ARCTIC ENVIRONEMNTAL PROTECTION STRATEGY

ARCTIC OFFSHORE OIL & GAS GUIDELINES

June 13, 1997

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*Transshipment of oil will be addressed by PAME in its work on Arctic Shipping.

Preamble

The Ministers of the Arctic States, Canada, Denmark, Iceland, Finland, Russia, Sweden, Norway an the United States of America, adopted these Guidelines at the Fourth Ministerial Conference on the Protection of the Arctic Environment, 11-12 June, 1997 in Alta, Norway by declaring: "**We receive** with appreciation….the "Arctic Offshore Oil and Gas Guidelines" developed under AEPS, and **agree** that these Guidelines be applied".

The endorsement of these Guidelines recognizes a uniform understanding of the minimum actions needed to protect the Arctic marine environment from unwanted environmental effects caused by offshore oil and gas activities. The Ministers, however, acknowledge that further steps can be taken nationally as a part of the environmental and natural resource management policies of the Arctic States.

The users of these Guidelines will find that all stages of offshore oil and gas activity are included. The Introduction sets forth the background for the Guidelines and important general concerns. The chapters which follow set forth the specific operation steps which should be followed when planning for Arctic offshore oil and gas activities.

1. Introduction

1.1 Background

The *Report of the Third Ministerial Conference on the Protection of the Arctic Environment* (Inuvik, Canada, March 20-21, 1996) expresses *concern regarding the potential impacts related to future increases in offshore petroleum activity in the Arctic*. The Report requests PAME:

> ...(to develop) "*guidelines for offshore petroleum activities in the Arctic, in particular guidelines for timely and effective measures for protection of the Arctic environment. In this regard, the Ministers welcomed the initiative of the United States to conduct a government designated expert meeting to develop such guidelines, in cooperation, as appropriate, with other AEPS Working Groups"* (Paragraph 2.3.5(ii)).

In addition, the Inuvik Report requests AMAP to "*...review the feasibility of developing sub-regional cooperative oil- related monitoring and assessment activities, as appropriate*." (Paragraph 2.1.2.1).

Finally, the Report requests EPPR to "*...continue their work on contributing to development of preventative, mitigating and response measures for oil and gas accidental releases in the Arctic*" (Paragraph 2.4.5).

In light of the interest of several Working Groups in Arctic oil and gas development and, desiring to assure greater coordination within the AEPS, the ministers emphasized the need for greater cooperation between the working groups.

While PAME has the overall responsibility for development of offshore guidelines, the ministerial requests to EPPR (on emergencies) and AMAP (on monitoring) suggested that the most efficient way for PAME to proceed was to ask EPPR and AMAP to assist in preparation of those aspects of the guidelines which deal with these subjects.

This document, therefore, represents the combined efforts of PAME, EPPR and AMAP, taking into consideration comments received from representatives of other governments, nongovernmental organizations, industry, indigenous people, the scientific community to provide agreed guidelines for offshore oil and gas activities in the Arctic.

It is acknowledged that a number of legal instruments related to offshore oil and gas activities exist, *e.g.* United Nations Convention on Law of the Sea; the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) and the London Convention 1972. It is assumed that Arctic petroleum activities will be conducted in compliance with applicable international law.

1.2 Goals

Purpose of the Guidelines

These guidelines are intended to be of use to the Arctic nations central and regional authorities at all stages during planning and development of oil and gas activities. They should be used to secure common policy and practices. The target group for the Guidelines is thus primarily the national authorities, but the Guidelines may also be of help to the industry when planning for oil and gas activities. While recognizing the nonbinding nature of these Guidelines, they are intended to encourage the highest standards currently available. They are not intended to prevent States from setting stricter standards, where appropriate.

Policy development should take into account the domestic situation with respect to political, economic, legal, and administrative conditions, as well as technical competence. Consideration should be given to macro-economic effects, regional effects, and potential environmental impacts. Such consideration should result in a staged opening plan, and ensure protection of areas of special environmental concern.

The Guidelines are intended to define a set of recommended practices for consideration by those responsible for regulation of offshore oil and gas activities (including transportation and related onshore activities[1] being an integrated part of the offshore activity) in the Arctic[2]. It is hoped that they will identify the key issues related to protection of human health and safety and protection of the environment, while at the same time remaining sufficiently general to permit alternative regulatory approaches. The goal is to assist regulators in developing a set of standards, which are applied and enforced consistently for all offshore Arctic oil and gas operators. Sensible regulation will vary to some degree based upon local circumstances. Thus, it is expected that, based on the outcome of environmental impact assessment procedures, regulators will establish policies such that offshore oil and gas activities are conducted so as to provide for human health and safety and protection of the environment.

Goals for Oil and Gas Activities in the Arctic Area

Offshore oil and gas activities in the Arctic should be planned and conducted so as to avoid:

- adverse effects on climate and weather patterns;

- significant adverse effects on air and water quality;

- significant changes in the atmospheric, terrestrial (including aquatic), glacial or marine environments in the Arctic;

- detrimental changes in the distribution, abundance or productivity of species or populations of species;

- further jeopardy to endangered or threatened species or populations of such species; or

- degradation of, or substantial risk to, areas of biological, cultural, scientific, historic, aesthetic or wilderness significance.

1.3 General Principles

Arctic offshore oil and gas activities should be based on the following principles:

Principle of the Precautionary Approach

In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

Polluter Pays Principle

National authorities should endeavor to promote the internationalization of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment.

Sustainable Development

In permitting offshore oil and gas activities Arctic governments should be mindful of their commitment to sustainable development, including, *inter alia*:

- protection of biological diversity;

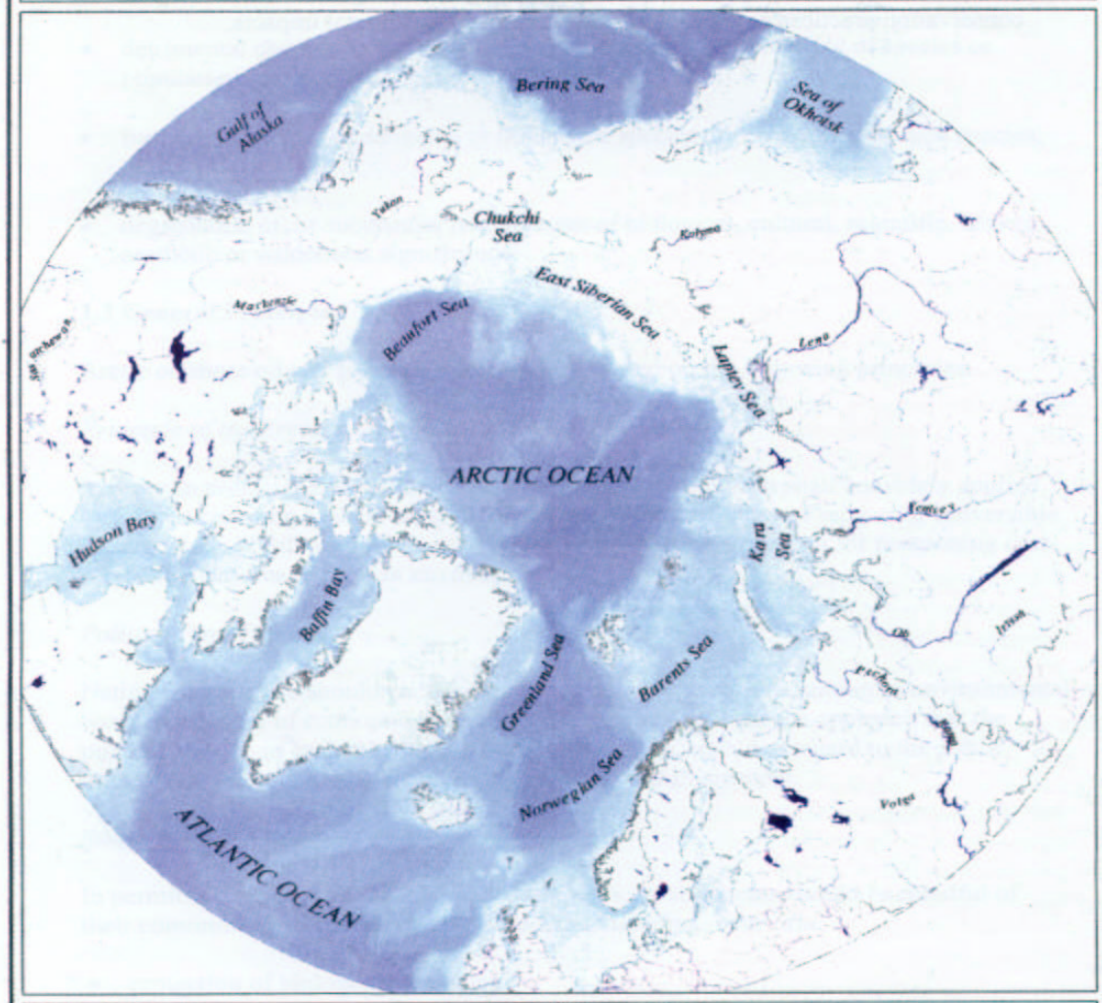
- the duty not to transfer, directly or indirectly, damage or hazards from one area of the marine environment to another or transform one type of pollution into another;

- promotion of the use of best available technology and best environmental practices;

- the duty to cooperate on a regional basis for protection and preservation of the marine environment, taking into account characteristic regional features; and

- the need to maintain of hydrocarbon production rates in keeping with sound conservation practices as a means of minimizing environmental impacts.

AEPS Working Group on the Protection of the Arctic Marine Environment PAME



Note: The area of application of these Guidelines is described in Annex B

Figure 1
The Arctic Region

Scale is approximately 1:45 000 000

Projection : Lambert-Azimuthal Equal Area

Neither the delineation of boundaries nor the use of any name in the publication implies an expression of opinion on the part of UNEP concerning the legal status of any country or territory, or of its authorities, or concerning the delimitation of the frontiers of any country or territory.

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1.4 Existing Impacts and Future Threats

Threats to marine Arctic areas from activities within Arctic countries at present mainly affect coastal areas. Impacts on offshore areas are mainly due to long range transport by wind and sea currents, but also include sediment transport in sea ice.

The coastal areas of the Arctic may be contaminated by direct runoff from industry or mining, through river discharges, from dumping and from nuclear tests. Hot spots have been identified by AMAP, but few of these are relevant in the context of these guidelines. However, when considering near-shore oil and gas activities, interaction between existing contaminants and expected discharges should be assessed.

Based on the results of the AMAP assessment persistent organic pollutants seem to be the main present threat to the Arctic environment. In addition, there seems to be some uncertainty concerning mercury which should be more closely monitored. Artificial radionuclides seems to pose only a nominal threat to the environment.

Based on AMAP results the most prominent future threats to the Arctic marine environment are persistent organic pollutants (POPs) and petroleum exploitation and transport.

1.5 Potential Impacts of Oil and Gas Activities on Environment and Society

Natural environment.

Oil and gas activities entail considerable inputs of gases to the air from power generation, flaring, well testing, leakage of volatile petroleum components, supply activities and shuttle transportation. Air emissions may have effects on the climate. They may cause acidification on nearby land and contribute to emissions of any number of hazardous substances. Discharges of drill cuttings with associated oil and chemicals may have considerable effects on sea floor flora and fauna and reduce both their abundance and diversity.

Discharges of produced water and chemicals to the water column appear to have acute effects on marine life only in the immediate vicinity of the installations. However, recent results give reason to assume that sub-lethal and long term effects of chronic discharges may be considerable. Scientific evidence of adverse effects of discharges are now emerging in the near-coast regions of some areas, showing that short-term exposure of sensitive life stages (gametes, eggs, larvae) to low concentrations of oil and chemicals may affect whole populations.

Human environment.

Oil and gas activities may have pronounced positive effects on a nation's employment and economy. There are examples of negative effects on local communities and indigenous peoples.

1.6. Institutional Strengthening in the Regional Context

Management of Arctic oil and gas activities and their effects on the Arctic offshore and near shore areas requires participation of governments, civil society and operators. Institutional mechanisms are capabilities are required at the local, national and regional levels to implement these guidelines:

- to ensure the openness, transparency and consistent application of regulatory regimes;

- to ensure that government agencies, local communities and non-governmental organizations are able to participate in their roles in environmental management;

- to ensure that scientific and traditional knowledge area available to the processes and are effectively used; and

- to facilitate regional activities and mechanisms commensurate with the regional nature of the physical, biological and socioeconomic environments, and of the regional impacts.

To ensure that the above needs are addressed, Arctic States should:

- review their own needs, and regional needs, for institutional strengthening and capacity-building in these areas, and identify priority needs with schedules for addressing them.

- cooperate in and facilitate bilateral and multilateral initiatives to address the needs, in concert with civil society and with oil and gas industry operators.

1.7 Periodic Review

These Guidelines should undergo periodic review and amendment, as necessary, to take into consideration experiences in the management and control of offshore and gas operations. The Guidelines must remain current if they are to support timely and effective measure for protection of the Arctic environment. An Experts Meeting should be held after the third anniversary date of the adoption of the Guidelines to review and update them.

1. Offshore Arctic oil and gas operations may result in a variety of related onshore activities and/or impacts. Individual governments should determine the extent to which these Guidelines apply when evaluating these activities.

2. Neither PAME nor the full AEPS has established a geographic definition of the Arctic. This is left for Arctic states to determine. For the purposes of these Guidelines, the definition of the Arctic is contained in Annex B.

2. Environmental Impact Assessment*

Preliminary Environmental Impact Assessment (PEIA) and Environmental Impact Assessment (EIA) procedures should be used to determine the impacts of offshore oil and gas exploration, development, transportation and infrastructure.

2.1 Purpose

Environmental impact assessment aims at protecting the Arctic environment, its flora and fauna, abiotic components, and human health, security and well being from deleterious effects. It does this by improving understanding of the possible effects of human activities. A main purpose of the environmental impact assessment process is to integrate environmental considerations in the overall planning from the beginning.

2.2 Technique and Process

The EIA process

The EIA process is a series of interactive steps, including feedback mechanisms and quality assurance procedures. Some of the main features are:

> *Organization:* A single organization should be given responsibility for coordination of the EIA process, including arrangements for logistical and financial support. A first task of this group should be to define the boundaries of the assessment area and reach agreement on the timetable to be followed.
>
> *Scope:* The scope of the assessment should apply to the whole assessment area. However, it may be decided that initial assessments should give priority to environmental sectors considered to be most at risk from the planned activities. In the context of offshore petroleum activities this may for instance be particularly sensitive nesting or feeding habitats for seabirds, or spawning grounds for commercially important fish species etc.
>
> *Data Quality Assurance:* Well-planned sampling programs and appropriate collection, preservation, storage and transport procedures form the basis of any EIA. In addition, a system for data quality assurance must be in place.
>
> *Timetable:* It is essential that the EIA process is performed according to a realistic time table agreed upon at an early stage of the process. The time frame will vary depending on the extent and type of assessment to be carried out.

Sources of Information: Data for EIA purposes may be collected among existing data (scientific literature, databases registers etc.) and necessary additional

information may be obtained through baseline investigations or monitoring programs.

2.3 Preliminary Environment Impact Assessment (PEIA)

A Preliminary Environmental Impact Assessment (or similar process) is a screening level review that should contain sufficient detail to permit assessment of whether a proposed activity may have a significant impact and should include:

- a description of the proposed activity, including its purpose, location, duration, and intensity;
- consideration of alternatives to the proposed activity and any impacts that the activity and its alternatives may have, including consideration of cumulative impacts in the light of other existing and known planned activities on:

    a. humans
    b. flora and fauna
    c. soil and permafrost
    d. air and water
    e. climate
    f. cultural heritage
    g. the overall landscape, and
    h. the interaction among any of the above; and

- a determination whether significant impacts, that would require further assessment, are likely to occur.

2.4 Environmental Impact Assessment (EIA)

An Environmental Impact Assessment should be based on the best available information and include:

- a description of the proposed activity, including its purpose, location, duration, and intensity. This includes the physical characteristics of the proposed activity and its land use requirements during construction and operation phases. It should state the main characteristics of the development process proposed, including type and quantity of materials to be use.

- the estimated type and quantity of expected residues and emission (including air, water, soil, vibration, light, heat and radiation pollution).

- a risk analysis and assessment of impacts, including oil spill trajectory modeling.

- the forecasting methods used to assess effects on the environment and any difficulties such as lack of data, in undertaking the assessment.

- based on the above, an identification of the area of impact.

- the likely significant direct and indirect effects, including secondary, cumulative, short, medium and long term, permanent, temporary, positive and negative, on the environment of the proposed activity which may result from the use of natural resources, the emission of pollutants, the creation of nuisances, and the elimination of wastes. The possibilities of transboundary impacts must also be considered. This should also include a description of the initial environmental reference state with which predicted changes are to be compared.

- a description of the likely significant effects on:

    a. humans
    b. flora and fauna
    c. soil and permafrost
    d. air and water
    e. climate
    f. cultural heritage
    g. the overall landscape
    h. the interaction among any of the above.

- where significant adverse effects are identified, including the worst case scenario a description of the measures proposed to avoid, reduce or rectify these effects, taking into consideration the slow recovery and regenerative capacity of the Arctic.

- other alternatives, including the alternative of no action. This should include an evaluation of the different alternatives and the reasons for choosing the selected activity.

- a summary in non-technical language, assisted with figures and diagrams, of the information specified above. If need be, other means of displaying this information, based on cultural heritage of the local and indigenous residents should be prepared.

2.5 Consultations and Hearings

Before commencing the assessment studies, the assessment must be carefully planned. By clearly defining the scope of an EIA, the appropriate focus can be determined. The determination of the scope should be initiated immediately after the decision to conduct the EIA. In the Arctic, public participation in scoping is necessary for efficient and full use of traditional knowledge. Sufficient time and resources to include public participation throughout the process should be included.

2.6 Decision/Implementation/Project monitoring/Modification

There should be a description of monitoring programs to determine unforeseen effects, assess the effectiveness of mitigation measures and provide early warning of any adverse effects and to provide for promptly addressing accidents. These programs should be elaborated in a manner consistent with Chapter 5 (**Monitoring**) and should provide for the possibility of modification of an activity, where warranted.

2.7 Key Considerations

PEIAs and EIAs should consider, in particular, the following effects (for example contamination, habitat disturbance and alternation) on:

- marine mammals;
- Arctic human communities;
- subsistence lifestyles (e.g. harvest practices and availability of food supply);
- oil spill preparedness and response in sea ice conditions;
- the permafrost and transition zones;
- sustainability of renewable resources;
- flora and other fauna;
- other human activities (e.g. tourism, scientific research);
- air and water quality;
- ports and shore reception facilities; and
- the effects of ice scour and movement.

* This Chapter should be read in concert with the AEPS *Guidelines for Environmental Impact Assessment (EIA) in the Arctic.*

Fig. Overview of offshore activities and potential environmental effects

Activity	**Potential environmental effects**
Evaluation	
Seismic activity	Noise effects on fish, sea birds and marine mammals
Exploration	
Rig emplacement	Seabed disturbance due to dredging, filling and anchoring
Drilling	Discharges of drill cuttings, drill fluids, excess cement, platform drainage, household discharges and emissions of exhaust gases. Discharges from supply vessels, helicopter transportation etc. Risk of blowouts.
Development and production	
Platform installation	Seabed disturbances due to dredging, filling and anchoring.
Drilling	As under exploration, but more extensive; orders of magnitude larger discharges to sea floor, water column and air. Extended risk of blowouts and oil spills.
Production	Chronic discharges of oil and chemicals to water, chronic emissions of gases with climate effects, acidifying affects etc. Additional risks of spills, discharges and emissions connected to transportation (tankers, supply vessels, pipelines etc.).
Decommissioning and reclamation	
Removal of installations	Seabed disturbance, disturbance from cutting piles containing oil and chemicals, dredging, air emissions, noise etc.

3. Arctic Communities, Sustainability and Conservation of Flora and Fauna

Offshore oil and gas activities should be conducted so as to protect and minimize adverse impacts on living resources and the ecosystems on which they depend; to minimize adverse impacts on the resource uses and cultural values of Arctic indigenous communities; and to coordinate with other human activities in the region.

3.1 Living Resources

Necessary measures should be taken to ensure that Arctic flora and fauna and the ecosystems on which they depend are protected during all phases of offshore oil and gas activities. Special attention - particularly with regard to intrusive activities - is required for species (e.g. fish, birds, whales, seals, polar bears, and other marine mammals) which are resources for human use, particularly by indigenous people, and for special habitats (such as ice-edge zones, coastal lagoons and barrier islands, estuaries, bays, and river deltas). Onshore features that should be protected and/or avoided during offshore exploration and production activities include areas used significantly by waterfowl (such as high-density nesting, brood-rearing, molting and staging areas), caribou (such as calving and insect relief areas), and by musk oxen. Consistent with the interests of human safety and well-being, a primary governing policy in the Arctic should be the conservation of resources for sustainable use.

3.2 Cultural Values

In planning and executing offshore oil and gas operations, necessary measures should be taken, in consultation with neighboring indigenous communities, to recognize and accommodate the cultural heritage, values, practices, rights and resource use of indigenous residents. Arctic States, in partnership with the oil and gas industry, should address the economic, social, health and educational needs of Arctic indigenous residents. All phases of oil and gas activity should avoid historic or prehistoric archeological and sacred sites, historic shipwrecks and other potentially important cultural resources.

3.3 Other Human Activity

Offshore oil and gas activities should be conducted in coordination with other human activities in the region, such as tourism and scientific research.

3.4 Arctic States should:

- incorporate indigenous and other residents, and their traditional knowledge into the decision-making process including the initial siting studies and disposition of resource use rights;

- urge and, where appropriate, require industry to integrate cultural and environmental protection considerations into planning, design, construction and operational phases of oil and gas activities;

- improve cross-cultural communication methods to ensure full and meaningful participation of indigenous residents including procedures to incorporate local knowledge;

- identify and prohibit or restrict oil and gas activities in ecologically and culturally sensitive areas; and

- for use in planning and decisions, identify species which are resources for human use and their ecological requirements, and identify patterns of their use as resources.

4. Safety and Environmental Management

Two regulatory approaches are available for dealing with offshore Arctic oil and gas operations. They are: (A) a performance based approach for achieving safe and pollution free operations and (B) a more traditional prescriptive approach, applied and enforced by a regulatory body. The performance based alternative is designed to be developed and implemented by an operator, and should apply to both operator and contractor personnel. The performance based approach can be voluntary or required through regulations. The prescriptive approach is based on a series of specific regulatory requirements. It can be complemented by a voluntary performance based program.

In either approach, before oil and gas activities are approved, governments should require the operator to demonstrate financial capacity to carry out all aspects of the operation, including responding to environmental emergencies and decommissioning. More specifically, a financial estimate of the worst case environmental emergency scenario should be developed and the operator should provide evidence of financial responsibility to undertake remediation measures and to compensate persons who may suffer losses as a result of the activity.

A Performance Based Approach

An important management tool to assist the operator in meeting the regulatory objectives of elimination of unsafe behavior and continuous improvement in safety and pollution prevention practices is defining and communicating a **safety culture** to the whole workforce and ensuring that they are fully motivated to implement it through a **management system**.

4.1 Safety Culture

The philosophy that safe, prudent working practices and procedures are good business practices is the underlying principle for an organization's safety culture. For a safety culture to be successful in being adopted, it is imperative that senior and, then, each progressively junior level of management exerts its leadership in establishing goals, demanding accountability for performance and provides the necessary resources. The establishment of a safety culture should also include the systematic identification and assessment of hazards and the devising and exercise of preventive systems which are subject to audit and review. In such a culture, particular attention is given to the investigation of error.

4.2 Operator's Management System

The use of a management system is needed if the operator is to ensure safety on its installations and compliance with the requirements of legislation. This involves a planned system with an overall objective to the elimination of danger both in the

design and in operation. The operator's system for the management of safety and the environment should set out the objectives of the operator, the system by which those objectives are to be achieved, the performance standards which are to be met and the means by which adherence to those standards are to be monitored.

4.2.1 Objectives

The operator's system shall incorporate, among other things, the following objectives:

- competent personnel are used during planning and implementation of the separate phases, including design, fabrication, installation and operation;
- the operator's and contractor's personnel are provided with necessary training;
- lines of responsibility, authority and communication are clearly defined and understood;
- safety evaluations are undertaken both prior to start-up and in subsequent phases of the operation;
- administrative systems are established for the control of all documentation in all phases of the operation;
- purchase documents and specifications contain Quality Assurance requirements;
- the contractor's Quality Assurance system is evaluated and assessed and is subject to an audit;
- it can be documented that materials and supplies have the specified quality;
- the Quality Assurance, including Quality Control during the operations functions effectively;
- corrective actions take place when the Quality Control indicates deviation from established specifications;
- operational programs are prepared and complied with relevant regulations and their functional capability can be verified;
- specifications for repairs are established and that specifications give sufficient basis and sufficient requirements for the execution;
- temporary equipment may be installed and operated in a secure way and in accordance with established specifications;
- modifications do not reduce the degree of safety originally specified;
- an emergency preparedness system is established and maintained so that necessary measures can be activated effectively and authorities involved notified;
- administrative decisions made by the supervisory personnel are communicated effectively to the personnel and contractors;
- there is a continuous control and mapping of the working environment with regards to safety risks, health risks and welfare aspects and that necessary actions are implemented;
- there will be a continuous control and mapping of the danger of pollution of the external environment, and that personnel at all times will perform their tasks in such a way that pollution is avoided; and

- the operator's and contractor's personnel are made aware of the potential danger of accidents and inherent health and pollution aspects, and they are given necessary information, training and exercises.

4.2.2 Management System

The operator's management system should demonstrate how safety and protection of the environment objectives are to be achieved in both design and operation, through, *inter alia,:*

- organizational structure;
- management personnel standards;
- training for operations and emergencies;
- safety assessment;
- design procedures, including specification of standards to be used;
- procedures, for operations, maintenance, modifications and emergencies;
- management of safety by contractors in respect of their work;
- the involvement of the workforce (both the operators' and contractors') in safety and protection of the environment;
- accident and incident reporting, investigation and follow-up;
- monitoring and auditing of the operation of the system;
- systematic re-appraisal of the system;.

4.3 Environmental Audits

Environmental auditing is a systematic, documented, periodic, and objective review by regulated entities to evaluate facility operations and practices, environmental, organizational, management, and equipment performance in order to meet environmental requirements and serve as a quality assurance check. Audits are the fundamental verification tool to ensure that environmental management procedures are being rigorously enforced. Audits are often conducted internally, but periodic reviews involving independent, external auditors may be considered. Environmental audits should be encouraged by the highest levels of management and conducted as an independent function of the audited activities. An environmental audit does not replace or substitute for direct compliance activities such as obtaining permits, installing controls, monitoring compliance, reporting violations, keeping records, or independent inspections.

Procedures should be maintained for audits to be carried out in order to:

- determine whether or not environmental management system elements and activities conform to planned arrangements and are implemented effectively;

- examine line management systems and procedures, field operations, monitoring practices, and data to see if they fulfill the company's environmental policy, objectives, and performance criteria;

- check the accuracy of the Environmental Impact Assessment predictions and ensure that mitigation and monitoring recommendations are being implemented;
- verify implementation and effectiveness of mitigating measures;
- review incident reporting and remedy schemes;
- identify current and potential environmental problems;
- formulate thorough documentation, feedback, and implementation procedures;
- determine compliance with relevant legislative and regulative requirements; and
- identify areas for improvement, leading to progressively better environmental management.

B. Traditional Approach

In developing a traditional, command and control approach to overseeing offshore oil and gas activities, a regulatory body will normally develop a set of requirements addressing all phases of offshore operations. These requirements will usually focus on critical issues relevant to an operation or process, and will represent the minimum requirements with which an operator or lessee is expected to comply. The requirements are typically developed from a series of existing industry standards, practices, and procedures. Compliance with these requirements will normally be evaluated by a regulatory body through review and evaluation of a series of plans, permits, and related documents and through a system of field based inspections and evaluations.

5. Environmental Monitoring

5.1 Aims and Objectives

Environmental monitoring is an analytical tool used to assist in conserving and protecting ecological and socioeconomic resources and human health. The purpose of monitoring with respect to petroleum activities is to:

- establish a basis for identifying developmental trends in contamination and pollution;
- assure that regulatory and licensing requirements are satisfied;
- assess the predictions and theoretical forecasts of the PEIA and EIA;
- detect the first signs of contamination or pollution;
- determine the actual level of contamination of effects;
- help assess whether the operator is meeting the goals of its environmental management plan;
- facilitate early detection of possible unforeseen effects; and
- aid future decisions about where, when, how and if oil and gas activities should be allowed to occur.

Environmental monitoring of petroleum activities should be designed and structured to determine and identify impacts (contamination and effects). The design of a monitoring program should ensure a clear statement of the objectives of monitoring. Identification of methods utilized to assure quality control for all aspects of the monitoring process should be in-place early in the project's planning phase.

Environmental monitoring should measure physical, chemical, biological and/or social conditions that may be impacted by the activities being conducted. Before petroleum activities commence, monitoring should begin with a comprehensive baseline investigation, which should incorporate existing information, and comprise as a minimum all monitoring sites and variables planned to be used in the long term monitoring program. The monitoring program should continue through the decommissioning and reclamation phase.

Monitoring should be conducted so as to distinguish between impacts due to the monitored activities and those from other sources. Monitoring should be coordinated regionally so that interactions between multiple activities may be more easily detected. The type of monitoring conducted depends on the specific type of activity anticipated and the nature of the environment that could be affected.

Prior to initiating offshore oil and gas activities, Arctic states should ensure funding within governmental and/or industry costing structures.

5.2 Monitoring Targets

Priority monitoring should comprise the following points during all phases of the oil and gas activities to assess and minimize or mitigate adverse effects:

- environmental accounting of emissions to air, discharges to water and sea floor emissions of noise;
- physical disturbance to sea floor, pelagic biota, ice edge communities and the sea shore;
- levels of contaminants in bottom sediments and the water column;
- levels of contaminants and effects in living marine resources, seabirds and other wildlife, with particular attention to vulnerable life states and areas of critical habitat;
- effects of petroleum activities on local human populations, subsistence access and harvest and other human activities; and
- effects of environment on operational structures.

The chief emphasis of the monitoring will vary depending on the phase of the petroleum activity. Exploratory drilling and production activities will demand different monitoring emphasis. Similarly, monitoring will have different emphasis in the early stages of the life of a field/installation from later stages. The fact that discharges do not cease to have an effect on the environment once they are terminated also calls for an identical monitoring practice throughout the lifetime of a field and as necessary after decommissioning.

The main emphasis of the baseline survey and/or EIA should be to make a complete inventory of environmental resources that may be affected by the planned petroleum activity and identify resources/areas particularly sensitive to the various phases of the petroleum activities. Some resources may be most sensitive to acute oil spills, while others may be more sensitive to chronic discharges/emissions even at sub-lethal concentrations. Both types may have effects on local biological communities, directly or indirectly through effects on the ecosystems.

Programs for identification of biota particularly sensitive to pollution from petroleum activities should not only include adult stages and established communities (e.g. seabird feeding grounds, shoreline communities etc.) but also early stages in the life cycle of plants and animals including gestation periods, which are more vulnerable to oil and chemicals than adult stages. Therefore, not only vulnerable species should be identified prior to setting up a monitoring program, but particularly sensitive life stages should also be identified.

5.3 Monitoring methods

Monitoring of trends in levels of contaminants in sediment, water, ice/snow and biota has been the traditional way of monitoring impacts of pollutants on environment. This is still the backbone of most monitoring programs, since reliable trend data are needed both to document changes in the environment as the result of the activities and as a basis for the prediction of future changes.

Monitoring should not only measure the level of pollutant in sediment or biota, but also the effects that the contaminants may have on species, ecosystems and human health. These effects may be monitored by recording changes in biodiversity over time or by measuring effects on single specimens. Such methods, including the use of biological indicators, could give early warning of negative changes in the environment. Methods for monitoring effects should be an integrated part of monitoring programs.

The monitoring programs should not only be centered around field monitoring, but also include laboratory experiments and combinations of laboratory experiments and field studies whenever relevant.

5.4 Monitoring Standards and Practices

Environmental monitoring standards and practices should be established for all phases of offshore petroleum activities, including offshore seismic operations and marine transportation. Principal monitoring activities should occur during drilling, development, production, decommissioning, and reclamation, as well as during transportation of oil, gas, supplies and personnel.

Monitoring should have a long term perspective showing developmental trends in contamination and effects, and should form the basis for predicting what impacts to expect in the years to come. The frequency in monitoring surveys must be dense during the first years of investigation until the main impacts and trends are clarified and then as frequent as necessary in subsequent years. Environmental accounting and budgeting should be part of the monitoring system, showing the type and quantity of chemicals and substances that are used and discharged, what environmental impacts have been monitored, and what might be expected in the next few years.

Monitoring should start with a baseline survey establishing pre-activity biodiversity, population structure and size etc. and existing level of contamination in the environment and biota. This is essential if previous introductions of the contaminant in question have already taken place either naturally or from human

activity. Usually, monitoring will be the chemical measurement of the level of the contaminant in the air, water, ice/snow, sediments, or biological tissue. The levels found are then compared to applicable criteria such as baseline data or appropriate standards. The ultimate goal, however, must be to measure the effects of contaminants on organisms.

Monitoring of contamination levels related to petroleum activities should take into account the source of the contaminant, the potential routes of transport (e.g., aqueous, particulate, air borne) and the potential pathways for bioaccumulation. Besides the contaminant in question and the particular processes that might be involved, other considerations may include: wind strength and gustiness; ocean currents; relevant river flow; precipitation; air temperature; ocean temperature; sea ice conditions and movement; water depth; sea surface state; subsurface geology; and other resources affected.

Data from environmental monitoring should be harmonized in collaboration with AMAP and could be collected and stored in a central Arctic database repository, such as ARIA or ADD, where it would be available freely to all national environmental protection and monitoring authorities, for circumpolar environmental assessments, and for other users.

Whenever appropriate, operators should consider local indigenous populations for conduct of contractual monitoring activities as well as drawing upon traditional knowledge for the identification of historical environmental extremes and trends. Establishment of cooperative relationships with resident indigenous communities for biological sample collection, environmental observation and monitoring, should be pursued.

Results have shown that air emissions from the offshore installations may have an impact on nearby land areas and monitoring of these impacts may be included in updated monitoring guidelines.

5.5 Compliance Monitoring and Review

Results of monitoring should also be utilized by regulators in compliance audits and on-site regulatory supervision as the basis for requiring modification, postponement, or shut-down of operations or specific components of an operation and to change laws. Monitoring activities can be conducted in conjunction with environmental audits to assure the operator that the equipment and procedures associated with an operation are functioning within design parameters and will not lead to any significant impact on the environment. Environmental audits should, furthermore, be used by the authorities to verify that the results of monitoring are used by the petroleum companies and reflected in their environmental strategy.

Figure . Example of generalized monitoring plan

Region	Installation	Phase	Type of investigation	Part of environment	Elements to be included	Frequency
Region I	*Installation 1*	planning for development	baseline	seabottom /water column /shoreline etc	inventory of biota/eco-systems, levels of all relevant contaminants, identification of particularly sensitive resources	once, before activities are started
		development	monitoring	seabottom and other as relevant	physical disturbance, biota, contaminants	every year and as frequent as necessary
		production	monitoring	seabottom water column seashore and other as relevant	 relevant contaminants in environment and biota, effects on biota as relevant	every year first 3 years, thereafter every 3 years every 3 years and /or periodically as necessary
		decommissioning	monitoring	seabottom and water column, as relevant	levels of contaminants and effects on biota	during operations and once at reclamation phase
	Installation 2					
	Installation 3					
Region II	*Inst. 1*					
	Inst. 2					
	Etc					
Region III	*Inst. 1*					
	Etc					
Etc	National shelves should be divided into regions where monitoring of the individual installations is coordinated. Regional monitoring of the water column is coordinated for the entire shelf of each country.					

6. Operating Practices

6.1 Waste Management

Offshore oil and gas activities produce a variety of wastes in the form of aqueous and solid discharges and atmospheric emissions that need to be managed to avoid air and water pollution, smothering of benthic communities, and radioactive contamination of materials and food sources. Waste management is most effective when included in the overall planning from the beginning and targeted toward the goal of eliminating waste discharges and emissions which pose pollution threats to the Arctic environment. Elimination of these discharges should be a targeted goal of regulatory activity, however, the appropriate waste management decision for each activity must also consider the feasibility of zero discharge in the area under review, whether the necessary onshore infrastructure exists, and whether an unacceptable transfer of pollutants from on media to another would result. The most effective management of discharges and emissions is attained in concert with pollution prevention. If elimination of wastes is not possible, then the hierarchical application of techniques for source reduction and waste minimization (recycle, reuse and reclamation; treatment; and, finally, proper disposal) should be employed to meet applicable regulations. These principles, along with the best available technology and the best available environmental practice, should be incorporated in the design and management of exploration and production facilities and planning of associated activities.

Examples of Recommended Preventative Management Techniques

- reduction of waste at the source by process modification, material elimination, material substitution, inventory control and management, improved housekeeping, and water recovery;
- reuse of materials or products such as chemical containers, and oil-based or synthetic-based drilling fluids;
- recycle/recovery by the conversion of wastes into usable materials and/or extraction of energy or materials from wastes such as recycling scrap metal, recovery of hydrocarbons from tank bottoms and other oily sludge, burning waste oil for energy, and the use of produced water for enhanced recovery;
- reduce toxicity of effluents through the careful selection of drilling fluids and chemical products used in separation equipment and wastewater treatment systems;
- perform radiation surveys of equipment and sites to prevent or minimize the spread of Naturally Occurring Radioactive Materials (NORM); and
- where NORM-scale formation is anticipated, the use of scale inhibitors may minimize or prevent the buildup of radioactive scale in tubulars.

Discharge Management Techniques for Drilling Wastes and Production Effluents

Discharges from Drilling Activities

Drilling wastes in the form of residual muds and cuttings comprise the principal wastes generated during well drilling. Initially, a determination needs to be made on whether to prohibit discharge based on the nature/volume of the discharge and its effect on the environment. In certain areas, due to identification of environmentally sensitive effects, muds and cuttings may need to be managed in a manner that will prevent discharge. In areas where discharge is permitted, the method of disposal should be based upon careful consideration of mud formulation and specific environmental conditions at the site or other disposal areas. Where water-based muds are employed, additives containing oil, heavy metals, or other bioaccumulating substances should be avoided or removed prior to discharge. Persistent and toxic substances should be avoided or criteria established for the maximum allowable concentration. This is particularly true if cuttings with adhered mud are discharged offshore or disposed of on land. If the option of land disposal is used, then both the properties of the mud and the environmental conditions at the proposed disposal site should be carefully considered to determine acceptability of the disposal site.

Environmental considerations favor the use of non oil-based muds for drilling. In shallow portions of a well, saltwater and saltwater with clay are often used as the primary drilling fluid and the cuttings and residual mud can generally be safely discharged into the marine environment. Based upon site-specific biological, oceanographic and sea-ice conditions, discharges should be at or near the sea floor or at a suitable depth in the water columns to prevent large sediment plumes that might affect benthic organisms, plankton productivity, or fish and marine mammal movements. These discharges should be considered on a case-by-case basis.

In cases where water-based drilling fluids are replaced by oil-based or synthetic-based muds, synthetic-based muds are strongly preferred. There are several disposal options for synthetic-based and oil-based drilling fluids and cuttings. Washing is generally not effective for removing oil from cuttings in oil-based muds. Spent oil-based or synthetic-based muds can often be reconditioned and recycled. Injection into disposal wells or encapsulation of reserve pit fluids, muds, cuttings, including those with acceptable levels of NORMs, and other pumpable wastes are potential disposal techniques. Management of down-hole disposal will require diligence to ensure that wastes do not migrate into unsealed or undesirable stratigraphic zones and that well integrity is maintained. Stabilized burial at approved onshore disposal sites is another potential alternative.

Depending on local environmental sensitivity and conditions including biological considerations, water depth and circulation, and ice conditions, additional controls on drilling waste discharges might be considered, such as discharge prohibition or limits on

discharge rates and volumes. Where appropriate, the use of a "closed-loop" solid control system minimizes discharge volumes of drilling fluids.

Production Waste Discharges

During production operations, produced water can be properly treated and discharged or may be reinjected in areas when discharge is undesirable. Treatment, workover, and completion fluids in most cases can be commingled with produced water for treatment and discharged within acceptable limits or reinjected.

Produced sand containing elevated levels of naturally occurring radioactive material should be removed from the site and stored in carefully controlled and evaluated circumstances, or can be re-injected or encapsulated. Management of these wastes will require diligence to ensure that radioactive wastes taken to shore are handled and disposed of in accordance with applicable international law and in an appropriate and approved manner. Radioactive materials should be transported in approved containers with proper labeling, which identify the substance and its special transport and handling requirements. Appropriate record keeping and proper notification for shippers should be maintained.

Deck wash and chemical/fluid releases are another concern to the marine environment, especially where oil-based muds are in use. Leak minimization and spill-control methods should be incorporated into facility design and maintenance procedures and a facility plan should be developed to address these potential conditions. Material storage areas, loading and unloading operations, oil/water separation equipment, wastewater treatment and waste storage areas, and facility runoff are particularly amenable to these controls.

All washdown waters, hydrocarbon contaminated rainwater and deck wash, and bilge water should be processed through an oil-water separator prior to overboard discharge, and should meet MARPOL 73/78 requirements.

Waste from Well-Testing

If flaring is considered environmentally unacceptable or if significant amounts of liquid hydrocarbons are produced during a test (i.e. extended well-testing operations), they may be processed and shipped to shore for sale.

Solids and Domestic Wastes

Disposal of solid and domestic wastes should be done in conformity with international law, such as MARPOL 73/78.

Sanitary Waste

Sanitary wastes such as sewage and gray waters should be processed according to international or local government standards prior to discharge into the marine environment. Processing in an acceptable sanitary waste treatment unit will generally properly treat waste streams prior to discharge.

Air Emissions

Air emissions associated with oil and gas exploration and production activities can be generally categorized as arising from two activities: (1) the combustion of fuels for power generation; and (2) emissions arising directly from the production, treatment, storage, or transportation of produced oil and gas. Standards should be implemented to reduce sulfur dioxide, nitrogen oxides and particulate matter from engines and gas flaring. International standards are currently under development under MARPOL Annex VI (73/78).

Overall emissions reductions can best be achieved through programs that emphasize energy efficiency and conservation in all activities, exploration (survey and exploratory drilling), development (construction and drilling), production, and transportation.

Hazardous Waste Handling and Disposal

The most effective way of protecting human health and the environment from the dangers posed by hazardous wastes is to ensure the reduction of their generation to a minimum in terms of quantity and/or hazard potential, taking into account technological and economic aspects. Minimizing the generation of hazardous wastes requires the implementation of environmentally sound low-waste technologies, recycling options, good house-keeping and management systems. Necessary measures should be taken to ensure that the management of hazardous wastes is protective of human health and the Arctic environment.

The availability of adequate disposal facilities should be ensured prior to allowing an activity to generate hazardous wastes. Hazardous wastes requiring transport to a disposal site should be packaged, labeled, and transported in conformity with generally accepted and recognized international rules and standards in the field of

packaging, labeling, and transport, and due account should be taken of relevant internationally recognized practices. Transported hazardous wastes should be accompanied by a movement document from the point at which movement commences to the point of disposal.

6.2 Health, Safety and Environmental Supervision

The appropriate regulatory agencies shall supervise the compliance by the responsible companies with applicable legislation, regulations, and\or conditions. The supervision should address the management system level by means of audits and be supplemented as needed by onsite verifications by qualified personnel who are authorized to act as the lead agency on behalf of all applicable regulatory entities.

The regulatory supervision should cover all stages of design, fabrication, installation, operations and removal of offshore installations, and should address the operating company's management of design, operations, working conditions, record keeping and reporting, as well as procedures for ensuring compliance with permits and approved plans. The regulatory supervision should also encompass the company's systems for pollution control and monitoring, drilling and well operations techniques, production, and pipeline operations. Representatives of the regulatory agencies should have enforcement authority to take the appropriate action in case of violations, incidents of noncompliance, or if the operator fails to react adequately to the occurrence of dangerous situations. These actions can include issuing warnings, citations, injunctions, or ordering a shut-in of a particular component of the operation, cessation of a specific operation, or a complete shut-down of the installation.

Representatives of the regulatory agencies should have the right of access to the installations and to all related documentation and equipment at any time. The operating company shall provide for, as far as practical, the accommodation and when necessary the transportation of regulatory agency personnel. Supervisory activities may be carried out as announced or unannounced visits. The frequency and extent of such activities will be decided by the regulatory agencies.

The regulatory agencies should establish plans for these supervisory activities for each operating company. The extent and the focal points of the regulatory supervision should be decided upon the basis of parameters such as: regulatory requirements, the previous experience with the operators compliance, environmental and geologic conditions, the type of activity conducted by the operator, the type of technology applied, and reported accidents and incidents.

6.3 Design and Operations

Offshore oil and gas activities should make use of the best available and safest technologies that are determined to be economically feasible and be conducted in a manner to minimize impact on the environment. Operators should identify technologies and procedures to be employed for each step of the process from prospecting to exploration, development, production, platform decommissioning, and site clearance. Regulators should examine technologies and procedures proposed for use by operators and their adequacy to ensure that they are appropriate for the Arctic.

Of primary importance is the need to ensure that wells remain under control at all times, regardless of formation pressures encountered, during drilling, well-completion, production, and well-workover operations. This capability must be maintained even while operating under conditions imposed by unstable sea floor and sub-sea geologic hazards, sea ice, and severe weather.

When planning an offshore oil and gas operation, a risk analysis may be used as a tool to identify and prevent personal injuries, loss of human lives, and pollution of the environment. Criteria used for conducting such an analysis should be based on local regulatory requirements, local environmental conditions in the area of operation, and the planned operational activity.

In the event a risk analyses is conducted it should:

- address prevention of injuries, loss of human lives, and pollution of the environment,
- define acceptance criteria for risk prior to conducting the analysis and document the evaluations forming the basis of the acceptance criteria,
- be used to follow the progress of activities in planning and implementation,
- identify risk that has been assessed with reference to the acceptance criteria, form the basis of systematic selection of technical operational and organizational risk to be implemented,
- be updated on a continuous basis and included as part of the decision making process, and
- systematically follow-up implemented risk reducing measures and assumptions made in the analysis to ensure safety within the defined acceptance criteria.

Risk Evaluation

Procedures should be established to identify potential health, safety, or fire hazards which may rise from anticipated offshore activities (Refer to Section 2.1, Environmental Impact Assessment). Potential health and safety hazards may arise from the following sources:

- environment;
- construction of installations/facilities;

- drilling, production, and maintenance activities; and
- transportation.

Procedures should be established and maintained to evaluate risks and the effects from identified potential hazards, taking into account the occurrence and severity of consequences for personnel. Attempts shall be made, to the extent possible, to eliminate or reduce the risks of identified potential hazards. Potential risks can be managed by appropriate planning and response.

Technology

Offshore platforms and other structures used for oil and gas activities in the Arctic should be designed, built, installed, maintained, and inspected to ensure their structural integrity taking into account the site specific environmental conditions as well as the international experience of nations with Arctic offshore oil and gas experience. Standards exist for the construction of fixed offshore platforms, including those constructed of steel, concrete,

sand, gravel and ice. In iceberg-prone areas, provision should be made for the emergency removal of removable installations.

A blowout preventer (BOP) system should be installed consisting of several remote controlled closing systems and a backup accumulator-charging system. When a sub-sea BOP stack is to be used in an area subject to ice scour, it should be placed in an excavation well below the maximum depth of ice scour. The BOPs and related equipment should be suitable for operation in subfreezing conditions.

A mud program should be prepared that has as its objective the maintenance of well control at all times. Mud temperatures should be controlled to minimize heat loss to permafrost zones in order to minimize thawing, which can result in serious problems while drilling.

Wells should be completed with casing strings and cement of sufficient quantity and quality to prevent the release of fluids from any stratum either to the water column or to another stratum. Special attention should be paid to cement placed across permafrost zones.

Prior to moving a well-completion rig, wells in the same well-bay capable of production should either be shut in, both at the surface and the subsurface, or equipped with emergency shutdown systems. Production safety equipment capable of operating in an Arctic environment should be installed on all wells and production facility equipment. Wells open to hydrocarbon-bearing zones should be equipped with subsurface safety devices capable of shutting off the flow from the well in an emergency. All production facility equipment should be equipped with devices capable of protecting the facility and the environment from pollution.

Pipelines should be installed, operated, and maintained in a manner that does not unreasonably interfere with other uses of the sea floor in the area. Although standards do not exist for the design of offshore Arctic pipelines, their design must take into account thaw settlement, near shore strudel scouring, and ice keel gouging. For example, sea floor pipelines should be buried well below the maximum depth of ice scour. Cathodic protection, quality control, and preventive maintenance also must be considered in the design of Arctic pipeline systems.

Procedures

Operators should submit a summary of the proposed project at the outset, followed by more detailed applications prior to the initiation of each major activity, such as the drilling of a well. The application should describe all procedures to be employed, including those necessary to prevent harm to life and the marine environment. Special attention should be paid to operations in offshore areas underlain by permafrost.

Safe work procedures should be developed for all phases of the proposed operations, including construction activities, transportation, equipment operation and maintenance, safety tests and drills. For example, well-control exercises should be conducted regularly for each crew to develop an adequate level of response proficiency to conditions threatening a blowout. Exercises should cover a wide range of situations. As appropriate, procedures should also be developed to ensure that hot work, welding, burning, cutting, and other operations with the potential to cause ignition of flammable vapors are conducted safely. Safe work procedures may also be developed for cold work such as use of radioactive material, trenching and excavating, and work on fire suppression, gas detection or emergency shutdown devices. These procedures may include issuance of a work permit.

Procedures should be developed to protect personnel from the toxic effects of hydrogen sulfide, if it is encountered during drilling.

Well abandonment, platform decommissioning, and site clearance are discussed in Chapter 8 (**Site Clearance and Decommissioning**). Operators shall incorporate into the design of an installation needed measures to ensure that removal of the installation can be accomplished without causing significant impacts on the environment.

6.4 Human Health and Safety

Threats to human health and safety including unsafe working conditions are factors contributing to accidents that could lead to environmental pollution. Possible threats or hazards affecting the health and safety of personnel in Arctic offshore oil

and gas activities take many forms and comes from multiple sources. Principal sources include, but are not limited to, the harsh Arctic environment, the structural integrity of the installation, blowouts, fire and explosions, equipment failure, the transfer of personnel and supplies, and drilling, production, well completion, and workover operations.

All offshore activities should be conducted in a safe and skillful manner and equipment maintained in a safe condition for the health and safety of all persons and the protection of the associated facilities. All necessary precautions should be taken to control, remove, or otherwise manage any potential health, safety or fire hazards.

Management System and Work Procedures

One way to manage potential risks is through the use of an appropriate management system. A management system or plan should address the identification of potential hazards, the evaluation of risks to the health and safety of personnel and procedures to eliminate or reduce health and safety risks. Management plans should:

- identify and recognize significant health and safety risks (e.g. polar bear or fire);
- evaluate significant health and safety risks;

- plan and implement actions/procedures to manage risks;
- review and test preparedness and effectiveness on a regular basis;
- establish clear lines of communication with personnel;
- provide training to personnel;
- identify appropriate personnel protection equipment; and
- communicate contents of the management plan to all personnel.

Operators should ensure that all contractors pursue established safe working environment objectives. Safe working procedures should be established for all persons, including contractors, to ensure safe working conditions for all offshore activities. In addition work permits may be required for specific work activities including hot work, cutting, and welding (see 6.3 **Design and Operations**).

Another useful tool to consider in the management or elimination of risks is through the use of a Health, Safety and Environment (HSE) Committee. HSE Committee meetings could be held to ensure that critical safety and environmental control information is communicated to all parties throughout offshore operations. HSE meetings would coordinate among the operator, contractors, and employees to ensure a mutual understanding of potential hazards in working environment.

Meetings would allow employees an opportunity to express safety concerns to be addressed by the operator.

Control of Materials

Materials specifications, inventories, separation, confinement, and handling of toxic or hazardous materials that can affect human health and safety should be determined, documented, labeled, and communicated to appropriate person and addressed (see 6.1 **Waste Management**).

6.5 Transportation of supplies and infrastructure

Offshore transportation by air and water should be planned and carried out in a manner to eliminate or minimize adverse impact on the environment. The guidelines for management systems, environmental monitoring programs and planning for emergencies should be applied, with adaptations where necessary, to transportation activities. Information gathering and mitigation measures identified at the environmental assessment stage of project planning should be fully utilized for minimizing the environmental impacts associated with transportation of supplies and people to and from offshore operations. For example, it may be necessary to select routes, flight altitudes and/or the time of voyages to avoid impact on wildlife or the harvesting of wildlife by area residents.

The planning and implementation of supply routes involves many considerations beyond environmental impacts. The system of transportation consists of supply bases, sea-routes and vessels. Procedures involved are the safe handling of cargo and safe navigation. All

these elements must be carefully evaluated and accounted for prior to the field development. Transportation of supplies, infrastructure and crude oil, shall therefore be an integrated part of the environmental impact assessment outlined in these Guidelines.

Ship based transportation of supplies to offshore oil and gas installation are to be carried out under the administration of those requirements and guidelines laid down in the International Management code for the Safe operation of ships and for pollution prevention. The basis of the ship owners management system should include guidelines, codes and relevant international conventions to safeguard those additional requirements of the harsh environment of the Arctic. The proposed International Code of Safety for Ships Navigating in Polar Waters (Code of polar Navigation) should be considered.

Supplies

In maintaining the activity of an oil or gas installation in every aspect, supplies of many categories are involved;

- Supplies for maintaining production
- Supply for installation maintenance and safe operation; and
- Supply of domestic use.

Storage, packaging and operational procedures of handling are to be as in accordance with general rules of safe practice and to recommendations of the product manufacturer.

Supply base, routing and installations

Prior to field development, it is necessary to plan infrastructure required to serve the needs of the installation. In addition to systems for handling the production, a system is also required to secure sufficient and safe supply. Beside the installation itself, the main elements of such infrastructure are the supply bases and sea-routes. The location of such bases is often decided on the basis of compromises in which the requirements to safe transportation must compete with other and maybe conflicting arguments. This calls for an even closer focusing on safe routing. An Arctic land-offshore transport routing system might cover more that one field and have requirements to reliability. To assure safe operations, sufficient care must be taken regarding both climatic and environmental seasonal variations. In order to encounter for these factors, the possible need of ice handling/ ice management procedures (integrated in the field operational plans if feasible) covering the installation, the route as well as the supply base must also be evaluated.

6.6 Training

Trained operator and contract personnel are the key to safe and environmentally sound oil and gas activities. Appropriate training plans, programs, and practices addressing offshore Arctic oil and gas activities should be established and implemented for these

personnel in accordance with their duties and job responsibilities. (Refer to Chapter 7, **Emergencies**, for information concerning response training).

All personnel should be provided with training on basic safety and environmental issues and procedures specific to the offshore prior to assuming their duties. This training should provide personnel with the necessary skills and knowledge needed to conduct their jobs in a safe manner, provide for health and safety of all persons, and protect the environment

Training programs should provide instruction on the operation of equipment, offshore operating practices, offshore emergency survival and fire fighting, local or

regional regulatory requirements, and Arctic cultural, social, and environmental concerns including marine mammal interactions as dictated by an individuals job responsibilities. Where appropriate, traditional knowledge should be used in training programs.

Supervisory personnel should have a thorough knowledge of the operations and the operating procedures for which they are responsible. Individuals responsible for drilling, well completion, or workover operations should be properly trained in well control. Individuals responsible for production operations should be properly trained in production safety system operations.

A person designated by the operator to be in charge of the offshore operation should have a thorough knowledge of the operations and the operating procedures they are responsible for, and training in the following areas as appropriate:

- leadership and command ability,
- communication skills,
- team building,
- crisis management, and
- installation specific emergency training.

Periodic refresher training should be provided to personnel as appropriate. As required, procedures should be developed to monitor the effectiveness of training programs.

7. Emergencies

7.1 Preparedness

Operators should establish and maintain emergency preparedness so that the mitigation of an incident will be carried out without delay in a controlled and organized manner. Risk analyses should be carried out in order to identify the accidental events that may occur and the consequences of such accidental events. Hazardous situations and accidents should be defined for the operations in question. An analysis should be carried out to design the emergency preparedness requirements so as to meet the specific circumstances of the operation. The emergency preparedness required for the operation should be incorporated in the design and modification of the oil and gas installation, and for the selection of equipment. The performance requirements expected of both standby vessel and ice roads in emergencies should also be defined. This should include design criteria, equipment and manning requirements for standby vessels and design criteria and construction and maintenance requirements for roads. Emergency preparedness should be part of the safety and environmental program to ensure its integration into all phases of the operation in question.

Preparedness relating to oil pollution should ensure that the source of any oil pollution is first secured, and any release is effectively contained and collected near the source of the discharge as quickly as possible. The preparedness should also address protection of public health, environmental resources including shorelines, ice and water interfaces, and economic and cultural resources. The health and safety of all persons who may be involved in an incident (e.g., local populations and their representatives, responders, volunteers, etc.) should be a predominant consideration, and should be integrated into the overall emergency preparedness regime.

The communication within the emergency preparedness organization should ensure effective administration and control of all response resources when abnormal conditions and emergencies occur. The means of communication and their use should ensure unambiguous and effective transmission of information.

A key factor in preparedness is ensuring that personnel involved in the response are trained and instructed in their roles and duties.

Preparedness planning of the operator should include co-ordination with any relevant municipal, local, state or federal emergency response plan.

Governments are responsible for oversight including national emergency contingency planning. Governments should also make appropriate arrangements that facilitate international coordination and cooperation.

7.2 Response

Emergency response plans should address abnormal conditions and emergencies that can be anticipated during the oil and gas operation being carried out, including:

- personnel injury or loss of life;
- loss of well control, or release of flammable or toxic gas;
- fire, explosion or other emergencies that may occur;
- damage to the oil and gas installation;
- loss of support craft including aircraft;
- spills of oil or other pollutants; and
- hazards unique to the operation including ice encroachment; uncontrolled flooding of the installation; loss of ballast control or stability; vessel collision; and heavy weather and difficulties with support facilities such as ice roads, aircraft or shuttle tankers.

Contents of Emergency Response Plans

An emergency response plan should contain at least the following elements:

- A Description of the Response Organization – This should clearly state its structure, roles, responsibilities and decision-making authorities;
- Policies and Procedures for Responding – This should include a summary of equipment to combat the particular condition or emergency situation, clearly stating the make and type of equipment, its capacity, location, type of transport, field of operation and operational procedures and training for operating staff. The procedures should include each key person's duties, when and how the emergency equipment is to be employed, and the action to be carried out. Policies should state measures for limiting or stopping the event in question and conditions for terminating the action. The procedures should be designed so as to be expedient to use for the emergency;
- A Description of the Alarm and Communication Systems – This should include notification criteria, reporting procedures and policies regarding government notification. Primary and secondary communication facilities among operational components should also be identified;
- Alert Criteria – Procedures here should list precautionary measures to secure the well and evacuate personnel in the event of damage from severe weather, sea, ice, erosion or other event;
- On-Site First Aid – List available backup medical support, medevac facilities and other emergency facilities, such as emergency fueling sites. Also describe required survival equipment, including extreme weather survival gear, alternate accommodation facilities, and emergency power sources; and

- Relief Well Arrangements – The operator should outline his immediate response to a well control incident or blowout. Also, the operator should demonstrate the availability of the necessary equipment, and support systems to be utilized.

Oil Spill Response Plan

Operators should be required to have site-specific or operator-specific plans. An oil spill response plan addresses an oil spill volume based on relevant well data, catastrophic loss of a tank ship or barge, or damage to a pipeline. The Plan should be supplemented by resource sensitivity maps arranged sequentially by month for those areas identified by spill trajectories as being potentially exposed to oil pollution. The plan should also describe the process for its development, which should include involvement by response entities, both government and private, health officials, scientists, local populations that may be affected, wildlife experts, trustees of resources, and anyone else who may be affected or who may have a role in the response.

The oil spill response plan should include, in addition to the items described above, the following:

- a brief description of the operation;
- description of the site, water depth, seasonal constraints, and logistical support;
- references to all environmental support material that would be relevant to establish cleanup priorities;
- details of the operator's capability in using real time wind and current data to implement an oil spill trajectory model both for open sea and for ice-infested areas;
- map depicting sensitive areas to be protected;
- description of cleanup and containment strategy required for shoreline and ice-covered areas;
- strategy to respond to small spills from the installation, shore base or loading operations; and
- provisions for transport, storage, and disposal of recovered oil and oil contaminated materials.

Operators should have access to oil spill countermeasures equipment. The oil spill response plan should itemize equipment on-site for immediate containment purposes. The plan should also provide details of oil spill equipment and resources

that are not on-site but will be mobilized in the event of a spill; the details should include type of equipment, required resources, logistics and timing of mobilizing the equipment to the site.

The oil spill response plan should include the qualifications and training of personnel responsible for the management of oil spill responses. It should clearly define their authority to take actions to respond to such emergencies.

A national preparedness and response system should be developed on the basis of protecting the health and safety, the environment, and the socio-economic interests of the nation's citizens.

Ice Management Plan

Where there may be pack ice, drifting icebergs or ice islands at the operational site, the operator should develop an ice management plan that provides for the protection of the installation.

The Plan should include details regarding ice detection, ice surveillance, data collection, forecasting and reporting of ice encroachment, multiyear ice hazards, ice loading, and structural loading. If required, the Plan should also include details of ice avoidance or ice deflection, including forecasting oil-in-ice drift.

The Plan should include alert criteria and alert procedures to ensure a totally effective mobilization of all relevant emergency preparedness resources, including procedures for moving the installation. Measures for danger limitation should be implemented when a hazardous situation occurs in order to prevent its developing into an accident situation.

Emergency Preparedness Maintenance

All the established technical, operational and organizational measures that make up the emergency preparedness of the individual activity should be maintained in order to keep up a state of effective emergency preparedness.

Oil spill response exercises should be carried out on a scheduled basis. In addition, a communication exercise in response to an emergency should be conducted on a scheduled basis. Exercises should be reviewed to ensure compliance with all requirements relating to emergency preparedness. Any deviation should be identified and corrected immediately; the causes of such deviation should be identified. In accordance with the safety and environmental program, emergency preparedness work should be verified and documented.

Measures should be taken to update the established emergency preparedness based on continuous evaluation of experience, technological development and new knowledge.

8. Decommissioning and Site Clearance

Decommissioning should be planned for at the project design phase and reviewed again when the facility is no longer needed for its current purpose (see Annex A, **Flowchart** and Chapter 2, **Environmental Impact Assessment**). Like the project itself, the decommissioning plan should be site- and condition-specific. A decision to grant approval for a specific decommissioning approach should be based on sound science and field experience, and balance environmental, safety, economic, health, and technological considerations. The appropriate authority should ensure that the operator has sufficient resources to guarantee that decommissioning and site clearance will be properly carried out.

Decommissioning decisions should be based on sound science and field experience, and balance environmental, safety, economic, health and technological considerations. IMO guidelines exist for the removal of offshore platforms and the guidelines state that as of January 1, 1998, no installation or structure should be placed on any continetal shelf or in any exclusive economic zone unless the design and construction is such that it is feasible to entirely remove the installation or structure upon abandonment or permanent disuse. If disposal at sea occurs, procedures would be governed by the London Convention, or after ratification, by the 1996 Protocol to that Convention.

It is noted that those Arctic States that are Contracting Parties to the Oslo and Paris Conventions (OSPAR) are currently discussing particular measures regarding disposal of disused offshore installations on the basis that the reuse, recycling and final disposal offshore installations on land will be the preferred option for most installations in the OSPAR Convention area. Consistent with the approach of these Guidelines, which do not prevent additional measures to protect the marine environment, those States would, of course, be bound by the outcome of those discussions.

The goals of decommissioning and decommissioning plans shall be considered and incorporated from the initial design stage.

The decommissioning plan should be developed in consultation with appropriate government representatives, general public, indigenous residents, fishing groups, and other interested parties. The plan should address the environment (the site and the habitat) and the facility (wells, production facilities, and pipelines). Each is summarized below.

Planning for, Managing, and Maintaining Habitat

The facilities and site exist within the context of a habitat, one that is altered by the presence of the facilities and associated activities. Habitat planning, its

management, and its maintenance through the decommissioning processes should be foremost in the minds

of operators, and affected parties. Operators should carefully plan decommissioning taking the following factors under consideration:

- the effects of removal depths on sediment transport;
- the effects of platform size on various fish species;
- habitat and water depth profile for fish kill from the use of explosives;
- attraction versus production in cold water environments with ample hard bottom;
- feasibility of using fish scare devices; and
- ecology of invertebrate communities on platform structures.

Decommissioning of Wells

Decommissioned wells should be plugged and abandoned to prevent the influx of hydrocarbons into the marine environment.

Removing Facilities

Decommissioning plans shall consider the impacts arising from the removal of the facility, including noise and disturbance, access to the area and waste disposal. Demobilization sea routes should take into consideration environmental sensitivities along the routes and the interaction with other uses, such as fishing.

Decommissioning Pipelines

At the end of production, pipelines should either be removed or flushed of content and left in place.

Site Clearance

Site clearance is a principal decommissioning objective and should be incorporated into the overall decommissioning plan to ensure that, with the exception of partial removal or toppling gin place, a site is cleared of obstructions. To ensure the site is clear of debris, a post well verification and monitoring program should be planned to demonstrate minimal impact and verify full recovery of the site. Where an artificial island has been constructed as a platform for drilling or production, it may be appropriate to allow natural processes to return the site to its former configuration.

9. Glossary of terms

ADD: International Arctic Environmental Data Directory

AMAP: Arctic Mapping and Assessment Program, a working group under the AEPS (Arctic Environmental Protection Strategy)

ARIA: Arctic Environmental Impact Assessment Database, proposed by the Arctic Centre of the University of Lapland.

EIA: Environmental Impact Assessment

contamination: raised concentration of pollutants

impact: for the purpose of these Guidelines: contamination or effects of contamination

PEIA: Preliminary Environmental Impact Assessment

petroleum activity : is in this context used for all activities being an integrated part of oil and gas activities, including shuttle transportation of petroleum, supply transportation etc.

pollution: in the context of these Guidelines pollution means: the introduction to air, water or sediments of solid matter, fluid or gas, or the introduction of noise and vibrations

Annex A. Flowchart

Phase	Procedure	Activity	Responsible
Opening of new area for petroleum activities	***PEIA*** ⇓ hearing ⇓ ***EIA*** ⇓ hearing ⇓ opening	Environmental survey Impact assessment Regulations	Authorities
Exploration	***EIA*** in Particularly Sensitive Areas Risk assessment Contingency planning and emergency response	Seismic Drilling	Operator
Development	***EIA*** ⇓ Permission for discharge ⇓ ***Baseline survey*** Risk assessment Contingency planning and emergency response	Construction activities Transportation Drilling	Operator
Production	***Monitoring*** Risk assessment Contingency planning and emergency response	Drilling Discharges to water Air emissions Transportation	Operator
Decomissioning	***PEIA/EIA*** ***Monitoring***		Operator/Authorities

Annex B. Definition of the Arctic

Canada

Canada has defined its Arctic area to include the drainage area of the Yukon Territory, all lands north of 60 degrees North latitude and the coastal zone area of Hudson Bay and James Bay.

Denmark

Denmark's Arctic area is the Faroe Islands and Greenland, which is the world's largest island on which stands 9% of the world's ice cap.

Finland

Finland has no Arctic marine territory.

Iceland

Iceland has defined the whole Iceland to be within the Arctic area.

Norway

Norway has no legal/formal definition of its Arctic areas, but the purposes of these Guidelines, Norwegian sea areas north of 65 degrees North form the Arctic.

Sweden

Sweden does not have any formal delimitation of the Arctic but has, for the purpose of AEPS,, accepted the Arctic Circle as the southern delimitation of the Arctic area.

Russian Federation

In accordance with the draft Law of the Russian Federation "On Zoning of North Russia", the Arctic areas of North Russia include:

All lands and islands of the Arctic Ocean and its seas;

Within the Murmansk region: Pechenga district (coastal areas of the Barents Sea

Including populated centers located on Sredniy and Rybachiy Peninsulas, as well

As Liynakhamareye populated center, and the town-type settlement of Pechenga)

Kolsk district (territories administered by the Tuman and Ura-Guba rural govern-

ment bodies), Lovozersk district (territory under the Sosnovsk rural government
body), territory administered by the Severomorsk municipal government, and

closed administrative-territorial entities of Zaozersk, Skalistiy, Snezhnogorsk, Ostrovnoy, and the city of Polyarniy with populated centers administratively Attached to it;

Nenets autonomous national area – all territory;

Within the Komi Republic – city of Vorkuta, within areas managed by it;

Within the Yamal-Nenets autonomous national area; Priural, Tazov, and Yamal
District, and territories and administered by the Salekhard and Labytnang Municipal governments;

Taimyr the Krasnoyarsk territory – areas administered by the Norilsk municipal
Government;

Within Cakha Republic (former Yakutia): Allaikhov, Anabar, Bulun, Nizhnekolym, Olenek and Ust-Yan district:

Chuckchi autonomous national area – all territory;

Within the Koryak autonomous area Olutor district

United States of America

All United States territory north of the Arctic Circle and all United States territory north and west of the boundary of formed by the Porcupine, Yukon and Kuskokwim Rivers; all contiguous seas, including the Arctic Ocean and the Beaufort, Bering and Chukchi Seas; and the Aleutian chain.

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