risk.

#### **Article 6: Characterisation of oil and chemicals**

- a) If oil is found in connection with exploration activities, a characterisation of the oil shall be carried out as soon as possible.
- b) Oil and chemicals that may be released to become acute pollution, shall be examined regularly with regard to physical and chemical parameters. If such measurements show significant changes, the oil and chemicals shall be re-characterised.
- c) The characterisation shall be carried out with particular emphasis on disintegration properties and fate in a marine environment. The characterisation shall be adapted to the decision base which at any time is necessary to reduce risk, including effective emergency preparedness development.

## **1.2 EMISSION AND DISCHARGE TO THE EXTERNAL ENVIRONMENT**

#### **Article 7: Discharge of oil-contaminated water**

- a) Oil-contaminated water shall be cleaned before it is discharged to sea. This does not apply to displacement water.
- b) Cleaning plants shall be operated with environmentally optimal effect even if the discharge limits, cf. third paragraph (c), can also be met with reduced cleaning effect. In the evaluation of what will give environmentally optimal effect, the degree of cleaning shall also be considered in relation to the use of chemicals.
- c) The content of oil in water that is discharged shall be as low as possible. The content of oil in water planned to be discharged to sea shall not exceed 29 mg oil per litre of water as a weighted average for one calendar month.
- d) The operator must have permission if oil contaminated water is planned to be injected.
- e) A fee shall be charged per ton of produced water discharged annually.

#### **Article 8: Emission to air**

The operator must have a permit for emission to air issued.

### Article 9a: Ecotoxicological testing of chemicals

- i. The operator shall ensure that chemicals that are used or discharged have been tested with regard to eco-toxicological properties.
- ii. Ecotoxicological testing of substances shall be performed by laboratories that are approved in accordance with OECD's principles for good laboratory practice (GLP).
- iii. Ecotoxicological documentation in the form of OSPAR Harmonised Offshore Chemical Notification Format (HOCNF) shall exist for all chemicals used in the petroleum industry. This requirement does not apply to lubricants which are used in small amounts and chemicals in closed systems which are used in small amounts. The requirement does not apply to laboratory chemicals, dispersants and beach-cleaning agents to combat oil spills, and to new chemicals during the period of field testing. Only part 1 and 3 of the HOCNF must be completed for substances on the OSPAR List of Substances / Preparations Used and Discharged Offshore which are Considered to Pose Little or No Risk to the Environment (the PLONOR list).
- iv. Chemicals shall be tested for the following ecotoxicological properties:
  - 1) Biodegradability
    - a) Chemicals that consist of several substances shall be tested for the individual organic substance's biodegradability. The substances shall preferably be tested in accordance with the seawater test OECD 306 "Biodegradability in Seawater". If this test is not applicable for the test substance, one of the following seawater tests shall be performed:
      - b) Marine CO<sub>2</sub> Evolution test (mod. Sturm), modified OECD 301B
      - c) Marine BODIS test (for insoluble substances), modified ISO/TC 147/SC 5 N141
      - d) Marine CO<sub>2</sub> Headspace test, modified ISO/TC 147/SC 5/WG 4 N182 For substances known to be toxic to micro organisms (e.g. biocides), EPA must be contacted if alternative tests are planned to be used.
      - e) For substances with moderate biodegradability (equivalent to BOD<sub>28</sub> from 20 to 60%) also the properties of the degradation products shall be evaluated.
    - 2) Bioaccumulation
      - a) Chemicals that consist of several substances shall be tested for the individual organic substance's bioaccumulation potential. This requirement applies to substances with a molecular weight below 700 g/mol. The substances shall be tested according to OECD 117 "Partition Coefficient (n-octanol/water), High Performance Liquid Chromatography (HPLC) Method" or OECD 107 "Partition Coefficient (n-octanol/water): Shake Flask Method". For substances where standardised tests are not applicable, as for surfactants, a calculation or a scientific evaluation of the bioaccumulation potential shall be performed. Scientific evaluations shall be documented and preferably be performed by an independent party.
      - b) Acute toxicity inorganic and organic chemicals shall be tested for acute toxicity. The requirement does not apply to substances/preparations on OSPAR's PLONOR list. The following toxicity tests are required:
        - *Skeletonema costatum*, ISO/DIS 10253:1995
        - *Acartia tonsa*, ISO 14669:1999

- *Scophtalamus maximus*; Part B in the OSPAR Protocols on Methods for the testing of Chemicals Used in the Offshore Industry, 1995. Sheepshead minnow is accepted as an alternative species.
  - *Corophium volutator*; Part A in the OSPAR Protocols on Methods for the Testing of Chemicals Used in the Offshore Industry, 1995. Required if the chemicals absorb to particles ( $K_{oc} > 1000$ ) and/or sink and end up in the sediments (e.g. surfactants)
- v. Toxicity tests of fresh water organisms can be accepted if results from marine tests are not available, and they have been performed according to standardised methods. Organic substances that are not very prone to degrade ( $BOD < 20\%$  over 28 days) shall be tested for acute toxicity at substance level. Toxicity tests, including fish tests, shall be performed at substance level for all chemicals. Fish tests are not required if the chemical is
- inorganic and with a toxicity to the other test organisms of  $EC_{50}$  or  $LC_{50} \bullet 1$  mg/l
  - organic and with a toxicity to the other test organisms of  $EC_{50}$  or  $LC_{50} \bullet 10$  mg/l.

#### Article 9b: Categorization of chemicals

The operator shall categorise chemicals according to the ecotoxicological properties of the substances. This applies to all chemicals with documentation in the form of a HOCNF.

Substances are categorised as follows:

- 1) **Black category:** Black category consists of chemicals on the following lists:
  - a. OSPAR List of Chemicals for Priority Action, ref. OSPAR Strategy with regard to Hazardous Substances
  - b. In addition, substances with the following ecotoxicological properties are categorized as black:
    - Substances that have both a low biodegradability ( $BOD_{28} < 20\%$ ) and a high bioaccumulation potential ( $\log Pow \bullet 5$ )
    - Substances that have both a low biodegradability ( $BOD_{28} < 20\%$ ) and a high acute toxicity ( $EC_{50}$  or  $LC_{50} \bullet 10$  mg/l)
    - Substances that are detrimental in a mutagenic or reproductive way
- 2) **Red category:** Red category consists of substances with the following ecotoxicological properties:
  - a. Inorganic substances which are acute toxic ( $EC_{50}$  or  $LC_{50} \bullet 1$  mg/l)
  - b. Organic substances with a low biodegradability ( $BOD_{28} < 20\%$ )
  - c. Substances that meet two of the three following criteria:
    - Biodegradability equivalent to  $BOD_{28} < 60\%$
    - Bioaccumulation potential equivalent to  $\log Pow \bullet 3$  and molecular weight  $< 700$  or
    - Acute toxicity of  $EC_{50}$  or  $LC_{50} \bullet 10$  mg/l
- 3) **Yellow category:**

Yellow category consists of substances that from the ecotoxicological properties of the substances shall not be categorized as red or black, and that are not defined as PLONOR substances

4) Green category

Green category consists of substances on the OSPAR PLONOR list

**Article 9c: Environmental assessments**

- a) The operator shall perform holistic evaluations of the chemicals' potential of causing environmental damage based on the chemicals' intrinsic properties, time, place and amounts of discharge, and also other conditions of significance for the risk. These evaluations shall be performed:
  1. Before new chemicals are used
  2. When entering into new chemical contracts
  3. Minimum every three years for chemicals in green and yellow category
  4. Annually for chemicals in red and black category, the environmental evaluations shall be documented.
- b) The operator shall have plans for substitution of chemicals in the red and black category. The plans shall give a description of which chemicals are prioritized to be replaced, and when this can take place. The plans shall be reported to EPA annually in accordance with the existing reporting requirements. The requirement also applies to chemicals in the yellow category with degradation products assumed to be hazardous to the environment.

**Article 9d: Choice of chemicals**

The operator shall choose the chemicals which according to the environmental evaluations poses the lowest risk of harming the environment. Chemicals in the red and black category shall only be chosen if they are necessary for technical and safety reasons.

**Article 10: Use and discharge of chemicals**

- a) The operator must have permission to use and to discharge chemicals and to inject chemicals or water containing chemicals.
- b) Unused chemicals shall not be discharged to sea, on dredging and dumping to sea and rivers.
- c) Chemicals shall be stored in a safe and prudent way.
- d) Use and discharge of chemicals shall be reduced as much as possible.
- e) The operator shall use chemicals with as little contamination from other substances as possible.
- f) Field-testing of chemicals as alternatives for chemicals covered by the permit or testing of chemicals within new areas of use that are not included in the permit, is allowed. Such field-testing shall not last longer than 14 days and at the same time the total amount of chemicals used shall not exceed 50 kilogram of substances which are presumed to be

categorised in red category. Chemicals which are presumed to be categorised in black category, and tracers, shall not be tested in the field.

- g) Before it is decided at what time larger amounts of water containing chemicals from pipelines are to be discharged, relevant expertise shall be consulted.

#### **Article 11: Chemicals for emergency preparedness**

If the operator plans to keep chemicals in readiness for safety reasons, an inventory of these shall be available. The operator shall also have directions for when the chemicals for emergency preparedness are to be used, and what quantities may be used. The guidelines shall be based on risk analyses.

#### **Article 12: Discharge of cuttings, sand and solid particles**

- a) Cuttings from drilling and well activities, sand and other solid particles shall not be discharged to sea if the oil content of formation oil, other oil or base fluid in organic drilling fluid is more than ten grams per kilogram of dry matter (see also SECTION 7 Table 3 for further guidelines on discharge limits).
- b) The operator must have permission if material such as cuttings, sand and solid particles is planned to be injected.

#### **Article 13: Discharge from formation testing and cleanup of wells**

- a) Oil or oily water from well testing or from cleanup of wells shall not be discharged into the sea unless the discharge is cleaned. This does not apply to testing or cleanup of exploration wells from facilities without water treatment equipment. The operator shall do an overall assessment to ensure that the best possible environmental solution for the facility is chosen.
- b) Formation testing shall be carried out with the least possible strain on the external environment. Flaring of hydrocarbons shall be avoided to the extent this is possible.
- c) The operator must have permission if the well flow is intended to be injected.

#### **Article 14: Measuring the quantity of discharged oil, other substances and water**

- a) The content of oil and other substances in the discharges shall be measured. The results from the measurement shall inter alia be used to verify the performance of the treatment system.
- b) The frequency of measuring, the discharge parameters and the measuring methods shall be documented.
- c) The programme for data collection shall be set up so that the extent of the measuring is sufficient in relation to the purpose, in order to ensure representative and comparable measurements.
- d) Analyses shall be carried out in a systematic and standardised manner. Analyses of oil content in water shall be carried out according to OSPAR's method of reference for the

determination of oil in water (OSPAR reference no. 2005-15, which is a modification of ISO 9377-2) or analysis methods calibrated against this standard.

- e) With regard to drain water, displacement water and injected oily water, the quantity of water and the oil content shall be measured, calculated or estimated.

#### **Article 15: Measuring associated fluids discharged with solids**

The party responsible shall measure the quantity of organic drilling fluid and oil discharged with solids.

### **1.3 WASTE**

#### **Article 16: Waste**

- a) The operator shall to the extent possible avoid generation of waste. The waste generated in connection with the activities shall be handled in an environmentally and hygienically adequate manner.
- b) Oil may be added to the production flow. The operator must have permission if waste oil is intended to be injected.
- c) Solid waste shall not be thrown overboard. The operator shall prepare a plan for treatment of waste.

#### **Article 17: Waste Monitoring, Inspection and Reporting**

- a) All waste producers (operators, contractors and sub-contractors) are required to keep a waste register and an inspection and reporting plan.
- b) The frequency and type of inspection shall be agreed by all parties with the inspection covering all waste generating activities through segregation, handling, storage and final disposal.
- c) A designated on-site staff member shall maintain the waste register (waste log) and copies of all consignment notes (WTN) that have been produced from the site. The waste register should be available on rigs, production platforms and Logistics Base in hard copy. The waste register shall contain a record of all waste arising. It should also serve as an index for all WTN consignments
- d) The Waste Register (waste log) shall include as a minimum the following information:
- Waste streams
  - Source of waste (e.g. rig, production platform, vessel, logistic base, etc)
  - Waste description (e.g. oily rags)
  - Classification of waste streams (i.e. hazardous or no-hazardous)
  - Quantity (weight (kg) or volume (litre or m<sup>3</sup>))
  - Disposal method
  - Waste Transfer Note numbers
  - Dates of transfer
  - Completed transfer notes returned to the responsible operator's department (in most cases the HSE department) and copies sent to the EPA.

- e) All reports should be passed from waste contractor to the operator's responsible department for review and to provide feedback to Management

**Article 18: Waste Transportation, Disposal Sites – Approved Contractors**

- f) All waste shall be handled in a safe and efficient manner taking into consideration associated MSDS information.
- g) Transportation of all waste shall be via well maintained, legally compliant and fit purpose vehicles, with appropriate documentation and driven by fully trained operators. Where relevant vehicle shall carry spill containment equipment.
- h) Only approved contractors, which meet the appropriate standards shall be used for transportation and disposal of waste. Site visits of disposal sites shall be conducted and later inspected/audited by the operator's responsible department, or independent consultants.

**Article 19: Records**

- i) Records are required to be kept by operators and relevant parties as follows:
- Waste records will be formally be kept by the rigs, production platforms, vessels – i.e. Waste Register, Monthly Waste reports for the rigs, production platforms, logistics base and disposal contractor Monthly Waste Reports.
  - Waste Disposal Contractors shall submit a Monthly Waste Report to the operator
  - EPA shall have access to all records and maintain a record of waste monitoring activities and audits

**Article 20: Reviews and Updates**

- j) The waste management systems of operators shall adapt to relevant changes such as in the event of:
- Changes in regulatory frameworks
  - Changes in operators' policies and reporting procedures
  - Changes in operators' programme activities
  - Identified deficiencies or improvement opportunities
  - Infrastructure developments

## **CHAPTER II: EMERGENCY PREPAREDNESS**

### **2.1 GENERAL REQUIREMENTS TO EMERGENCY PREPAREDNESS**

#### **Article 21: Establishing emergency preparedness**

- a) The operator or the one responsible for the operation of a facility shall prepare a strategy for emergency preparedness against situations of hazard and accident. The emergency preparedness shall be established on the basis of results from risk and preparedness analyses.
- b) The emergency preparedness against acute pollution shall provide for protection of ocean, coast and shore zones. Sufficient time in advance of planned start-up of an activity that may entail pollution or danger of pollution, the operator shall submit to the EPA a summary of the results from the environmentally oriented risk and emergency preparedness analyses, together with a description of how the planned preparedness against acute pollution has been provided for.

The EPA may in particular cases stipulate further requirements with regard to the establishment of this emergency preparedness.

#### **Article 22: Joint use of emergency preparedness resources**

- a) In co-operation on joint use of the emergency preparedness resources of different operators, the cooperation shall be regulated by agreement and the emergency preparedness shall be based on area specific emergency preparedness analyses.
- b) When using vessels and mobile facilities registered in a national shipping register, the operator shall coordinate his own emergency preparedness plans and those of the contractors.
- c) The operator shall ensure that the emergency preparedness is co-ordinated with the public rescue service and the rest of the health service of the country, so that the chain of action in respect of rescued, sick or injured personnel is coherent and professionally adequate.

#### **Article 23: Emergency preparedness organisation**

The emergency preparedness organisation shall be robust so as to be capable of handling situations of hazard and accident effectively. In the event of acute pollution the emergency preparedness organisation shall provide the necessary functions to be capable of implementing actions against acute pollution effectively.

#### **Article 24: Emergency preparedness plans**

Emergency preparedness plans shall be prepared which at all times describe the emergency preparedness and contain action plans in respect of the defined situations of hazard and accident.



## **2.2 EMERGENCY PREPAREDNESS ACTIONS IN SITUATIONS OF HAZARD AND ACCIDENT**

### **Article 25: Handling of situations of hazard and accident**

The party responsible shall ensure that necessary actions are taken as quickly as possible in the event of situations of hazard and accident so that:

- a) the right alert is given immediately,
- b) situations of hazard do not develop into situations of accidents. In the event of situations of accident, combating actions shall be taken in order to limit harm and pollution. Combating actions to limit pollution shall be taken as close to the discharging source as possible,
- c) personnel can be rescued in situations of accident d) the personnel on the facility can be quickly and efficiently evacuated at all times,
- d) the condition can be normalised when the development of a situation of hazard and accident has been stopped, inter alia by monitoring and cleanup of the pollution and restoring the environment, and thereby restore the condition to the state existing before the situation of hazard and accident occurred. Criteria shall be defined in respect of normalisation of the external environment.

## **2.3 EMERGENCY PREPAREDNESS AGAINST ACUTE POLLUTION**

### **Article 26: Regional emergency preparedness against acute pollution**

- a) The regional emergency preparedness against acute pollution shall be regulated by agreement and shall at all times provide for and be updated in relation to the environmental risk represented by the facilities in the region.
- b) In the case of new activities the operator shall take action, if necessary, in relation to the regional emergency preparedness, in order to ensure that the activity does not lead to unacceptable risk.

### **Article 27: Action against acute pollution**

- a) In the case of action taken against acute pollution there shall as soon as possible be produced a plan for implementation of the action. The first version of the plan shall be ready at the latest one hour after the executive management group for the action has been established. The plan shall be updated regularly through all the phases of the action.
- b) The action shall not be concluded until the objectives have been achieved, and this has been documented.

## **CHAPTER III: COMMUNICATION**

### **Article 28: Communication**

- a) At all times during installation and operation, as well as in situations of hazard and accident, the necessary internal and external alerts and communication shall be ensured.
- b) A person shall be designated on board to be responsible for the communication systems on manned facilities.

## **CHAPTER IV: DRILLING AND WELL ACTIVITIES**

### **Article 29: Well programme**

Prior to starting well activities, a programme shall be prepared which describes the individual activities to be carried out and the equipment to be used.

### **Article 30: Well location and well path**

- a) Well location and well path shall be chosen on the basis of well parameters of importance to a safe drilling and well activity, including occurrences of shallow gas, other hydrocarbon bearing formation layers and distances to adjacent wells. In addition it shall be possible to drill a relief well from two alternative locations.
- b) The well path shall be known at all times.
- c) If the distance to adjacent wells is less than the defined minimum distance, limitations shall be imposed.

### **Article 31: Shallow gas and shallow formation fluids**

The party responsible shall ensure that necessary actions have been planned and can be taken to handle situations of shallow gas or other formation fluids.

### **Article 32: Monitoring of well parameters**

During all drilling and well activities drilling and well data shall be collected to verify the well prognoses, in order that necessary actions may be taken and the well programme may be adjusted if necessary.

### **Article 33: Well barriers**

During drilling and well activities there shall be tested well barriers of sufficient independence. If a barrier fails, no other activities shall take place in the well than those intended to restore the barrier.

#### **Article 34: Well control**

If well control is lost, it shall be possible to regain the well control by direct intervention or by drilling a relief well. An action plan shall be produced describing how the lost well control can be regained.

#### **Article 35: Controlled well flow**

Operational limitations shall be set in relation to controlled well flow.

#### **Article 36: Securing of wells**

- a) All wells shall be secured before they are abandoned so that well integrity remains intact during the time they are abandoned. With regard to subsea completed wells the well integrity shall be monitored if the wells are planned to be abandoned for more than twelve months.
- b) It shall be possible to control the well integrity by reconnection to temporarily abandoned wells. Radioactive sources shall not be left behind in the well.

#### **Article 37: Remote operation of pipes and work strings**

- a) Remote-operated pipe handling systems for transport, storage and for assembling of pipes and work strings, shall be used.
- b) Limitations shall be set for the access of personnel to the work area of these remote-operated systems.
- c) There shall be visual contact and radio communication between the person with the control and monitoring function and the personnel in the work area for these systems. This personnel shall have a corresponding contact and communication between themselves.

### ***CHAPTER V: MARINE OPERATIONS***

#### **Article 38: Positioning**

- a) During conduct of marine operations, the party responsible shall take necessary actions so that those who take part in the operations, are not injured, and so that the probability of situations of hazard and accident is reduced.
- b) Requirements shall be set to maintaining position in respect of vessels and facilities during implementation of such operations, and criteria shall be set for start up and suspension of activities.

### ***CHAPTER VI: ELECTRICAL INSTALLATIONS***

#### **Article 39: Work on and operation of electrical installations**

- a) During work on live electrical systems, work near installations connected to an electrical power source, work in or close to earthed and short-circuited installations and during operation of low and high voltage installations, necessary actions shall be taken so

that those who carry out the work, are not injured, and so that the probability of situations of hazard and accident is reduced.

- b) The operator shall appoint a person to be responsible for the electrical installations.

## ***CHAPTER VII: LIFTING OPERATIONS***

### **Article 40: Lifting operations**

- a) Lifting operations shall be cleared, lead and conducted in a safe manner and it shall be ensured, inter alia, that personnel do not come under suspended loads.
- b) Everyone participating in lifting operations, shall have a radio to communicate with and the radio shall be used unless everyone involved can communicate clearly with each other by direct speech. The party responsible shall ensure that all communication takes place in a clear and unambiguous way and without disturbance.
- c) The party responsible shall also ensure that lifting operations with transfer of personnel are approved by the management of the facility individually, if offshore cranes are used for such lifting operations.

## ***CHAPTER VIII: COMMUNITY RELATIONS AND SECURITY***

### **Article 41: Community/Fisheries Liaison**

- a) Operators shall appoint a community/fisheries liaison officer, who shall receive and process any grievance that the community/fishermen might have.
- b) Operators are liable and shall pay for the full cost of fishing gears that are damaged by their supply vessels, installation vessels or any of their actions that might have resulted in fishing gear damage.
- c) All offshore facilities shall have a standby vessels to warn and ward off all intruders away from entering the safety exclusion zones of the facilities
- d) Operators shall make adequate security arrangements to prevent external or internal aggression result in facility damage or explosion.

## **SECTION 7: TABLES**

## 7.0 TABLES

The activity matrix (Table 1) below describes offshore exploration, development and production activities and their potential effects. It also provides an indication of the policy or regulation applicable to the activity. Note that this activity matrix is intended as a guide only and is not exhaustive.

**Table 1:** Offshore Exploration, Development and Production Activities and their Potential Effects.

CATEGORY /OPERATION	ACTIVITY	POTENTIAL ADVERSE EFFECTS	POLICY / REGULATED
Surveys	Seismic Operations	<ul style="list-style-type: none"> <li>• Temporary navigation restriction</li> <li>• Physical impact on marine life, wildlife and marine mammals</li> <li>• Temporary displacement of marine life, wildlife and marine mammals, or impact on communication and behaviours</li> </ul>	MARPOL
	seafloor/bathymetry surveys		
Platform Installation (Temporary)	Temporary deployment of Anchors /Jack-up Rig	<ul style="list-style-type: none"> <li>• Physical disturbance on seabed</li> <li>• Introduction of exotic invasive marine species</li> <li>• Displacement of marine life, wildlife and marine mammals</li> </ul>	MARPOL
	Temporary Drill Rig	<ul style="list-style-type: none"> <li>• Introduction of exotic organisms via hull fouling/ballast water</li> </ul>	
Platform Installation (Permanent)	Fixed Permanent Installation e.g. Jacket, CGS	<ul style="list-style-type: none"> <li>• Physical disturbance of seabed</li> <li>• Acoustic disturbance of marine life, wildlife and marine mammals</li> <li>• Displacement of marine life, wildlife and marine mammals</li> </ul>	MARPOL
	Floating Permanent Installation e.g. FPSO, FSO, TLP etc	<ul style="list-style-type: none"> <li>• Introduction of exotic organisms via hull fouling / ballast water</li> </ul>	
Drilling	Physical Impact	<ul style="list-style-type: none"> <li>• Underwater noise</li> <li>• Displacement of marine life, wildlife and</li> </ul>	OSPAR

		<p>marine mammals</p> <ul style="list-style-type: none"> <li>• Local physical damage</li> </ul>	
	Discharge of Drilling Cuttings	<ul style="list-style-type: none"> <li>• Accumulation of contaminated material</li> <li>• Smothering of Benthos</li> <li>• Physical obstruction</li> <li>• Turbidity</li> <li>• Toxicity</li> </ul>	OSPAR
	Discharge of drilling fluids	<ul style="list-style-type: none"> <li>• Toxicity</li> <li>• Turbidity</li> </ul>	OSPAR
Discharge to water (Operational)	Produced water	<ul style="list-style-type: none"> <li>• Toxicity</li> <li>• Floating oil</li> </ul>	OSPAR
	Cooling Water	<ul style="list-style-type: none"> <li>• Thermal</li> <li>• Toxicity</li> </ul>	
	Organic waste	<ul style="list-style-type: none"> <li>• Pathogens</li> <li>• Turbidity</li> </ul>	
Discharge to water (Accidental)	Oil Spills	<ul style="list-style-type: none"> <li>• Marine life, wild life and marine mammals</li> <li>• Physical/shoreline/amenity</li> <li>• Economic</li> <li>• Toxicity</li> </ul>	OPRC
	Chemical Spills	<p>Marine life, wild life and marine mammals</p> <ul style="list-style-type: none"> <li>• Toxicity</li> </ul>	OPRC/HNS 2000
Discharge to Air	Flaring	<ul style="list-style-type: none"> <li>• Climate change</li> <li>• Possible attractant to sea birds</li> </ul>	OSPAR
	GHG Emission (non flaring) Plant & Machinery emissions	<ul style="list-style-type: none"> <li>• Climate Change</li> </ul>	OSPAR
	Tank Venting	<ul style="list-style-type: none"> <li>• Climate Change</li> </ul>	OSPAR

Presence of Structure	Exclusive occupation of platform footprint	• Access restrictions	UNCLOS
	Exclusion zones		UNCLOS
	Restricted Areas/Protection Zones		UNCLOS
	Security		Ghana Navy
Waste Management	Garbage		MARPOL
	Commercial Waste		
	Food waste		MARPOL
	Support Vessels	• Introduction of exotic organisms via hull fouling/ballast water	• MARPOL; IMO; OPRC; • Codes for hull fouling
Ancillary Operations	Helicopters	Safety	• Civil Aviation
	Ancillary structures and Platform Abandonment		IMO, OSPAR



**Table 2:** Management of Direct and Indirect Environmental Impacts

Direct Potential Impact or Risk	Indirect Potential Impact or Risk	Comment
Ship movements		
<p>The risk of an oil spill is directly related to:</p> <ul style="list-style-type: none"> <li>a) frequency of ship movement;</li> <li>b) physical and mechanical condition of a ship and its equipment; and</li> <li>c) performance of crews.</li> </ul> <p>Oil spill risk is minimised through achieving appropriate standards and adequate training.</p> <p>Impacts of an oil spill may be severe on sensitive organisms and/or habitats.</p> <p>Open ocean impacts likely to be less than coastal impacts.</p> <p>Risk of collision with other vessels (especially artisanal fishermen, which could not be spotted on the radar)</p>	<p>Noise, lights and physical presence of ships may affect the movement of sensitive species.</p> <p>Effects are of short duration and impacts are likely to be minimal.</p>	<p>Community education prior to survey to inform and warn fishermen about presence of seismic vessel. Employ local fishermen liaison officer to be on board vessels to interact with fishermen during surveys</p>
Seismic surveys		
<p>Air based energy sources in seismic arrays generate sounds and may have potential impacts on organisms within range.</p> <p>To avoid adverse impacts, surveys are adapted or scheduled to avoid seasonal migrations or key breeding locations.</p> <p>Survey lines and accessories destroying fishermen nets (e.g. drift nets)</p>	<p>Avoidance behaviour by some species may affect feeding.</p> <p>Impacts are likely to be of short duration</p>	<p>Industry must commence and fund research projects to provide better information on potential impacts and environmental effects in Ghanaian conditions</p>

Drilling rig placement		
Physical placement of drilling rig may cause localised damage, depending on the nature of the sea floor, however the area, if affected, is very small.		
Anchoring		
Localised physical damage may be observed.		Minimised by avoiding seabed structures of environmental or other significance.
Drilling		
<p>When drill cuttings are discharged overboard impacts are limited to the immediate area surrounding the drill site. In shallow waters accumulation of drill cuttings on the sea floor could be very significant.</p> <p>Discharge of drilling fluids into the marine environment (especially NADF) has severe impacts on the marine environment.</p>	<p>Suspended sediment in the water column may reduce the amount of light reaching the sea floor. This may reduce plant growth until the particulate material settles.</p> <p>Localized effects on the food chain. Such effects can be minimized by reducing levels of toxic components, and/or removing or recycling fluids before discharge.</p>	<p>Generally, no toxic oil-based drilling fluids must be used in Ghana to limit discharges of these substances to the marine environment.</p> <p>In very sensitive environments, waste from drilling operations should be collected and stored onboard for disposal on land.</p>
Platform placement		
Habitat disturbance	Platforms often attract marine life and can act as artificial reefs. They often become important resting points for seabirds and seals.	

Produced formation water (PFW)		
<p>Hydrocarbon traces in PFW may have localised impacts.</p> <p>Although PFW is of low toxicity, it is often warmer than the ocean when discharged and may cause possible local effects when organisms make inadvertent contact.</p>	<p>Cumulative and/or sublethal impacts may occur from long exposure to low levels of particular hydrocarbons.</p> <p>PFW may have a salt content greater or less than sea water causing localised transient salinity levels which are likely to affect nearby organisms.</p>	<p>Industry must fund research projects to assess and improve current management practices for PFW discharge.</p>
Reinjection		
<p>Reinjection of water or gas down wells is sometimes used to increase the amount of oil recovered.</p>	<p>Reinjection of gas decreases the volume of gas that might be otherwise flared (reducing emissions of greenhouse gases).</p>	<p>Reinjection of gas or water is costly but where possible, is often a more environmentally sound option than discharge to the environment.</p> <p>All options explored must clearly be documented and reasons why a particular option is preferred must be given</p>
Sewage		
<p>Increased nutrient content in the water column.</p>	<p>May increase population numbers of some organisms.</p>	
Greenhouse gas emissions		
<p>Contributes to global greenhouse concentrations.</p>	<p>Exploration and production activities contribution is insignificant of Ghana's total greenhouse gas emissions currently due to low activity.</p>	<p>Minimised through careful management of sources, including power generating equipment, flaring and fugitive fuel emissions. Companies should participate in voluntary cooperative action to minimise avoidable greenhouse gas</p>

		emissions.
Oil spills		
<p>May have toxic and/or smothering effects for some species on contact.</p>	<p>Possible impacts on the food chain, as a result of contamination or loss of food sources. However effects are transient.</p> <p>Hydrocarbons are organic compounds and are readily decomposed or used as food sources by some microorganisms.</p>	<p>The proximity to sensitive species is dependent on the type of oil, currents, and wind. Oil spill risk cannot be eliminated but may be reduced to very low levels. The National Contingency Plan and Strategy spelt out industry's responsibilities in this regard.</p> <p>Industry is encouraged to fund research projects on the impacts of oils spills on key mangrove species, to recommend improved procedures to protect and enhance recovery of affected mangroves.</p>

**Table 3: Effluent Guidelines**

Parameter	Guidelines				
<b>Drilling Fluids and Cuttings – NADF</b>	1) NADF – re-inject or ship-to-shore, no discharge to sea. 2) Drilled cuttings – re-inject or ship-to-shore, no discharge to sea except: <ul style="list-style-type: none"> <li>• Hg – max 1 mg/kg dry weight in stock barite</li> <li>• Cd - max 3 mg/kg dry weight in stock barite</li> <li>• Discharge via a caisson at least 15 m below sea surface</li> <li>• Oil concentration by weight on dry cuttings:</li> </ul> <p style="margin-left: 40px;"><b>Water depth</b></p> <table style="margin-left: 40px; border: none;"> <tr> <td style="padding-right: 20px;">0 – &lt;500m</td> <td>No discharge</td> </tr> <tr> <td>&gt;500m</td> <td>3% maximum</td> </tr> </table>	0 – <500m	No discharge	>500m	3% maximum
0 – <500m	No discharge				
>500m	3% maximum				
<b>Drilling fluids and cuttings – WBDF</b>	1) WBDF – re-inject or ship-to-shore, no discharge to sea except: <ul style="list-style-type: none"> <li>• In compliance with 96 hr. LC-50 of SPP-3% vol. toxicity test first for drilling fluids or alternatively testing based on standard toxicity assessment species (preferably site-specific species);</li> </ul> 2) WBDF, fluids and cuttings– re-inject or ship-to-shore, no discharge to sea except: <ul style="list-style-type: none"> <li>• Hg – 1 mg/kg dry weight in stock barite</li> <li>• Cd - 3 mg/kg dry weight in stock barite</li> <li>• Maximum chloride concentration must be less than four time’s ambient concentration of fresh or brackish receiving water</li> <li>• Discharge via a caisson at least 15 m below sea surface</li> </ul>				
<b>Produced water</b>	Reinject. Discharge to sea maximum one day oil and grease discharge should not exceed 40 mg/l; 30 day average should not exceed 29 mg/L.				
<b>Completion and Well Workover fluids</b>	Ship-to-shore or reinject. No discharge to sea except: <ul style="list-style-type: none"> <li>• Maximum one day oil and grease discharge should not exceed 40 mg/L; 30 day average should not exceed 29 mg/L</li> <li>• Neutralize to attain a pH of 6 or more</li> </ul>				
<b>Produced Sand</b>	Ship-to-shore or reinject. No discharge to sea except when oil concentration lower than 1% by weight on dry sand.				
<b>Hydrotest water</b>	<ul style="list-style-type: none"> <li>• Send to shore for treatment and disposal</li> <li>• Discharge offshore following environmental risk analysis, careful selection of chemicals</li> <li>• reduce use of chemicals</li> </ul>				

<b>Cooling Water</b>	The effluent should result in a temperature increase of no more than 3° C at edge of the zone where initial mixing and dilution take place. Where the zone is not defined, use 100 m from point of discharge.
<b>Desalination Brine</b>	Mix with other discharge waste streams if feasible
<b>Sewage</b>	Compliance with MARPOL 73/78b
<b>Food waste</b>	Compliance with MARPOL 73/78b
<b>Storage displacement water</b>	Compliance with MARPOL 73/78b
<b>Bilgewater</b>	Compliance with MARPOL 73/78b
<b>Deck Drainage</b> (non-hazardous and hazardous drains)	Compliance with MARPOL 73/78b
<p><b>Notes:</b></p> <ul style="list-style-type: none"> <li>a. 96-hr LC-50: Concentration in parts per million (ppm) or percent of the Suspended Particulate Phase (SPP) from sample that is lethal to 50 percent of the test organism exposed to that concentration for a continuous period of 96 hours.</li> <li>b. In nearshore waters, carefully select discharge location based on environmental sensitivities and assimilative capacity of receiving waters</li> </ul>	

## **SECTION 8: APPENDICES**

## **APPENDIX 1: Environmental Assessment Regulations Schedules**



## **APPENDIX 2: Petroleum Operations Form (Form P01)**

## **APPENDIX 3: Public Notice for EIA**

## **APPENDIX 4: EXAMPLE OF WASTE TRANSFER NOTES**

### **WASTE DECLARATION FORM**

The information requested below is to enable all parties to discharge their duties under the following legal requirements:

## **APPENDIX 5: WASTE TRANSFER NOTES**

## **SECTION 9: BIBLIOGRAPHY**

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