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LC-LP.1/Circ.11
16 February 2007

**1996 PROTOCOL TO THE CONVENTION ON THE PREVENTION OF MARINE
POLLUTION BY DUMPING OF WASTES AND OTHER MATTER
(LONDON PROTOCOL 1996)**

**Notification of entry into force of the
“CO₂ Sequestration” amendments to Annex 1 to the London Protocol 1996**

1 This is to notify, in accordance with Article 22.5 of the London Protocol 1996, all National Focal Points in administrations responsible for waste disposal at sea under the London Convention and Protocol that:

- .1 IMO received, on 29 January 2007, from the Government of Canada its instrument of acceptance, in accordance with Article 22.4 of the London Protocol 1996, of the amendment to Annex 1 to the Protocol, as contained in resolution LP.1(1) adopted on 2 November 2006; and
- .2 IMO received **no** objections to the amendments from Contracting Parties to the London Protocol 1996 within the 100 days-period mentioned in Article 22.4 after resolution LP.1(1) was adopted.

2 Consequently, the amendments contained in resolution LP.1(1) that were developed to regulate the sequestration of CO₂ streams from CO₂ capture processes in sub-seabed geological formations under the purview of the London Protocol 1996 entered into force on:

- .1 **29 January 2007** for Canada; and
- .2 **10 February 2007** for all other Contracting Parties to the Protocol.

3 States that are preparing ratification of, or accession to, the London Protocol 1996 are advised that their preparations should now focus on the London Protocol 1996, as amended.

4 The text of Resolution LP.1(1) was distributed on 27 November 2006 as circular LC-LP.1/Circ.5. Appended hereto in annex 1 is the text of Annex 1 to the London Protocol, as amended. IMO distributed on 9 February 2007 a press release on the entry into force of the said amendments. Appended hereto in Annex 2 is a general “Briefing on CO₂ Sequestration”, which is self-explanatory, and which the Secretariat developed with the assistance of several experts in this field.

ANNEX 1

**TEXT OF ANNEX 1 TO THE LONDON PROTOCOL,
AS AMENDED BY RESOLUTION LP.1(1)¹**

**WASTES OR OTHER MATTER THAT
MAY BE CONSIDERED FOR DUMPING**

- 1 The following wastes or other matter are those that may be considered for dumping being mindful of the Objectives and General Obligations of this Protocol set out in articles 2 and 3:
- .1 dredged material;
 - .2 sewage sludge;
 - .3 fish waste, or material resulting from industrial fish processing operations;
 - .4 vessels and platforms or other man-made structures at sea;
 - .5 inert, inorganic geological material;
 - .6 organic material of natural origin;
 - .7 bulky items primarily comprising iron, steel, concrete and similarly unarmful materials for which the concern is physical impact, and limited to those circumstances where such wastes are generated at locations, such as small islands with isolated communities, having no practicable access to disposal options other than dumping; and
 - .8 Carbon dioxide streams from carbon dioxide capture processes for sequestration.**
- 2 The wastes or other matter listed in paragraphs 1.4 and 1.7 may be considered for dumping, provided that material capable of creating floating debris or otherwise contributing to pollution of the marine environment has been removed to the maximum extent and provided that the material dumped poses no serious obstacle to fishing or navigation.
- 3 Notwithstanding the above, materials listed in paragraphs 1.1 to **1.8** containing levels of radioactivity greater than *de minimis* (exempt) concentrations as defined by the IAEA and adopted by Contracting Parties, shall not be considered eligible for dumping; provided further that within 25 years of 20 February 1994, and at each 25 year interval thereafter, Contracting Parties shall complete a scientific study relating to all radioactive wastes and other radioactive matter other than high level wastes or matter, taking into account such other factors as Contracting Parties consider appropriate and shall review the prohibition on dumping of such substances in accordance with the procedures set forth in article 22.

¹ The amendments are shown in “**bold**”.

- 4 Carbon dioxide streams referred to in paragraph 1.8 may only be considered for dumping, if:**
- .1 disposal is into a sub-seabed geological formation; and**
 - .2 they consist overwhelmingly of carbon dioxide. They may contain incidental associated substances derived from the source material and the capture and sequestration processes used; and**
 - .3 no wastes or other matter are added for the purpose of disposing of those wastes or other matter.**

ANNEX 2

BRIEFING ABOUT CO₂ SEQUESTRATION

New international rules to allow storage of carbon dioxide (CO₂) in sub-seabed geological formations have come into force on 10 February 2007.

What is sequestration of CO₂ in geological formations?

CO₂ sequestration is the capture and permanent storage in geological formations of carbon dioxide that would otherwise be emitted to the atmosphere.

Why is CO₂ sequestration being developed?

Elevated levels of CO₂ in the atmosphere caused by CO₂ emissions from the combustion of fossil fuels (coal, oil or gas) contribute to climate change and ocean acidification. The use of CO₂ sequestration is only one option of a range of measures to tackle these challenges, including, first and foremost, the need to further develop and use low carbon forms of energy and conservation measures to reduce emissions.

What happens if the oceans become more acidic?

The oceans are a massive reservoir of CO₂. Oceanic carbon includes a portion of that resulting from human activity. Recent studies reveal that the oceans have absorbed nearly half of the approximately 1,300 Gigatonnes of CO₂ emitted to the atmosphere from anthropogenic fossil fuel combustion sources during the last 200 years. Ocean chemistry has helped buffer some of the effects of climate change. However, increased CO₂ absorption by the surface ocean has already resulted in a pH reduction (i.e., acidification of the surface ocean) of 0.1 unit – from pH 8.2 to 8.1 over the last 200 years. Studies indicate that with a “*business as usual*” scenario, by the year 2100 the pH of the surface mixed layer could decrease by more than 0.3 units and by 2250 by 0.7 units. This would create a lower pH than that known to have been experienced in at least the last 20 million years. The best scientific information currently available suggests that these changes in ocean chemistry could have a profound effect on corals, shellfish, specific groups of phytoplankton such as coccolithophores, and other calcareous organisms thereby affecting biodiversity and disrupting the marine food web and ocean biogeochemistry. Increased CO₂ in seawater may also directly affect the physiology of some marine organisms, such as squid.

Ocean acidification caused by elevated emissions of CO₂ is therefore a cause for serious concern.

How does CO₂ sequestration work?

CO₂ is separated (captured) from flue gases, pressurized, and transported by pipeline or vessel to the selected geological storage site using established technology. The capture, transport and storage process itself also requires energy, so one has to think in terms of how to achieve the greatest overall benefit. Some of the existing infrastructure of depleted offshore oil and gas fields, where available, might be used for CO₂ sequestration after

adaptation. Otherwise, this infrastructure will have to be built. The proper selection and assessment of the storage site will be important to ensure that the CO₂ remains in the geological formation over the long term.

What is the potential for capturing CO₂?

The main potential for CO₂ capture is in the electricity generating sector where fossil fuels are used, but interesting opportunities exist in fuels processing and other energy-intensive industrial sectors. Coal-fired power plants have the highest CO₂ emissions and offer, therefore, the best potential for CO₂ sequestration.

What is the potential for CO₂ sequestration?

The main underground CO₂ storage potential is in depleted oil and gas fields and in deep subterranean and sub-sea saline aquifers. Suitable geological formations exist in many places around the world and can provide storage of significant amounts of CO₂, equivalent to decades or even centuries of global emissions.

What are the risks of CO₂ sequestration?

CO₂ could leak while being transported, or after storage. There are two different kinds of leakage scenarios: (1) *abrupt* leakage, through injection well failure, or leakage up an abandoned well; and (2) *gradual* leakage, through undetected faults, fractures, or wells. The potential consequences of leakage are currently poorly characterized but will depend on the location, scale, geographical extent and prevailing conditions in the overlying environment.

How can the risks associated with CO₂ sequestration be minimized?

The risks associated with leakage and transport of CO₂ can be minimized through the use of standard engineering practices such as monitoring and metering. Pipeline transport of CO₂ requires attention to route selection, overpressure protection, leak detection and other design factors. With appropriate site selection based on available geological information, a monitoring programme to detect problems, a regulatory system and the use of remediation methods to stop or control CO₂ releases if they arise, the local health, safety and environment risks of CO₂ sequestration would be comparable to the risks of current activities such as natural gas storage and enhanced oil recovery.

The '*Risk Assessment and Management Framework for CO₂ Sequestration*' developed in 2006 and the Guidelines being developed under the London Protocol are designed to address these issues (see also below).

Features of storage sites with a low probability of CO₂ leakage include: (1) highly impermeable cap rocks; (2) geological stability; (3) absence of leakage paths; and (4) effective trapping mechanisms of the sequestered CO₂.

What are the new rules for CO₂ sequestration in sub-seabed geological formations?

Parties to the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 (London Protocol) adopted amendments on 2 November 2006 to Annex 1 to this Protocol to regulate CO₂ sequestration in sub-seabed geological formations. To date, 8 February 2007, there are 30 Parties to this Protocol.

The rules state that carbon dioxide streams may only be considered for dumping, if: (1) disposal is into a sub-seabed geological formation; (2) they consist overwhelmingly of carbon dioxide (they may contain incidental associated substances derived from the source material and the capture and sequestration processes used); and (3) no waste is added for the purpose of its disposal. In other words, these rules do not permit CO₂ sequestration in the deep oceans themselves.

As sub-seabed geological sequestration of CO₂ will now be subject to licensing, Parties also agreed that guidelines should be developed for adoption when Parties meet again in November 2007 on how to capture and sequester CO₂ in a manner that meets all the requirements of the Protocol and is safe for the marine environment, over both the short and long terms.

Protection of the oceans, being part of the 'global commons', requires internationally agreed standards. The use of geological formations on land for CO₂ sequestration, on the other hand, is generally subject to national law.

What is the effect of the new rules?

The new rules provide a basis in international environmental law to regulate CO₂ sequestration in sub-seabed geological formations. They also create a climate in which more research can be done to further develop and improve existing technologies enabling, in the end, safe sequestration of CO₂. Such research requires time and is costly.

How will the new rules be enforced?

CO₂ sequestration in the sub-seabed will be subject to licences issued by governments. Every applicant will have to demonstrate the integrity of a proposed sequestration site with monitoring and mitigation safeguards in place to ensure that the CO₂ will be permanently stored as intended. The monitoring provisions will be crucial components of the license approval process.

The '*Risk Assessment and Management Framework for CO₂ Sequestration*' developed under the London Protocol in 2006 provides provisional information to regulators and others regarding: (1) the selection of those underground reservoirs with the best potential for permanent isolation; (2) site-specific risks to the marine environment of CO₂ sequestration; (3) the development of management strategies to address uncertainties; and (4) the reduction of residual risks to acceptable levels. If storage sites are selected and managed appropriately, the probability of leakage from reservoirs should be minimal.

Using the abovementioned Framework, Guidelines are being prepared for adoption under the London Protocol in 2007 to cover all the points which need to be taken into account by applicants for these licences and also by licensing authorities when assessing these applications and enforcing the permit conditions.

Guidelines generally provide a good basis for harmonized interpretation and implementation of the London Protocol. Furthermore, the regular meetings of Parties give the opportunity to discuss individual CO₂ sequestration licences, both informally and formally.

What research is currently being done?

Currently, there are three projects on a larger scale to test deep geological storage of CO₂: (1) the “*Sleipner Project*” beneath the North Sea off the Norwegian coast (storage in a deep underground saline water reservoir); (2) the “*Weyburn Project*” in Canada (storage in an underground oil field); and (3) the “*In Salah Project*” in Algeria (injection of CO₂ into a depleted gas reservoir). Further large offshore storage projects are being developed in several countries, including Norway and the United Kingdom, while several smaller scale pilot projects have been undertaken and are being planned. In addition, much research is devoted to develop and test monitoring techniques and other technical issues, using for instance natural CO₂ reservoirs and leakages. These research and pilot projects are carried out in many countries, including Australia, China, France, Germany, India, Italy, Japan, the Netherlands, the United Kingdom and the United States.

Underground oil and gas reservoirs have already retained materials for geologically significant periods and offer, in the short term, the most attractive sites for CO₂ sequestration.

Further information on this issue can be found at:

<http://co2captureandstorage.info/>: This website provides a collection of resources related to the capture and storage of CO₂. Deep reductions in greenhouse gas emissions are required in order to meet the UNFCCC goal of stabilising anthropogenic greenhouse gas emissions.

<http://www.iea.org>: the International Energy Agency, especially its Greenhouse Gas Research and Development Programme at <http://www.ieagreen.org.uk/ccs.html> on Capture and Storage of CO₂.

<http://www.ipcc.ch>: The Intergovernmental Panel on Climate Change. The reader is referred in particular to the IPCC “*Special Report on Carbon Dioxide Capture and Storage*”, published in 2005 by Cambridge University Press.

If you need more information on the CO₂ sequestration discussions under the London Convention and Protocol go to: <http://www.londonconvention.org> or contact rcoenen@imo.org.