

National Energy Board

Canada-Newfoundland
Offshore Petroleum Board

Canada-Nova Scotia
Offshore Petroleum Board

Office national de l'énergie

Office Canada – Terre-Neuve
des hydrocarbures extracôtiers

Office Canada – Nouvelle-Écosse
des hydrocarbures extracôtiers

OFFSHORE

WASTE TREATMENT

GUIDELINES

August 2002

Table of Contents

1. INTRODUCTION	1
2. REQUIREMENTS FOR SPECIFIC WASTES	3
2.1 WASTE MINIMIZATION	3
2.2 AIR EMISSIONS	3
2.3 PRODUCED WATER	4
2.4 DRILLING MUDS	5
2.5 DRILL SOLIDS	6
2.6 STORAGE DISPLACEMENT WATER	7
2.7 BILGE AND BALLAST WATER	8
2.8 DECK DRAINAGE	8
2.9 PRODUCED SAND	9
2.10 WELL TREATMENT FLUIDS	9
2.11 COOLING WATER	10
2.12 DESALINATION BRINE	10
2.13 SEWAGE AND FOOD WASTES	10
2.14 WATER FOR TESTING FIRE CONTROL SYSTEMS	10
2.15 MONOETHYLENE GLYCOL (MEG)	10
2.16 NATURALLY OCCURRING RADIOACTIVE MATERIAL	10
2.17 OTHER SUBSTANCES, WASTES AND RESIDUES	11
3. MIXING OF WASTE DISCHARGES	11
4. LOCATION OF DISCHARGES	11
5. COMPLIANCE MONITORING AND ENVIRONMENTAL EFFECTS MONITORING PROGRAMS	12
REFERENCES	13
APPENDIX I	15
EXTRACTS FROM REGULATIONS UNDER THE <i>CANADA OIL AND GAS OPERATIONS ACT</i> ...	15
Canada Oil and Gas Drilling Regulations	15
Canada Oil and Gas Production and Conservation Regulations	16
APPENDIX II	18
EXTRACTS FROM REGULATIONS UNDER THE CANADA-NEWFOUNDLAND ATLANTIC ACCORD IMPLEMENTATION ACT	18
Newfoundland Offshore Petroleum Drilling Regulations	18
Newfoundland Offshore Area Petroleum Production and Conservation Regulations	19
APPENDIX III	20
EXTRACTS FROM REGULATIONS UNDER THE CANADA-NOVA SCOTIA OFFSHORE PETROLEUM RESOURCES ACCORD IMPLEMENTATION ACT	20
Nova Scotia Offshore Petroleum Drilling Regulations	20
Nova Scotia Offshore Area Petroleum Production and Conservation Regulations	21

1. INTRODUCTION

The Offshore Waste Treatment Guidelines, 2002 edition, outline recommended practices and standards for the treatment and disposal of wastes from petroleum drilling and production operations in Canada's offshore areas, and for sampling and analysis of waste streams to ensure compliance with these standards. The Guidelines were prepared jointly by the National Energy Board, the Canada-Newfoundland Offshore Petroleum Board, and the Canada-Nova Scotia Offshore Petroleum Board, with the assistance of a committee comprised of government, industry and public representatives. These Guidelines are intended to be the minimum standards that will be applied by the Boards and their respective Chief Conservation Officers in making decisions related to waste treatment, disposal and monitoring.

The regulatory frameworks applicable to oil and gas activities in each of Canada's offshore areas are broadly the same. In the Newfoundland and Labrador offshore area, such activities are administered by the Canada-Newfoundland Offshore Petroleum Board under the *Canada-Newfoundland Atlantic Accord Implementation Act*, S.C. 1987, c. 3 and *The Canada-Newfoundland Atlantic Accord Implementation (Newfoundland) Act*, R.S.N 1990, c. C-2. In the Nova Scotia offshore area, oil and gas activities are administered by the Canada-Nova Scotia Offshore Petroleum Board under the *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act*, S.C. 1988, c. 2 and the *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation (Nova Scotia) Act*, S.N.S. 1987, c. 3. The National Energy Board is responsible for the regulation of oil and gas operations in the rest of Canada's offshore areas under the *Canada Oil and Gas Operations Act*, R.S.C. 1987, c. O-7.

Each of these Acts requires that a person who proposes to carry on any work or activity related to oil or gas exploration or production must first obtain an authorization from the appropriate Board. (Each Board may delegate its power to issue work authorizations, and this function is normally handled for the Boards by the Chief Conservation Officers. Other persons may, however, be delegated this function.) Such authorizations may be made subject to such requirements as the Board (or its delegate) determines, including conditions pertaining to the treatment and disposal of wastes. Each application for a drilling program authorization or production operations authorization must include compliance monitoring and waste management programs that describe how the operator intends to fulfil the expectations of these guidelines. Failure to adhere to these programs, or to conditions of an authorization, constitutes a violation of the Board's authorization and can expose the offender to enforcement measures.

In addition, regulations governing drilling and production operations have been promulgated under each Act, which contain requirements related to the protection

of the environment, including the treatment and disposal of wastes. These requirements are summarized in the Appendices. Again, where the regulations require approval by one of the Boards or its Chief Conservation Officer, these Guidelines will normally be applied.

These Guidelines supersede the following documents:

- *Offshore Waste Treatment Guidelines* (September 1996)
- *Offshore Waste Treatment Guidelines* (Canada Oil and Gas Lands Administration and Canada-Newfoundland Offshore Petroleum Board, January 1989)
- *Guidelines for the Use of Oil-Based Drilling Muds* (Canada Oil and Gas Lands Administration, November 1985)

The concentrations of specific substances in waste discharges as specified in these Guidelines are known to be achievable using proven and practicable, best available waste treatment technology. These limits are also set to encourage the assessment and development of new technologies to reduce the amount of substances discharged. Based on current knowledge and experience, waste discharged at these concentrations and in the specified manner is not expected to cause significant adverse environmental effects in areas where offshore petroleum activities are anticipated to occur in the near future.

In areas where increased risk to the environment is apparent or anticipated, modifications may be required to treatment and disposal procedures and the allowable volumes of discharges may be reduced or eliminated. This may be achieved through the use of more advanced waste treatment technologies, through the use of underground disposal, if feasible, or through the relocation of the points of discharge. More frequent sampling, analysis and reporting may also be required in these circumstances.

The results of Canadian and international research and environmental compliance and effects monitoring programs will be used to determine the adequacy of waste treatment technology and disposal procedures for the protection of the environment.

A formal review will be undertaken at least every five years to ensure that these Guidelines continue to reflect significant gains in scientific and technical knowledge. More frequent reviews may be initiated should the results of environmental effects monitoring programs or research studies indicate a higher than anticipated risk to the environment from waste discharges and disposal procedures that are in accordance with the Guidelines. Other reviews may be considered as the result of specific written requests from government departments, industry or the public.

2. REQUIREMENTS FOR SPECIFIC WASTES

2.1 Waste Minimization

Offshore operators are expected to minimize the volumes of wastes generated by their operations and to minimize the quantity of substances of potential environmental concern contained within these wastes.

Each application for a Drilling Program Authorization or Production Operations Authorization should contain a description of specific pollution prevention measures the operator plans to implement to reduce waste generation and discharge. Such measures may include considerations of process design, purchasing, reuse and recycling, and material substitution. The plan should include a provision for monitoring the progress of waste reduction plans and for reporting progress at least annually.

In addition, operators should evaluate chemical substances used in their operations to ensure that those used are the most environmentally appropriate. The *Guidelines Respecting the Selection of Chemicals Intended to be Used in Conjunction with Offshore Drilling & Production Activities on Frontier Lands* [1] contain a suggested management system to assist in this process. A chemical substance that “passes” this process is not necessarily automatically accepted for discharge. The discharge of all chemical substances is subject to these guidelines and any associated regulations.

The following sections describe minimum standards for the treatment and disposal of specific waste streams and in no way should be viewed as detracting from the expectations outlined above.

2.2 Air Emissions

Air emissions from installations currently active in Canada’s frontier lands likely do not cause significant effects on an individual basis but may contribute to cumulative effects or affect national commitments on matters such as “greenhouse gas” (GHG) emission reductions.

Each operator of a production installation should, as part of its development application, provide an estimate of the annual quantities of GHG that will be emitted from its offshore installation(s) and a description of its plans to control and reduce these emissions.

Each operator of a drilling or production installation should calculate the greenhouse gases (GHG) emitted from the installation on an annual basis and provide the results to the Chief Conservation Officer no later than

March 31 of the following year. These estimates and calculations should be made in accordance with CAPP's *Global Climate Change Voluntary Challenge Guide* [2].

Each operator of a drilling or production installation should determine the type and significance of volatile organic compound (VOC) emissions and report them in accordance with existing best management practices for oil and gas operations in Canada [3] [4].

2.3 Produced Water

Produced water includes formation water, injection water and process water that is extracted along with oil and gas during petroleum production.

Each operator of a production installation should, as part of its development application, examine and report upon the technical and economic feasibility of alternatives to conventional marine discharge of produced water (e.g., subsurface re-injection, subsea separation, downhole separation), to justify a marine discharge. Operators of existing production installations should re-examine this feasibility every five years and report thereon to the Chief Conservation Officer.

The concentration of oil in produced water that is discharged should be measured every 12 hours and a volume weighted 30-day rolling average calculated daily. Protocols for sampling and analysis are to be in accordance with *Standard Methods for the Examination of Water and Wastewater, 20th Edition* (or as amended or updated), *5520 Oil and Grease, 5520 C Partition-Infrared Method and 5520 F Hydrocarbons* [5]. Time series of both raw and averaged data should be reported to the Chief Conservation Officer monthly.

Production installations in operation prior to publication of these Guidelines should ensure that the 30-day weighted average of oil in discharged produced water does not exceed 40 mg/L and that the 24-hour arithmetic average of oil in produced water does not exceed 60 mg/L. These installations will be expected to achieve a 30-day weighted average of oil in discharged produced water of 30 mg/L no later than December 31, 2007. Production installations that commence operation following publication of these Guidelines should ensure that the 30-day weighted average of oil in discharged produced water does not exceed 30 mg/L and that the 24-hour arithmetic average of oil in produced water does not exceed 60 mg/L. An exceedance of either the 30-day or the 24-hour limit must be reported to the Chief Conservation Officer in an approved manner within 24 hours of its occurrence.

The composition of produced water should be analyzed for the following parameters and the results submitted to the Chief Conservation Officer on an approved schedule:

Twice yearly: (Refer to references [6] and [7] for test methods.)

Aluminium	Antimony	Arsenic	Barium
Boron	Cadmium	Chromium	Cobalt
Copper	Iron	Lead	Magnesium
Molybdenum	Nickel	Phosphorus	Selenium
Silver	Strontium	Thorium	Tin
Uranium	Vanadium	Zinc	Mercury
Ammonia	Nitrogen	Sulphur	

Total petroleum hydrocarbons via gas chromatography – mass spectrometry.

Annually:

Aquatic toxicity, using the sea urchin fertilization test method [8] and at least two other bioassay tests (e.g., early life stage of fish, bacteria, algal species, etc.) satisfactory to the Chief Conservation Officer. The tests should be conducted contemporaneously with one of the twice-yearly chemical characterization tests described above.

2.4 Drilling Muds

Drilling muds are fluids that are circulated in oil and gas wells to clean and condition the hole, to lubricate the drill bit and to counterbalance formation pressure. Drilling muds typically use water, oil or a synthetic fluid as the base fluid. In recent years oil based muds have for the most part been replaced by synthetic-based drilling muds (SBM). A “synthetic-based drilling mud” is defined as a drilling fluid whose continuous phase is composed of one or more fluids produced by the reaction of specific purified chemical feedstock, rather than through physical separation processes such as fractionation, distillation and minor chemical reactions such as cracking and hydro processing. SBM base fluids also must have a total polycyclic aromatic hydrocarbon concentration of less than 10 mg/kg, be relatively non-toxic in marine environments and have the potential to biodegrade under aerobic conditions.

In order to minimize the quantity of oil discharged into the marine environment, operators should use water-based or synthetic-based muds if possible. The use of oil-based mud will be approved only in exceptional circumstances where the use of water-based or synthetic-based muds is not

technically feasible. Under no circumstances will whole oil based mud be discharged to the sea. The Chief Conservation Officer may approve the use of enhanced mineral oil-based mud provided its environmental and safety-related performance is demonstrated to be equivalent to or better than SBM. An enhanced mineral oil-based mud (EMOBM) is a non-water based fluid in which the continuous phase is a highly-purified petroleum distillate that has a polycyclic aromatic hydrocarbon content less than 10 mg/kg.

Each operator should, when applying for authority to drill a well, identify a “generic mud composition” respecting each hole section and provide results of toxicity testing according to Environment Canada test method EPS 1/RM/26 [9], using multiple concentrations (see, for example, Harris (1998) [10]) for each mud type proposed.

The use of SBM or EMOBM should be limited to wells, or portions thereof, where drilling requirements are such that use of water-based fluids is technically impractical. The base fluid should be non-toxic as determined by *Laboratory Procedure for Determining the Acute Lethality of the Water Soluble fraction of Mineral oil to Rainbow Trout* [11]. SBM or EMOBM remaining from a drilling mud change-over or drilling program completion should be recovered and recycled, reinjected down-hole, or transferred to shore in a manner approved by the Chief Conservation Officer and disposed of in a manner approved by local regulatory authorities. Under no circumstances are whole SBM or EMOBM to be discharged to the sea.

Spent and excess water-based drilling muds may be discharged onsite from offshore installations without treatment. Operators should, however, develop procedures that reduce the need for the bulk disposal of these muds following either a drilling mud changeover or a drilling program completion.

2.5 Drill Solids

Drill solids are particles that are generated by drilling into subsurface geological formations and are carried to the surface with drilling muds.

Drill solids associated with the use of oil-based drilling muds may not be discharged to sea, and the manner of their disposal requires the prior approval of the Chief Conservation Officer.

Drill solids associated with the use of water-based muds may be discharged to sea.

Each operator that plans the use of synthetic-based muds or enhanced mineral oil-based muds in development drilling should, as part of its development application, examine and report upon the technical and economic feasibility of re-injecting the associated drill solids into subsurface formations at its drill site(s).

Permissible discharge concentrations for operators experiencing periods of unanticipated malfunction during reinjection of drill solids will be evaluated on a case by case basis by the Chief Conservation Officer.

Where re-injection of drill solids associated with SBM or EMOBM is not technically or economically feasible, the solids may be discharged at the drill site provided they are treated prior to discharge with best available treatment technology. At the time of publication of these Guidelines best available technology in some offshore regions internationally is believed to be capable of achieving a concentration of 6.9 g/100 g or less oil on wet solids. This discharge limit may be modified in individual circumstances where more challenging formations and drilling conditions are experienced or areas of increased environmental risk are identified. It is anticipated that performance will improve in future as further improvements in technology and operating procedures are developed.

The concentration of oil on discharged drill solids from all sources should be measured every 12 hours in accordance with *Procedure for Field Testing Oil Based Drilling Muds* [12] and a mass-weighted rolling 48-hour average calculated in units of grams oil per 100 grams wet solids. Time series of both raw and averaged data should be reported to the Chief Conservation Officer on an approved schedule. Exceedences must be reported to the Chief Conservation Officer in an approved manner within 24 hours of occurrence. More frequent sampling and analysis may be required during periods of operations not considered to be within normal operating practice.

2.6 Storage Displacement Water

Storage displacement water is water that is pumped into and out of oil storage chambers on certain types of production installations during oil production and off-loading operations.

Storage displacement water that is discharged should be treated to reduce its oil concentration to 15 mg/L or less. Oil concentrations greater than 15 mg/L must be reported to the Chief Conservation Officer in an approved manner within 24 hours of the occurrence.

The concentration of oil shall be measured every 12 hours according to the

analytical procedure referenced in Section 2.3 and reported to the Chief Conservation Officer on an approved schedule.

2.7 Bilge and Ballast Water

Bilge water is seawater that may seep or flow into the structure from various points in the offshore installation. Ballast water is water used to maintain the stability of an offshore facility.

If present, oil concentrations in discharged bilge and ballast water should be treated to levels of 15 mg/L or less before discharge. Oil concentrations in the discharge greater than 15 mg/L are considered to have exceeded normal operating practice and must be reported to the Chief Conservation Officer in an approved manner within 24 hours of the occurrence.

Bilge and ballast water should be:

- Sampled in a manner approved by the Chief Conservation Officer and analyzed in accordance with the method referred to in Section 2.3; or
- Discharged in accordance with Regulation 21 of the International Convention for the Prevention of Pollution from Ships [13], 1973, signed at London on November 2, 1973, and the Protocol of 1978 relating thereto, signed at London on February 17, 1978, and any amendments, whenever made, to Protocol I, the Annexes or the Appendices to that Convention.

2.8 Deck Drainage

Deck drainage is water that reaches the deck of offshore installations through precipitation, sea spray or from routine operations such as washdown and fire drills.

Deck drainage that has the potential to be contaminated with oil should be treated to reduce its oil concentration to 15 mg/L or less. Oil concentrations in the discharge greater than 15 mg/L are considered to have exceeded normal operating practice and must be reported to the Chief Conservation Officer in an approved manner within 24 hours of the occurrence. Deck drainage with no potential for oil contamination may be discharged directly to sea.

Deck drainage is to be sampled in accordance with a schedule approved by the Chief Conservation Officer, and analyzed in accordance with the methodology referenced in Section 2.3.

Any systems used to collect deck drainage should be separated from drip pans placed under machinery. Waste materials and fluids from drip pans should be returned to the process or recovered and recycled, or transferred to shore in a manner approved by the Chief Conservation Officer and disposed of in a manner approved by local regulatory authorities.

2.9 Produced Sand

Produced sand originates from geological formations and is separated from formation fluids during oil and gas production. It may also contain scale particles that are generated during the processing of those fluids.

Operators of offshore production installations should monitor and report to the Chief Conservation Officer the volume of produced sand which is being recovered during production operations. Approval will be required to discharge produced sand. Whether or not approval is granted will depend on the concentration of oil in the produced sand and its aromatic content. In all cases, the sand should be treated to reduce oil concentrations to the lowest level practicable.

2.10 Well Treatment Fluids

Well treatment fluids are fluids used in operations such as well workover, well stimulation, well completion and formation fracturing.

Well treatment fluids recovered from operations should be treated to an oil concentration of 30 mg/L or less. Where feasible, well treatment fluids may be directed to the produced water discharge and be treated as a component of produced water. The Chief Conservation Officer may require sampling and analysis of well treatment fluids on a separate schedule and before entry into the produced water discharge based on such factors as the duration of treatment procedures, the volumes of fluids and waste treatment equipment that is available or can be accommodated on the installation.

Time series of both raw and averaged data from any required analyses should be reported to the Chief Conservation Officer on an approved schedule.

Well treatment fluids containing diesel oil or other highly aromatic oils should not be used unless they are recovered at site and recycled, or are transferred to shore in a manner approved by the Chief Conservation Officer and disposed of in a manner approved by local regulatory authorities.

Strongly acidic fluids recovered from well treatment operations should be

treated with neutralizing agents to a pH of at least 5.0 prior to discharge

2.11 Cooling Water

In some circumstances, the Chief Conservation Officer may impose restrictions on the level of residual chlorine in the cooling water being discharged.

The use of biocide agents other than chlorine in cooling water should be approved by the Chief Conservation Officer.

2.12 Desalination Brine

Desalination brine recovered from the production of potable water may be discharged without treatment.

2.13 Sewage and Food Wastes

Sewage and food wastes should be reduced through maceration to a particle size of 6 millimetres or less prior to discharge. In some circumstances the Chief Conservation Officer may require additional treatment.

2.14 Water for Testing Fire Control Systems

Water for testing fire control systems may be discharged without treatment.

2.15 Monoethylene Glycol (MEG)

MEG is added to gas to inhibit water formation in pipelines. The discharge of MEG requires the prior approval of the Chief Conservation Officer.

Where MEG is present in discharged produced water its concentration should be measured a minimum of once per week and reported to the Chief Conservation Officer on an approved schedule. More frequent reporting may be required during the initial phases of discharge at an installation. A monthly report of discharged MEG concentrations, and an estimate of the equivalent tonnage discharged, also should be prepared and submitted to the CCO.

2.16 Naturally Occurring Radioactive Material

Naturally occurring radioactive material (NORM) is material containing radioactive elements such as uranium, thorium and potassium, and any of their decay products, such as radium and radon. These elements, which exist naturally, are present in the earth's crust and within the tissues of all

living beings at low levels, but pose no risk or hazard at these levels to human health or the environment. When substances containing NORM are processed, the NORM can be concentrated through precipitation in processing equipment, resulting in concentrations of radioactive materials that could pose a hazard to human health or the environment.

NORM occurs in oil and gas formations and is brought to the surface with the oil and gas. When the oil and gas is processed to separate the oil, gas and water, radioactive elements will precipitate in tubulars, production vessels and other areas of the processing equipment exposed to fluids from the geological formation. This results in the formation of scales and sludges containing higher concentrations of radioactive elements, which may pose a risk to human health and require special handling and disposal practices. Operators should report the occurrence or probability of occurrence of NORM to the appropriate Board as early as possible in order to initiate discussion on available disposal options. General guidance on NORM is provided in *Canadian Guidelines for the Management of Naturally Occurring Radioactive materials (NORM)*[14]

2.17 Other Substances, Wastes and Residues

All other wastes generated on offshore installations, including sludges from oil-water separation systems, spent lubricants and all plastic material, along with excess or damaged supplies of chemicals, should be reused or recycled, or alternatively recovered and transferred to shore in a manner approved by the Chief Conservation Officer and disposed of in a manner approved by local regulatory authorities. Except as described elsewhere in this document, no substances should be discharged without the prior notification and approval of the Chief Conservation Officer.

3. MIXING OF WASTE DISCHARGES

Any proposal relating to the mixing of waste streams should be prepared and presented to the Chief Conservation Officer for consideration as early as possible in the design stage of a project, and should specifically identify the points of waste discharge. Mixing of waste should not be carried out as a means of dilution in order to meet specified waste concentrations. Where there are justifiable technological, engineering or environmental reasons for mixing, these may be considered by the Chief Conservation Officer. In most cases, the sampling points for the purposes of compliance monitoring of waste concentrations cited in these Guidelines will be upstream of the mixing point.

4. LOCATION OF DISCHARGES

The locations on offshore installations for the discharge of wastes are subject to the approval of the Chief Conservation Officer and will be determined on a case-

by-case basis. As a rule, all points of discharge should be below the water or ice surface.

5. COMPLIANCE MONITORING AND ENVIRONMENTAL EFFECTS MONITORING PROGRAMS

Operators should design compliance monitoring programs which provide for the measurement and reporting of waste discharges which undergo treatment pursuant to these Guidelines. Compliance monitoring programs should also provide, where practicable, for the measurement or the calculation of absolute quantities of oil and other contaminants contained in discharges. Onshore laboratories that are used for the analysis of samples described in these Guidelines should be accredited by the Canadian Association for Environmental Analytical Laboratories (CAEAL).

Operators of production installations should design and implement environmental effects monitoring programs to detect and document any adverse environmental effects, which may result from their operations. The results of these programs will be used by regulatory authorities, in consultation with industry and other interested parties, to determine the continued adequacy of the waste treatment technologies and disposal procedures which are used by operators to achieve the waste concentrations in the discharges cited in these Guidelines.

Both compliance and environmental effects monitoring programs require the approval of the Chief Conservation Officer.

REFERENCES

1. *Guidelines Respecting the Selection of Chemicals Intended to be Used in Conjunction with Offshore Drilling & Production Activities on Frontier Lands*. Canada-Newfoundland Offshore Petroleum Board, Canada-Nova Scotia Offshore Petroleum Board and National Energy Board, January 1999.
2. *Global Climate Change Voluntary Challenge Guide: 5th Edition*. CAPP Publication number 2000-0004, Calgary, Alberta, Canada, June 2000.
3. *CH₄ and VOC Emissions from the Canadian Oil and Gas Industry*. CAPP Publication numbers 1999-0009 to 1999-0012, Calgary, Alberta, Canada, July 1999.
4. *Best Management Practices for the Control of Benzene Emissions from Glycol Dehydrators*. CAPP Publication number 2000-0035 Calgary, Alberta, Canada, December 2000.
5. *Standard Methods for the Examination of Water and Wastewater, 20th Edition (or as amended or updated)*. American Public Health Association, American Water Works Association, Water Environment Federation, 1998.
6. *Determination of Trace Elements in Marine Waters by On-line Chelation Preconcentration and Inductively Coupled Plasma - Mass Spectrometry*. EPA method 200.10
7. *Mercury Cold Vapor Extraction*. EPA Method 245.1
8. *Biological Test Method: Fertilization Assay using Echinoids (Sea Urchins and Sand Dollars)*. Environmental Protection Directorate Report No. EPS 1/RM/27, Environment Canada, 1993
9. *Biological Test Method: Acute Test for Sediment Toxicity Using Marine or Estuarine Amphipods*, Environmental Protection Directorate Report No. EPS 1/RM/26, Environment Canada, December 1992.
10. Harris, G., 1998. *Toxicity results of five drilling muds and three base oils using benthic amphipod survival, infaunal bivalve survival, echinoid fertilization and Microtox*. Harris Industrial Testing Service Ltd., Mt. Uniacke, Nova Scotia, Canada. BON 1Z0. Unpublished report for Sable Offshore Energy Inc. July, 1998. 11 pages.
11. *Laboratory Procedure for Determining the Acute Lethality of the Water Soluble Fraction of Mineral oil to Rainbow Trout*, Environmental Protection Service, Atlantic Region, Environment Canada, June 1985.
12. *Procedure for Field Testing Oil Based Drilling Muds*, API Recommended Practice RP 13B-2, Appendix B, American Petroleum Institute, 1991 (or as amended or updated)
13. MARPOL, *The International Convention for the Prevention of Pollution from Ships*, 1973, signed at London on November 2, 1973, and the Protocol of 1978 relating thereto,

signed at London on February 17, 1978, and any amendments, whenever made, to Protocol I, the Annexes or the Appendices to that Convention.

14. *Canadian Guidelines for the Management of Naturally Occurring Radioactive Materials (NORM)*, Cat. H46-1/30-2000E, Health Canada, October 2000

APPENDIX I

EXTRACTS FROM REGULATIONS UNDER THE CANADA OIL AND GAS OPERATIONS ACT

Canada Oil and Gas Drilling Regulations

22. (1) Every drilling unit shall
- (a) be equipped with drip trays, curbs and gutters and such other facilities as are necessary to prevent pollution of the water by fuel or chemicals that have been spilled or leaked aboard the drilling unit; and
 - (b) be equipped with a means for burning, venting, storing, transporting or otherwise disposing of waste in accordance with sections 137 to 139.
- (2) The operator of every drilling unit shall ensure that the drilling unit is equipped with a system capable of collecting any waste oil from the oil sumps on the unit.
137. Every operator shall ensure that all waste material, drilling fluid and drill cuttings generated at a drill site are handled and disposed of in a manner that
- (a) does not create a hazard to safety, health or to the environment; and
 - (b) is approved by the Chief.
138. Every operator shall ensure that. . .
- (c) in respect of a well that is offshore
 - (i) any waste fuel, oil or lubricant is collected in a closed system that is designed for the purpose, and
 - (ii) any stored waste oil or oily material, not burned at the drill site, is transported to shore in a suitable container and properly disposed of at the shore.
139. Every operator shall ensure that
- (a) all sewage, galley and other domestic waste that might contribute to pollution is disposed of in a manner approved by the Chief;
 - (b) combustible trash is not burned at a drill site except where precautions are taken to ensure that the fire does not endanger personnel or the safety of the well;

- (c) any spent acid or excess acid is disposed of in a manner approved by the Chief; and
- (d) in respect of a well that is offshore, all non-combustible trash, including glass, wire, scrap metal and plastics, is transported to a port and properly disposed of at that port.

Canada Oil and Gas Production and Conservation Regulations

8.(3) For purposes of paragraph 5.1(3)(b) of the Act, Part II of a development plan shall contain: . . .

- (f) plans for the treatment and disposal of waste material;

9.(2) A production operations authorization is subject to the requirement that the Chief approve, pursuant to subsection 60(4) . . .

- (b) an environmental protection plan;

18.(1) The operator of a development well shall, in addition to complying with section 220 of the *Canada Oil and Gas Drilling Regulations*, complete and operate the well in a manner that is consistent with good engineering practices and that provides for . . .

- (c) the protection of the environment;

58.(1) No operator shall operate a system for the disposal of produced water at sea unless the system is designed and maintained to ensure that the average oil content of the water does not exceed any monthly average or maximum daily volume that is specified in a requirement of the production operations authorization that authorizes the operation in which the water is produced

(2) No operator shall discharge process water unless the water discharged is, in quality, equal to or better than water that meets any contamination limits specified in a requirement of the production operations authorization that authorizes the operation in which the water is produced.

(3) The operator of a production installation shall institute appropriate sampling and analysis procedures to ensure that the quality of produced water and process water meets any quality specified in a requirement of the production operations authorization that authorizes the operation in which the water is produced.

60.(1) Every operator shall submit to the Chief, in a form and manner satisfactory to the Chief, . . .

- (b) an environmental protection plan that relates to the protection of the natural environment from the oil or gas, pollutants or waste material discharged, emitted or disposed of during the production operation; . . .
- (4) The Chief shall approve a plan submitted pursuant to subsection (1), where the Chief is satisfied that adherence to the plan will . .
 - (b) in the case of an environmental protection plan, provide adequately for the protection of the environment;

APPENDIX II

EXTRACTS FROM REGULATIONS UNDER THE CANADA-NEWFOUNDLAND ATLANTIC ACCORD IMPLEMENTATION ACT

Newfoundland Offshore Petroleum Drilling Regulations

16.(1) Every drilling installation shall:

- (a) be equipped with drip trays, curbs and gutters and such other facilities as are necessary to prevent pollution of the water by fuel or chemicals that have been spilled or leaked aboard the drilling installation; and
- (b) be equipped with a means for burning, venting, storing, transporting or otherwise disposing of waste in accordance with sections 112 to 114.

112. Every operator [*of a drilling installation*] shall ensure that all waste material, drilling fluid and drill cuttings generated at a drill site are handled and disposed of in a manner that:

- (a) does not create a hazard to safety, health or to the natural environment; and
- (b) is approved by the Board or any person designated by the Board.

113. Every operator shall ensure that:

- (c) any waste fuel, oil or lubricant is collected in a closed system that is designed for the purpose; and
- (d) any stored waste oil or oily material that is not burned at the drill site is transported to shore in a suitable container and properly disposed of onshore.

114. Every operator shall ensure that:

- (a) all sewage, galley, and other domestic waste material that might contribute to pollution is disposed of in a manner approved by the Board or any person designated by the Board;
- (b) combustible trash is not burned at a drill site except where precautions are taken to ensure that the fire does not endanger personnel or the safety of the well;

- (c) any spent acid or excess acid is disposed of in a manner approved by the Board or any person designated by the Board; and
- (d) all non-combustible trash, including glass, wire, scrap metal and plastics, is transported to a port and properly disposed of at that port.

Newfoundland Offshore Area Petroleum Production and Conservation Regulations

- 8.(1) A production operations authorization is subject to the following requirements, namely, that
 - (d) an environmental protection plan exists.

- 16.(1) In order to ensure the safe operation of a development well, the operator shall operate the well in a manner that is consistent with these Regulations and that provides for
 - (c) the protection of the environment

- 49.(1) An operator [*of a production installation*] shall ensure that all waste material produced and stored at a production site is treated, handled and disposed of in accordance with the environmental protection plan.

- 51.(2) An operator shall develop and submit to the Chief Conservation Officer an environmental protection plan that provides for the protection of the natural environment and includes
 - (c) a description of equipment and procedures for treatment, handling and disposal of waste material;
 - (d) compliance monitoring programs to ensure that the composition of spilled waste material is in accordance with the limits specified in the environmental protection plan;
 - (5) The Chief Conservation Officer shall approve the environmental protection plan submitted pursuant to subsection (2), including any amendments thereto, where adherence to the plan will provide for the protection of the natural environment.

APPENDIX III

EXTRACTS FROM REGULATIONS UNDER THE CANADA-NOVA SCOTIA OFFSHORE PETROLEUM RESOURCES ACCORD IMPLEMENTATION ACT

Nova Scotia Offshore Petroleum Drilling Regulations

16.(1) Every drilling installation shall:

- (a) be equipped with drip trays, curbs and gutters and such other facilities as are necessary to prevent pollution of the water by fuel or chemicals that have been spilled or leaked aboard the drilling installation; and
- (b) be equipped with a means for burning, venting, storing, transporting or otherwise disposing of waste in accordance with sections 112 to 114.

112. Every operator [*of a drilling installation*] shall ensure that all waste material, drilling fluid and drill cuttings generated at a drill site are handled in a manner that

- (a) does not create a hazard to safety, health or to the environment; and
- (b) is approved by the Board or any person designated by the Board.

113. Every operator shall ensure that:

- (c) any waste fuel, oil or lubricant is collected in a closed system that is designed for the purpose; and
- (d) any stored waste oil or oily material that is not burned at the drill site is transported to shore in a suitable container and properly disposed of onshore.

114. Every operator shall ensure that:

- (a) all sewage, galley, and other domestic waste material that might contribute to pollution is disposed of in a manner approved by the Board or any person designated by the Board;
- (b) combustible trash is not burned at a drill site except where precautions are taken to ensure that the fire does not endanger personnel or the safety of the well;
- (c) any spent acid or excess acid is disposed of in a manner approved by the Board or any person designated by the Board; and

- (d) all non-combustible trash, including glass, wire, scrap metal and plastics, is transported to a port and properly disposed of at that port.

Nova Scotia Offshore Area Petroleum Production and Conservation Regulations

8.(2) A production operations authorization is subject to the following requirements, namely, that

- (d) an environmental protection plan exists.

16.(1) In order to ensure the safe operation of a development well, the operator shall operate the well in a manner that is consistent with these Regulations and that provides for

- (c) the protection of the environment

49.(1) An operator [of a production installation] shall ensure that all waste material produced and stored at a production site is treated, handled and disposed of in accordance with the environmental protection plan.

51.(2) An operator shall develop and submit to the Chief Conservation Officer an environmental protection plan that provides for the protection of the natural environment and includes

- (c) a description of equipment and procedures for treatment, handling and disposal of waste material;
- (d) compliance monitoring programs to ensure that the composition of spilled waste material is in accordance with the limits specified in the environmental protection plan;

(5) The Chief Conservation Officer shall approve the environmental protection plan submitted pursuant to subsection (2), including any amendments thereto, where adherence to the plan will provide for the protection of the natural environment.