

Aide-mémoire for the APPG on marine dumping of wastewater

David Smythe BSc, PhD

[Emeritus Professor of Geophysics, University of Glasgow]

Ventenac en Minervois, France

www.davidsmythe.org

david.smythe@lafontenille.org

15 February 2017

1 Introduction

Professor Ernie Rutter, who was the geologist on the Shale Task Force, told me last year that marine dumping was being considered as an option for flowback/produced water (hereinafter 'wastewater') from fracking. This aide-mémoire is intended to inform the APPG of the likely legal limitations of such an approach, were it to be adopted.

2 The London Protocol on marine dumping

Here are some extracts from the International Maritime Organisation's web page (<http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/Convention-on-the-Prevention-of-Marine-Pollution-by-Dumping-of-Wastes-and-Other-Matter.aspx>):

Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter
Adoption: 13 November 1972; Entry into force: 30 August 1975; 1996 Protocol: Adoption: 7 November 1996; Entry into force: 24 March 2006

...

"Dumping" has been defined as the deliberate disposal at sea of wastes or other matter from vessels, aircraft, platforms or other man-made structures, as well as the deliberate disposal of these vessels or platforms themselves. Annexes list wastes which cannot be dumped and others for which a special dumping permit is required.

...

In 1996, Parties adopted a Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 (known as the **London Protocol**) which entered into force in 2006.

The Protocol, which is meant to eventually replace the 1972 Convention, represents a major change of approach to the question of how to regulate the use of the sea as a depository for waste materials. Rather than stating which materials may not be dumped, it prohibits all dumping, except for possibly acceptable wastes on the so-called "reverse list", contained in an annex to the Protocol.

The London Protocol stresses the "precautionary approach", which requires that "appropriate preventative measures are taken when there is reason to believe that wastes or other matter introduced into the marine environment are likely to cause harm even when there is no conclusive evidence to prove a causal relation between inputs and their effects".

It also states that "the polluter should, in principle, bear the cost of pollution" and emphasizes that Contracting Parties should ensure that the Protocol should not simply result in pollution being transferred from one part of the environment to another.

The 1996 Protocol restricts all dumping except for a permitted list (which still require permits).

Article 4 states that Contracting Parties "shall prohibit the dumping of any wastes or other matter with the exception of those listed in Annex 1."

Here are the relevant extracts from the 1996 Protocol, as amended 2006:

ANNEX 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.

...

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.

...

ANNEX 2

ASSESSMENT OF WASTES OR OTHER MATTER THAT MAY BE CONSIDERED FOR DUMPING

GENERAL

1 The acceptance of dumping under certain circumstances shall not remove the obligations under this Annex to make further attempts to reduce the necessity for dumping.

WASTE PREVENTION AUDIT

2 The initial stages in assessing alternatives to dumping should, as appropriate, include an evaluation of:

- .1 types, amounts and relative hazard of wastes generated;
- .2 details of the production process and the sources of wastes within that process; and
- .3 feasibility of the following waste reduction/prevention techniques:
 - .1 product reformulation;
 - .2 clean production technologies;
 - .3 process modification;
 - .4 input substitution; and
 - .5 on-site, closed-loop recycling.

...

CONSIDERATION OF WASTE MANAGEMENT OPTIONS

5 Applications to dump wastes or other matter shall demonstrate that appropriate consideration has been given to the following hierarchy of waste management options, which implies an order of increasing environmental impact:

- .1 re-use;
- .2 off-site recycling;
- .3 destruction of hazardous constituents;
- .4 treatment to reduce or remove the hazardous constituents; and
- .5 disposal on land, into air and in water.

...

CHEMICAL, PHYSICAL AND BIOLOGICAL PROPERTIES

7 A detailed description and characterization of the waste is an essential precondition for the consideration of alternatives and the basis for a decision as to whether a waste may be dumped. If a waste is so poorly characterized that proper assessment cannot be made of its potential impacts on human health and the environment, that waste shall not be dumped.

8 Characterization of the wastes and their constituents shall take into account:

- .1 origin, total amount, form and average composition;
- .2 properties: physical, chemical, biochemical and biological;
- .3 toxicity;
- .4 persistence: physical, chemical and biological; and
- .5 accumulation and biotransformation in biological materials or sediments.

3 IAEA determination of suitability for disposal at sea

Wastewater cannot be exempted under the terms of para. 1.5 of Annex 1 quoted above ("*inert, inorganic geological material*") because such water contains NORM (i.e. it is not inert). If the waste is above the *de minimis* (exempt) level then it cannot be dumped at sea. The issue then is whether the waste falls below the *de minimis* levels for disposal, which are defined by the IAEA (Annex 1, para. 3, above).

The IAEA first considered this problem in 1979 (IAEA 1981), and issued a procedure for the assessment of such waste in 2003 (IAEA 2003). The guidance is provided in Annex 1 to this latter document. Firstly, it would appear that the wastewater does not fulfil the automatic exemption criteria (Annex 1, para. 3.5). It therefore requires specific assessment. Here is a summary of the stepwise evaluation procedure as it would be applied to wastewater (IAEA 2003, pp.51-54).

Step 1. Wastewater will be eligible for dumping if and only if it falls below the *de minimis* level.

Step 2. Since wastewater is a *modified* material, i.e. it is the water extracted from shale along with the hydrocarbons, and is not 'virgin' natural shale, we go to Step 3.

Step 3. The cause of the modification is assessed; in the case of wastewater this is due to the second cause: "*human activities that increase the concentrations of natural radionuclides in candidate materials*". So we go to Step 5.

Step 5. This assessment concerns whether the UK national radiation protection authority has previously assessed and cleared or exempted the wastewater for dumping, taking into account marine environmental pathways. The answer here is No, so we proceed to Step 6.

Step 6. Since wastewater has not passed the *de minimis* criteria under Steps 1-5, a *specific assessment* is required.

Unfortunately Appendix 2 of IAEA (2003), dealing with the assessment of dose resulting from the dumping process assumes that the material is a ship-borne dry load. This clearly does not apply to wastewater, which I assume would be disposed of *via* a pipeline. So much of the assessment procedure is irrelevant; only the dose to the public resulting from exposure to seafood and contaminated sediments, by external or internal radiation (table II.III, p. 40; table II.VII, p. 42) would appear to be applicable.

The assessment would need to be made for each type of wastewater from the various sources envisaged. The assessment of NORM for the purposes of determining whether

the wastewater passes under the *de minimis* limit does not, of course, preclude the need to assess the environmental impact of the other toxic components of the wastewater.

4 Definition of 'sea'

The 'sea' is defined, for the purposes of the London Protocol, to be the part of the sea lying seaward of the baseline by which a state measures its territorial waters. The baseline is normally the low water mark or datum, defined by the lowest astronomical tide. In addition, 'straight lines' are used to define the baseline across bays, and to help simplify the definition of the territorial sea.

In the UK baseline definition (Order in Council, 25 September 1964), there is an extensive set of straight lines enclosing the Hebrides from Cape Wrath to the Mull of Kintyre, and bay closing lines for the following bays:

West coast

- a) Firth of Clyde
- b) Solway Firth including Luce and Wigtown Bays
- c) Morecambe Bay
- d) Tremadoc Bay
- e) Bristol Channel including Carmarthen Bay (Britain);

East coast

- f) The Thames Estuary
- g) The Wash
- h) The Humber Estuary
- i) Firth of Forth
- j) Firth of Tay
- k) Moray Firth

Northern Ireland

- l) Belfast Lough

The Hebridean baseline is defined by a schedule of 26 latitude/longitude coordinates, whereas the bay closing lines listed above are indicated on a chart provided by the Hydrographer.

The London Protocol on the prevention of marine dumping applies to all sea lying seaward of the baseline, and is not to be confused with the nation's territorial limits, which lie 12 nautical miles further out (Fig.1 below). However, if the dumping is to take place within the baseline defined above the London Protocol will not apply.

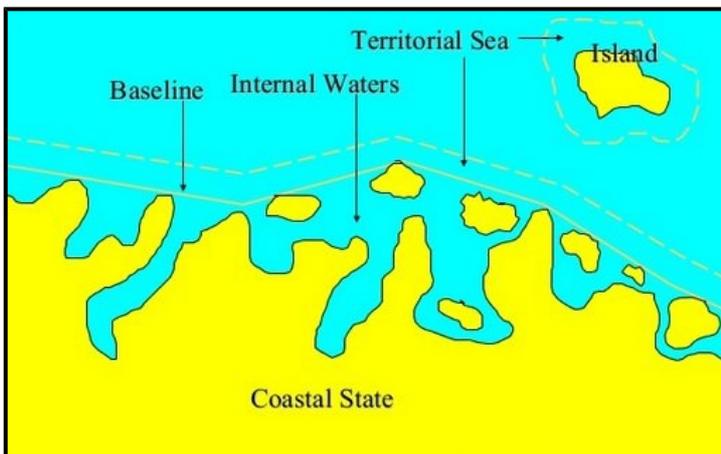


Figure 1. Hypothetical example of straight baselines.

So the London Protocol does not apply to internal waters, but does apply to all waters seaward of the baseline. By way of example, consider a hypothetical wastewater treatment and disposal facility at Bran Sands, on Teesside. The wastewater could be dumped into the River Tees, to the west, and be exempt from the London Protocol, but a pipeline running north-east out to sea at Coatham Sands would have to comply with the protocol.

5 Discharges from pipelines into internal waters

My understanding of this topic comes from a review by Hunt (2004), who states that the principles for release of waste *via* pipelines was reviewed by the IAEA (2000). Pipeline discharge is not explicitly mentioned in the cited IAEA document, which does, however, state that discharges "*directly to surface water bodies*" are considered in the report. The report states:

1.7. An additional principle of the Waste Safety Fundamentals is that radioactive waste be managed in such a way as to provide an acceptable level of protection of the environment. This includes the protection of living organisms other than humans and also the protection of natural resources, including land, forests, water and raw materials, together with a consideration of non-radiological environmental impacts. This Safety Guide is concerned only with control measures to protect human health.

The report gives guidance in Section 3 for setting discharge limits for new sources; clearly, discharge of wastewater is a new source as far as the UK is concerned. The environmental impacts of the wider environment, and not just humans, will have to be assessed, as stated in the quoted paragraph above.

Lastly, if discharge of wastewater into internal waters is envisaged (see Fig. 1 above), consideration may also have to be given to the resulting discharge into the sea (Section 4 above). For example, in the case of a possible treatment plant at Bran Sands, discharging into the River Tees, an assessment would have to be made of the resulting downstream discharge into the sea, which falls under the London Protocol.

References

Hunt, G.J. 2004. Radiological assessment of ocean radioactivity. In *Marine radioactivity* (Livingston, H.D., ed.), Elsevier, 205-236.

IAEA 1981. *Considerations concerning "de minimis" quantities of radioactive waste suitable for dumping at sea under a general permit*. IAEA Tecd-244. International Atomic Energy Agency, Vienna.

IAEA 2000. *Regulatory control of radioactive discharges to the environment*. Safety guide no. WS-G-2.3. International Atomic Energy Agency, Vienna.

IAEA 2003. *Determining the suitability of materials for disposal at sea under the London Convention 1972: A radiological assessment procedure*. IAEA Tecd-1375. International Atomic Energy Agency, Vienna.

Appendix: Brief CV

Professor Smythe has 45 years of professional experience in applied geophysics, first at the British Geological Survey, then as Chair of Geophysics at the University of Glasgow, followed by consulting for the oil industry. His research interests and experience relevant to the wastewater problem include:

- Adviser to Department of Energy and F&CO on Law of the Sea (1984-85)
- Geological disposal of nuclear waste
- Radiation dose in relation to nuclear accidents
- Economics of unconventional energy exploration