Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment

MARINE SEISMIC SURVEYS IN CANADA are conducted in the Atlantic, Pacific and Arctic oceans in waters with very diverse biological, oceanographic and geomorphic characteristics. In response to public concerns over the potential impacts of seismic surveys on marine life, federal and provincial authorities responsible for the review and assessments of proposed surveys agreed to develop a national code of conduct.

DEVELOPMENT PROCESS

1. National and international peers reviewed scientific evidence of potential physical, physiological and behavioural impacts associated with seismic survey, considering the direct, indirect, chronic or cumulative nature of those impacts.

2. Technical experts reviewed and identified best mitigation practices used world wide

3. Public review of the draft Statement was completed.

OUTCOME

Conclusions were drawn using a risk-based approach that considered the likelihood of occurrence, the frequency and duration of the mitigated impact, the recovery potential and the ecological significance or severity of the impact.

THE STATEMENT DOES NOT APPLY TO ICE COVERED WATERS, TO NON-ESTUARINE PORTIONS OF RIVERS OR TO LAKES.

During the Planning Phase the Statement sets out mitigation requirements that must be met:

EXERCISING PRECAUTION, operators must minimize the unnecessary introduction of sound and design survey which:

- use the minimum energy needed
- reduce horizontal spread
- reduce the generation of unnecessary high frequency sounds.

THE PEER REVIEW PROCESS CONCLUDED THAT AT CERTAIN RECEIVED SOUND LEVELS, BEHAVIOURAL CHANGES COULD BE MANIFESTED BY SOME MARINE FISH, MARINE MAMMALS AND SEA TURTLES. THE REVIEW ALSO RECOGNIZED THAT ADDITIONAL PRECAUTION WAS CALLED FOR TO ADDRESS THE NEEDS OF MARINE SPECIES LISTED AS ENDANGERED OR THREATENED AND THAT INDIVIDUAL LEVEL IMPACTS SHOULD THEREFORE BE MITIGATED.

Surveys must therefore be designed to avoid causing:

- a significant adverse effect for an individual marine mammal or sea turtle listed as endangered or threatened in the Canadian legislation to protect species at risk;
- a significant adverse population-level effect for any other marine species;

REDUCING THE IMPACT ON POPULATION

To reduce the potential impacts of the survey and to reflect the peer review conclusion that population-level impacts could result if surveys were conducted in areas and at times when large groups of marine mammals and fish were engaged in critical biological activity, surveys must be planned to avoid:

- displacing an individual endangered or threatened marine mammal or sea turtle breeding, feeding or nursing;
- diverting an individual endangered or threatened marine mammal or sea turtle from a known migration corridor;

Surveys must also be planned to avoid:

- dispersing large groups (aggregations) of spawning fish from know spawning areas
- displacing a group of breeding, feeding or nursing marine mammals, if it is known that there are no alternate areas available or if use of those areas will result in significant adverse effects.
- diverting large groups of fish or marine mammals from known migration routes if it is known that there are no alternate routes or that using those routes will result in significant adverse effects.

REGIONAL FLEXIBILITY

The diverse biological, oceanographic, geomorphic characteristics of the Atlantic, Pacific and Arctic oceans require that regional flexibility be built into the code of conduct for seismic operations. Environmental processes and the associated regulatory reviews may require additional or modified mitigation as required to address regional specificities, chronic or cumulative effects, variations in sound propagation levels, or other region or project specific conditions.

During field operations a number of mitigative measures are required during the conduct of the seismic survey.

THESE INCLUDE THE establishment and monitoring of a *Safety Zone*, which must at a minimum be 500m as measured from the center of the air source array.

SAFETY ZONE

The Statement recognizes that in certain circumstances, an environmental assessment process may identify the need for a safety zone greater than 500m. It further specifies that for 30 minutes prior to start up, the area must be clear of whale, dolphin, porpoise or sea turtles and that a regular watch maintained during the conduct of the survey.

Recognizing that many marine species appear to avoid seismic vessels when the air sources are active, seismic operators are required to start up the air source arrays with a pulse from the lowest energy source. The remainder of the sound sources on the array must be gradually activated over a fixed period of time.

SHUT DOWN

Survey activities must be suspended if an endangered or threatened marine mammal or sea turtle or if a marine mammal or sea turtle identified by an environmental assessment process as possibly subject to population-level impacts enters the safety zone. Air sources can be gradually ramped up when the animals have left the area.

LINE CHANGES AND MAINTENANCE

To futher reduce the amount of unnecessary sound entering the marine environment, operators are required to either shut down the energy source completely or shut down all but one source when active surveying ceases for example during line changes or for maintenance reasons.

LOW VISIBILITY

Reduced visibility due to shorten light periods, fog, storm conditions may limit the ability of the marine mammal observer to watch the full extent of the Safety zone. In situations of low visibility, the Statement calls for the use of alternate monitoring measures to detect the presence of cetaceans if the survey is in an area identified as critical habitat for an endangered or threatened vocalizing cetacean, or if the survey areas has been identified as an area where a species for which significant environmental impacts have been identified by an environmental process.

It is recognized that the field of cetacean detection technology is a rapidly evolving one and that there are limitations to the current technology particularly with respect to the location and identification of the vocal signature of the cetacean. Required use of cetacean detection technology is limited to areas where operators can expect the presence of endangered or threatened cetaceans or species for which special concerns have been identified through an environmental process. Precaution is called for and operators are directed to treat all non-identified cetacean vocalizations as those of endangered, threatened or species for which concern has been identified by the environmental process and to shut down until the area until no vocalizations have been detected for a fixed period of time.

THE STATEMENT OF PRACTICE IS REVIEWED ANNUALLY BY THE GOVERNMENTS. THE REVIEW ALLOWS FOR REVISIONS TO THE REQUIREMENTS BASED UPON NEW TECHNOLOGIES, SCIENCE FINDINGS, INNOVATIVE INDUSTRY PRACTICES AND DISCUSSION WITH OTHER GOVERNMENT REGULATORS.

Statement of Canadian Practice on the Mitigation of Seismic Noise in the Marine Environment

Released for discussion purposes February 19th, 2005

Seismic surveys in the marine environment are conducted by earth scientists and geophysicists to understand the structure and movement of the earth's crust and to detect and delineate potential commercial quantities of sub-sea oil and gas resources.

The potential for environmental impacts from seismic surveys on key components of the marine ecosystems has been recognized for some time.
In order to understand the state of scientific knowledge, DFO sponsored a peer review by Canadian and international science experts. Their objective was to develop scientific conclusions and advice on the potential impacts of seismic noise on marine fish, marine invertebrates, marine zooplankton, eggs and larvae of fish and invertebrates, marine turtles and marine mammals. A copy of the peer-reviewed report, entitled "Review of Scientific Information on Impacts of Seismic Sound on Fish, Invertebrates, Marine Turtles and Marine Mammals" (Habitat Status Report 2004/002) is available at http://www.dfo-mpo.gc.ca/csas/Csas/status/2004/HSR2004_002_E.pdf.

Based on this peer-reviewed advice and an assessment by technical experts of the best available and internationally-recognized techniques to mitigate the effects of seismic noise in the marine environment, a group of federal and provincial experts in marine regulatory policy and practice developed a Statement of Canadian Practice. The Statement of Canadian Practice is intended to formalize and standardize the mitigation measures in Canada with respect to the conduct of seismic surveys in the marine environment. It will consist of minimum standards which will be given effect through existing regulatory authorities. For oil and gas seismic activities, Natural Resources Canada and Indian Affairs and Northern development, the provinces of Nova Scotia, Newfoundland and British Columbia, and their related boards, the National Energy Board, the Canada-Newfoundland Offshore Petroleum Board and the Canada-Nova Scotia Offshore Petroleum Board, will give effect to the Statement under their respective regulatory instruments. Non-oil and gas related seismic surveys will be regulated by the *Oceans Act.*

The Statement of Practice is being released by the Government of Canada and the Provinces of British Columbia, Newfoundland and Labrador, and Nova Scotia for public comment for a period of sixty days (April 19th, 2005). A copy of the Statement can be obtained electronically at _____
http://www.dfo-mpo.gc.ca/oceans-habitat/oceans/im-gi/seismic-sismique/statement-enonce_e.asp

Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment

Background Paper

2007

Summary

Recent years have seen a heightened interest in the potential impacts of seismic surveying on the marine environment. In 2004, federal and provincial government advisors, and national and international scientific experts met to review the body of scientific knowledge that exists in this area. A review of the most effective and appropriate mitigative measures used world-wide was also conducted. These reviews led to the identification of a set of mitigation measures, which can assist in minimizing the potential adverse impacts of marine seismic activity. Federal and provincial governments have compiled these mitigation measures into the *Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment*. The *Statement* sets out minimum standards which will apply in Canada's non-ice covered marine waters to all seismic activities that use air source arrays. It will complement the existing environmental assessment processes, including those pursuant to settled land claims, and the existing regulatory requirements that currently govern marine seismic activities. Recognizing that the body of scientific knowledge is continually expanding, the *Statement* will be regularly reviewed. As new scientific information and improved mitigation technologies and practices emerge, these will be considered for incorporation into the *Statement*.

SOUND IN THE OCEANS is generated by a variety of natural sources, including vocalisation by marine life as well as wind and wave action, ice movements, and meteorological and oceanographic conditions.

Human activity also contributes to sound in the marine environment. Activities such as navigation, dredging, pile driving, ice breaking, whale watching and operating fishing gear each produce sound patterns with distinct characteristics. Resource exploration and production activities, including offshore drilling and marine seismic surveying, produce different types of sound. Active sonar which is used by security and defence operations produces a distinct type of sound.

There are fundamental differences between the type and intensity of sound generated by seismic air source arrays and sound associated with active sonar. These differences are mainly due to the emission of sounds of different intensity, frequency and direction of transmission.

Oceanographic characteristics such as the physiography of the sea bottom, the water depth, temperature, salinity and density differences can influence the transmission of sound as it travels through water. For example, sound levels are quickly reduced in shallow waters. In deeper waters, sound is likely to propagate further, especially where acoustic channels exist to conduct and focus sound energy.

In recent years, considerable international effort has been dedicated to a better understanding of the generation and transmission of sound in the marine environment and of the potential impacts of marine sound on life in the oceans. One area that has been of

particular interest to the Canadian public is the sound associated with conducting marine seismic surveys.

SEISMIC SURVEYS use sound waves to gather information about geological structures lying beneath the surface of the earth, both on land and in the marine environment. A common purpose for conducting seismic surveys is to locate rock formations that could potentially contain hydrocarbons. Seismic surveys are also conducted by government and academic researchers for general scientific purposes, to understand the composition, structure and movement of the earth's crust.

During marine seismic surveys, compressed air is released into the water column, creating a sound energy pulse. The pulse is "focused" to concentrate the sound energy toward the ocean bottom rather than horizontally. These surveys are carried out from a ship that tows a sound source or sources, referred to as "air source arrays", and one or more cables ("streamers") that contain sound receivers and other instruments.

The sea floor and the structures beneath it are mapped by measuring the time it takes for a sound energy pulse to leave the source, penetrate the earth, reflect off a subsurface layer, and return to a sound receiver. Reflections occur at each layer where there is a measurable change in the speed at which sound is transmitted. The data retrieved from these surveys provides information on depth, position and shape of underground geological formations.

Most seismic surveys conducted in Canadian marine waters fall into the category of two-dimensional (2D) surveys or three-dimensional (3D) surveys. The objective of a 2D survey is to provide a broad picture of the geological characteristics of an area, including type and size of structures present. In conducting a 2D survey, a seismic vessel typically tows a single air source array and a single set of receivers along a set of parallel and transverse lines, spaced up to five kilometres apart, to create a grid pattern. A 3D seismic survey is conducted over a smaller area, to obtain more detailed geological information and to identify potential targets for hydrocarbon drilling. 3D surveys also create a grid pattern, but generally use two or more air source arrays and multiple sets of receivers trailed closer together.

THE POTENTIAL IMPACTS OF SEISMIC SOUND ON MARINE LIFE have been studied internationally for decades. Biological impacts on marine life from seismic surveys are generally discussed in terms of:

- physical impacts, or changes in organisms' physical state;
- physiological impacts, or changes in biological functions; and
- behavioural impacts, or changes in how organisms act.

In 2004, governments and academic researchers set out to take stock of our scientific knowledge in these areas. The process, which was led by Fisheries and Oceans Canada, culminated in a scientific peer review process involving national and international scientific experts. It considered the most current evidence of physical and physiological impacts of seismic sound on marine life, as well as potential behavioural impacts, and

whether those impacts were direct, indirect, chronic or cumulative. The peer review process drew a number of conclusions using a risk-based approach that considered the likelihood of occurrence, the frequency and duration of the impact and the ecological significance or severity of the impact.[1]

In general, studies have found that for key components of the ecosystem, including invertebrates, fish, marine mammals and sea turtles, biological impacts vary from species to species and according to the proximity to the sound source arrays. Impacts are greatest within a few metres of the seismic source arrays.

Some marine mammals rely heavily on the use of underwater sounds to communicate and to echo-locate and emit and can sense different sound frequencies. There is evidence that these species hear and react to many man-made sounds including those associated with seismic surveys. The available data suggests that for a seismic sound to result in auditory impairment or other direct physical impacts for marine mammals, animals must be located within a short distance from the sound source. Most marine mammals, including most baleen whales, some odontocetes (toothed whales) and some pinnipeds (seals), generally avoid the immediate vicinity of active seismic vessels. However, some marine mammals, such as dolphins and porpoises, have been observed to swim near sources of seismic sound, with no apparent impacts.

The findings of the peer review process concluded that there was evidence that at certain received sound levels, behavioural changes can be manifested by some marine fish, marine mammals and sea turtles. If seismic surveys were to occur in areas and at times when a large enough aggregation of these marine organisms were engaged in critical biological functions the behavioural impacts might have important ecological and population-level impacts. For example the impact may be important if it results in the displacement of breeding, feeding or nursing marine mammals, dispersion of spawning aggregations of fish in their spawning areas and diversion of aggregations of marine mammals and fish from their migration routes.

While there has recently been an increased interest in sea turtles because of the endangered or threatened status of some species, relatively little is known about the sensitivity of these species to sound. Studies do indicate that sea turtles are able to detect sound frequencies similar to those generated during seismic surveys. As a measure of precaution, given the limited knowledge on the sensitivity of sea turtles to sound and given the endangered status of a number of sea turtles, it was concluded that sea turtles should have the benefit of the same mitigative measures as marine mammals.

Building on existing scientific information, the peer review process concluded that mitigation should be used where detrimental population-scale impacts were considered likely to occur, or where adverse impacts including death, harm or harassment of

[1] The report of the peer review, *Review of Scientific Information on Impacts of Seismic Sound on Fish, Invertebrates, Marine Turtles and Marine Mammals" (Habitat Status Report 2004/002)*, is available online at: http://www.dfo-mpo.gc.ca/csas/Csas/status/2004/HSR2004_002_E.pdf

individual marine mammals or turtles listed as endangered or threatened on Schedule 1 of the *Species at Risk Act* were likely to occur.

The peer review process identified a number of recognized measures for mitigating the potential impacts of seismic sound, consistent with a precautionary approach. A federal-provincial regulatory policy review further identified the most effective measures which would be appropriate for use in Canadian marine waters. Federal and provincial governments have agreed to incorporate these measures into the *Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment*.

The *Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment* specifies the mitigation requirements that must be met during the planning and conduct of marine seismic surveys, in order to minimize impacts on life in the oceans. These requirements are set out as minimum standards, which will apply in all non-ice covered marine waters in Canada. The *Statement* complements existing environmental assessment processes, including those set out in settled land claims. The current regulatory system will continue to address protection of the health and safety of offshore workers and ensure that seismic activities are respectful of interactions with other ocean users.

The *Statement* was developed by federal and provincial authorities responsible for the regulation and management of seismic surveys, including representatives from the provincial governments of Nova Scotia, Newfoundland and Labrador, British Columbia and Quebec. Federally, representation included Natural Resources Canada, Indian and Northern Affairs Canada, and Fisheries and Oceans Canada. The *Statement* was developed following a peer review process involving scientific and technical experts, acousticians, and experts in the design and effectiveness of mitigative measures. Public policy experts as well as experts from the National Energy Board, the Canada-Nova Scotia and the Canada-Newfoundland and Labrador Offshore Petroleum Boards were also consulted. Public input on the *Statement* was received during a 60-day web-based public consultation, and targeted discussions were held with representatives from the fishing and oil and gas sectors, academics and other interested parties.

The *Statement* will apply to all seismic activities in the marine environment that use air source arrays; as such it will not apply to activities conducted in ice covered waters. For seismic surveys conducted for the purpose of oil and gas exploration, the *Statement* will be administered by the existing oil and gas regulatory bodies – the National Energy Board, the Canada-Nova Scotia Offshore Petroleum Board, and the Canada-Newfoundland and Labrador Offshore Petroleum Board. For seismic surveys conducted for any other purposes, the *Statement* will be administered by Fisheries and Oceans Canada.

The *Statement* was drafted using the best available scientific information, current international best management practices and internationally recognized techniques to mitigate the impacts of seismic sound in the marine environment. However, it is recognized that the body of scientific knowledge is continually expanding. As new

scientific information and improved mitigation technologies and practices emerge, these will be considered for incorporation into the *Statement*. The *Statement* will be reviewed on an annual basis, and interested parties will be consulted on any potential amendments.

The *Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment* sets out mitigation requirements for:

- Planning of seismic surveys;
- Establishment and monitoring of a safety zone;
- Prescribed marine mammal observation and detection measures.
- Prescribed start-up; and
- Prescribed shut-down.

The following sections briefly describe each of these areas, and the requirements contained in the *Statement*:

Planning of seismic surveys

The *Statement* requires that operators plan and design seismic survey programs according to certain conditions. As a precautionary measure and to minimize the unnecessary introduction of sound into the marine environment, surveys are to be designed to use the minimum energy needed to obtain the information sought, to reduce or baffle the horizontal spread of sound and reduce the generation of unnecessary high frequency sounds.

In order to further reduce the potential impacts of a seismic survey, there is an additional requirement to design programs which avoid areas where it is known that there are aggregations of marine mammals and marine fish at critical times in their life cycle and during critical biological functions such as spawning, breeding, feeding, nursing and migration times.

Establishment and monitoring of a safety zone

Recognizing that sound is most intense closest to the air source and that the potential impacts of seismic are greatest within short distances, the *Statement* requires that a "safety zone" be established and monitored around seismic air source arrays. As noted above, the propagation of sound and of specific frequencies varies according to many factors, including ocean depths, temperatures and salinity. This poses a challenge in establishing precise distance at which specific sound levels can be expected. Similarly, marine species respond differently to various frequencies of sound, depending on their biological characteristics, life history and their respective hearing thresholds. The use and testing of sound propagation models combined with active science research programs are increasing our understanding of potential impacts and relationships between sound levels/distance and those impacts.

The *Statement* contains a basic requirement for a minimum 500m safety zone, established around the air source array(s). Existing scientific evidence and the application of a

precautionary approach revealed that beyond a 500m safety zone, sound energy from seismic activity is unlikely to cause adverse impacts on marine mammals and sea turtles, under many circumstances. However, the *Statement* recognizes that in other circumstances, environmental assessment processes may identify the need for a safety zone of greater than 500m.

As is discussed below, the *Statement* requires seismic vessels to use a qualified marine mammal observer to watch the safety zone. If a whale, dolphin, porpoise or sea turtle is seen by a marine mammal observer to be within the safety zone, the air source array must not be started up until the area is clear. Similarly if a marine mammal listed as endangered or threatened in Schedule 1 of the *Species at Risk Act* is in the area of the safety zone, no activity can begin.

Prescribed start-up

Most marine species will likely avoid a seismic vessel while survey activities are underway. Seismic operators are required to take advantage of this behaviour by using a start up technique whereby activation of the air source arrays begins with a pulse from the lowest energy source on the array. The remainder of the sound sources on the array are gradually activated over a fixed period of time. This procedure provides the time and the incentive for marine mammals and fish to leave the immediate area.

In certain circumstances, such as well site surveys and vertical seismic profiling, only one energy source is used. In this circumstance, where technically feasible, the start-up procedure should consist of a gradual increase of the intensity of the sound until it reaches the required intensity.

Prescribed shut-down

Once seismic survey activity is ongoing, if a marine mammal or a turtle listed as endangered or threatened on Schedule 1 of the *Species at Risk Act* enters the safety zone the operator must shut down and wait for them to leave. The Statement also requires shut down of the array if other marine mammals or sea turtles enter the safety zone. These species could be those identified by an environmental review process as possibly experiencing significantly-adverse population-level impacts if exposed to seismic sound.

Prescribed procedures when active surveying ceases

As a precautionary measure and to reduce the amount of unnecessary sound released into the marine environment, when active surveying ceases, operators are required to either shut down the energy source completely or shut down all but one source. Continued release of sound from a single source would serve to deter whale, dolphin, porpoises or turtles from entering the safety zone.

Prescribed marine mammal observation and detection measures

Marine mammal observer: The *Statement* requires the stationing of a qualified marine mammal observer on board seismic vessels. The marine mammal observer is required to verify that the safety zone is clear for at least 30 minutes before the seismic air source array (s) can be activated. A marine mammal observer is required to maintain a regular watch during the entire duration of the time that the air source arrays are active and that the safety zone is visible.

Use of Cetacean detection technology: Reduced visibility and storm conditions may require the use of different mitigative measures, such as Passive Acoustic Monitoring, to detect and track the sounds made by vocalizing marine mammals prior to start-up.
Passive Acoustic Monitoring uses "listening" technology to detect animals that are below the sea surface, while having no adverse environmental impacts of its own. Passive Acoustic Monitoring's usefulness presently is limited to those species that are known to vocalize and to spend much time below the water surface (e.g., dolphins, sperm whales, northern bottlenose whales). Additional approaches to marine mammal detection (including radar, infrared detection and adaptation of fishing industry "fish finder" technologies) are currently in the research and planning stages, and will likely be available in upcoming years.

The *Statement* requires the use of cetacean detection technology under certain circumstances and conditions. If all of the following conditions exist, then PAM, or equivalent technology, must be used:

- the survey's sound sources array has been shut down for more than 30 minutes;
- the full extent of the safety zone is not visible;
- the survey is in an area where vocalizing cetaceans such as dolphins, porpoises and whales listed as endangered or threatened in Schedule 1 of the Species at Risk Act are likely to be encountered, or if the survey is conducted in an area where species identified in an environmental assessment process as likely to be negatively impacted at a population level by seismic sound are likely to be found.

Under these conditions, if the presence of a vocalizing whale, porpoise or dolphin is detected and it cannot be identified, the operator must assume that it is a whale listed as endangered or threatened in Schedule 1 of the *Species at Risk Act*, or one identified by an environmental assessment process, and the operation must shut down and remain shut down until the operator is able to determine that the whale, dolphin or porpoise is outside the safety zone, or has not been heard for at least 30 minutes.

Additional or modified mitigative measures

In some cases, environmental assessment processes will point to regional specificities, including oceanographic, geomorphologic and biological characteristics, and regulatory reviews may require modified or additional mitigative measures to be applied. Also, variations to the mitigative measures set out in the Statement may be allowed if persons

wishing to conduct seismic surveys provide an equivalent or greater level of environmental protection.

Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment

Context

The Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment specifies the mitigation requirements that must be met during the planning and conduct of marine seismic surveys, in order to minimize impacts on life in the oceans. These requirements are set out as minimum standards, which will apply in all non-ice covered marine waters in Canada. The *Statement* complements existing environmental assessment processes, including those set out in settled land claims. The current regulatory system will continue to address protection of the health and safety of offshore workers and ensure that seismic activities are respectful of interactions with other ocean users.

Definitions

Cetacean: means a whale, dolphin or porpoise.

Critical habitat: means the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species.

Marine Mammal Observer: means an individual trained to identity different species of marine mammals and turtles that may reasonably be expected to be present in the area where the seismic survey will take place.

Marine mammals: means all cetaceans and pinnipeds.

Passive Acoustic Monitoring: means a technology that may be used to detect the subsea presence of vocalizing cetaceans.

Pinniped: means a seal, sea lion or walrus.

Ramp-up: means the gradual increase in emitted sound levels from a seismic air source array by systematically turning on the full complement of an array’s air sources over a period of time.

Seismic air source: means an air source that is used to generate acoustic waves in a seismic survey.

Seismic air source array(s): means one or a series of devices designed to release compressed air into the water column in order to create an acoustical energy pulse to penetrate the seafloor.

Seismic survey: means a geophysical operation that uses a seismic air source to generate acoustic waves that propagate through the earth, are reflected from or refracted along subsurface layers of the earth, and are subsequently recorded.

“Statement:” means the Statement of Canadian Practice for the Mitigation of Seismic Sound in the Marine Environment.

Whale: means a cetacean that is not a dolphin or porpoise.

Application

1. Unless otherwise provided, the mitigation measures set out in this Statement apply to all seismic surveys planned to be conducted in Canadian marine waters and which propose to use an air source array(s).

2. The mitigation measures set out in this Statement do not apply to seismic surveys conducted:
   a. on ice-covered marine waters; or
   b. in lakes or the non-estuarine portions of rivers.

Planning Seismic Surveys

Mitigation Measures

3. Each seismic survey must be planned to
   a. use the minimum amount of energy necessary to achieve operational objectives;
   b. minimize the proportion of the energy that propagates horizontally; and
   c. minimize the amount of energy at frequencies above those necessary for the purpose of the survey.
4. All seismic surveys must be planned to avoid:
   a. a significant adverse effect for an individual marine mammal or sea turtle of a species listed as endangered or threatened on Schedule 1 of the *Species at Risk Act*; and
   b. a significant adverse population-level effect for any other marine species.

5 Each seismic survey must be planned to avoid:
   a. displacing an individual marine mammal or sea turtle of a species listed as endangered or threatened on Schedule 1 of the *Species at Risk Act* from breeding, feeding or nursing;
   b. diverting an individual migrating marine mammal or sea turtle of a species listed as endangered or threatened on Schedule 1 of the *Species at Risk Act* from a known migration route or corridor;
   c. dispersing aggregations of spawning fish from a known spawning area;
   d. displacing a group of breeding, feeding or nursing marine mammals, if it is known there are no alternate areas available to those marine mammals for those activities, or that if by using those alternate areas, those marine mammals would incur significant adverse effects; and
   e. diverting aggregations of fish or groups of marine mammals from known migration routes or corridors if it is known there are no alternate migration routes or corridors, or that if by using those alternate migration routes or corridors, the group of marine mammals or aggregations of fish would incur significant adverse effects.

Safety Zone and Start-up

Mitigation Measures

6. Each seismic survey must:

   a. establish a safety zone which is a circle with a radius of at least 500 metres as measured from the centre of the air source array(s); and

   b. for all times the safety zone is visible,

      i. a qualified Marine Mammal Observer must continuously observe the safety zone for a minimum period of 30 minutes prior to the start up of the air source array(s), and

      ii. maintain a regular watch of the safety zone at all other times if the proposed seismic survey is of a power that it would meet a threshold requirement for an assessment under the *Canadian Environmental Assessment Act*, regardless of whether the Act applies.

7. If the full extent of the safety zone is visible, before starting or restarting an air source array(s) after they have been shut-down for more than 30 minutes, the following conditions and processes apply:

   a. none of the following have been observed by the Marine Mammal Observer within the safety zone for at least 30 minutes:

      i. a cetacean or sea turtle,

      ii. a marine mammal listed as endangered or threatened on Schedule 1 of the *Species at Risk Act*, or

      iii. based on the considerations set out in sub-section 4(b), any other marine mammal that has been identified in an environmental assessment process as a species for which there could be significant adverse effects; and

   b. a gradual ramp-up of the air source array(s) over a minimum of a 20 minute period beginning with the activation of a single source element of the air source array(s), preferably the smallest source element in terms of energy output and a gradual activation of additional source elements of the air source array(s) until the operating level is obtained.

Shut-down of Air Source Array(s)

Mitigation Measures

8. The air source array(s) must be shut down immediately if any of the following is observed by the Marine Mammal Observer in the safety zone:

   a. a marine mammal or sea turtle listed as endangered or threatened on Schedule 1 of the *Species at Risk Act*; or

   b. based on the considerations set out in sub-section 4(b), any other marine mammal or sea turtle that has been identified in an environmental assessment process as a species for which there could be significant adverse effects.

Line Changes and Maintenance Shut-downs

Mitigation Measures

9. When seismic surveying (data collection) ceases during line changes, for maintenance or for other operational reasons, the air source array(s) must be:
    a. shut down completely; or
    b. reduced to a single source element.

10. If the air source array(s) is reduced to a single source element as per subsection 9(b), then:
    a. visual monitoring of the safety zone as set out in section 6 and shut-down requirements as set out in section 8 must be maintained; but
    b. ramp-up procedures as set out in section 7 will not be required when seismic surveying resumes.

Operations in Low Visibility

Mitigation Measures

11. Under the conditions set out in this section, cetacean detection technology, such as Passive Acoustic Monitoring, must be used prior to ramp-up for the same time period as for visual monitoring set out in section 6. Those conditions are as follows:
    a. the full extent of the safety zone is not visible; and
    b. the seismic survey is in an area that
        i. has been identified as critical habitat for a vocalizing cetacean listed as endangered or threatened on Schedule 1 of the Species at Risk Act, or
        ii. in keeping with the considerations set out in sub-section 4(b), has been identified through an environmental assessment process as an area where a vocalising cetacean is expected to be encountered if that vocalizing cetacean has been identified through the environmental assessment process as a species for which there could be significant adverse effects.

12. If Passive Acoustic Monitoring or similar cetacean detection technology is used in accordance with the provision of section 11, unless the species can be identified by vocal signature or other recognition criteria:
    a. all non-identified cetacean vocalizations must be assumed to be those of whales named in sections 8(a) or (b); and
    b. unless it can be determined that the cetacean(s) is outside the safety zone, the ramp-up must not commence until non-identified cetacean vocalizations have not been detected for a period of at least 30 minutes.

Additional Mitigative Measures and Modifications

Mitigation Measures

13. Persons wishing to conduct seismic surveys in Canadian marine waters may be required to put in place additional or modified environmental mitigation measures, including modifications to the area of the safety zone and/or other measures as identified in the environmental assessment of the project to address:
    a. the potential for chronic or cumulative adverse environmental effects of
        i. multiple air source arrays (e.g., two vessels on one project; multiple projects), or
        ii. seismic surveys being carried out in combination with other activities adverse to marine environmental quality in the area affected by the proposed program or programs;
    b. variations in sound propagation levels within the water column, including factors such as seabed, geomorphologic, and oceanographic characteristics that affect sound propagation;
    c. sound levels from air source array(s) that are significantly lower or higher than average; and
    d. species identified in an environmental assessment process for which there is concern, including those described in sub-section 4b).

14. Variations to some or all of the measures set out in this Statement may be allowed provided the alternate mitigation or precautionary measures will achieve an equivalent or greater level of environmental protection to address the matters outlined in sections 6 through 13 inclusive. Where alternative methods or technologies are proposed, they should be evaluated as part of the environmental assessment of the project.

15. Where a single source element is used and the ramping up from an individual air source element to multiple elements is not applicable, the sound should still be introduced gradually whenever technically feasible.