Considerations of Transfrontier Shipment of NORM Waste from the North Sea Oil and Gas Industries

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ABSTRACT

A liaison group was established in 2008 comprising competent authorities from Norway, the UK, Denmark and Germany, with responsibilities for regulating the accumulation and disposal of NORM wastes arising from the extraction of oil and gas in the North Sea area. This group has met on a regular basis to discuss issues of joint interest, including the increasing need to clarify provisions for transboundary movement of NORM wastes from this industry. There are a number of associated regulatory issues, which the liaison group is seeking to resolve. This paper provides an overview of the regulatory issues and an update on the liaison group's work in this area.

It has been recognized that many platforms in the North Sea area are reaching the end of their productive life and, although the precise timing is uncertain and will depend upon economic and other conditions, the volume of decommissioning wastes is likely to increase over the coming years. International and national policies related to the movement, treatment and final disposal of such wastes may influence the pattern of the decommissioning market and clarity on these points is essential.

The main instrument for placing controls on the transfrontier shipment of radioactive waste within the European Union is Directive 2006/117/Euratom. However, the scope of this directive relates to natural radionuclides only where they are produced from processing of natural sources for their '*radioactive, fissile or fertile properties*', and therefore does not apply to NORM waste from the oil and gas industry. Thus, there is a need to establish additional notification and/or consent procedures for the movement of NORM wastes from the decommissioning of oil and gas platforms in the North Sea area. This will involve further clarification of appropriate mechanisms and of national regulatory policies regarding exemption and disposal of NORM wastes.

Key words: NORM wastes, Oil, Transfrontier Shipment

Introduction

In 2008, the competent authorities in oil- and gas producing states around the North Sea decided to establish a working group to enhance their cooperation, with the objective of:

- Developing a common understanding of present practices on regulation of the oil and gas industry in the North Sea area; and
- Establishing a managed process to work towards cooperation and harmonisation between the regulatory bodies in this area.

This group comprises competent authorities from Norway, the UK, Denmark and Germany[1], with responsibilities for regulating the accumulation and disposal of wastes containing Naturally Occurring Radioactive Materials (NORM) arising from the extraction of oil and gas in the North Sea area.

Since 2008, the group has provided a useful focus for the exchange of information on developments in national legislation, and for considering their potential implications. For example, in that period, new legislation related to the control of radioactive waste and pollution has been introduced in Norway (Norwegian Ministry of Environment, 2011) and the UK has revised Exemption Orders for radioactive substances, including those applied within the oil and gas industries (Defra, 2011). A comparison of the exemption criteria currently in place for NORM around the North Sea is presented in another paper in these proceedings (Stackhouse et al, 2012).

The need to clarify the requirements and conditions for the transfrontier shipment of equipment containing NORM from the oil and gas sector, from both operational and decommissioning activities, was also identified as an issue of joint interest. It was recognized that many platforms in the North Sea area are reaching the end of their productive life such that the volume of decommissioning wastes is likely to increase over the coming years. International and national policies related to the movement, treatment and final disposal of such wastes may influence the pattern of the decommissioning market and clarity on these points is essential. Representatives of the industry also expressed this viewpoint as part of informal information exchange meetings with the liaison group during 2010.

A working group was therefore established to consider a range of decommissioning scenarios and the practical regulatory issues that might arise in moving and disposing of NORM materials and wastes. This included a review of the relevant international legal instruments and national policies on the movement and disposal of radioactive waste. This paper provides a summary of the current status of the group's work. The nature and magnitude of NORM wastes arising from the oil and gas industry under operational and decommissioning conditions is introduced followed by an overview of the key international agreements associated with the transfrontier shipment of such wastes. The key regulatory issues that need to be resolved are then explored in more detail.

Form and Quantities of NORM Wastes

The earth's crust contains a range of naturally occurring radionuclides. The extraction of oil and gas leads to the release and deposition of such nuclides from and within production equipment. The main naturally occurring radionuclides associated with oilfield operations are the decay products from two of the primordial nuclides: uranium-238 (^{238}U) and thorium-232 (^{232}Th). These nuclides are present both in the source rocks from which the hydrocarbons are extracted and in the reservoir rocks from which they are produced (SNIFFER, 2005). NORM contaminated deposits in oil and gas production occur in two main forms:

- As mineral scales, and sludges of particulate scale, containing radium and its decay products;
- As thin coatings and "black sludges" in gas and condensate processing equipment, mainly containing decay products from radon-222, predominantly lead-210 and polonium-210 (SNIFFER, 2005).

[1] Norwegian Radiation Protection Authority (NRPA); Department of Energy and Climate Change (DECC), Scottish Environment Protection Agency (SEPA); Environment Agency (EA), Danish National Institute of Radiation Protection (NIRP), Bundesamt für Strahlenschutz (BfS, Germany)

As part of work to determine the potential impact of the new legislation in Norway, a working group[2] was established to determine the amounts of NORM wastes that could arise in the future during operational and decommissioning phases.There are significant uncertainties in the amounts of waste estimated. . This work indicated that the major proportion of operational NORM waste has activity concentration below 10 Bq/g, around 600 – 800 tonnes. However, data from the first year following implementation of the new legislation indicates that the amount of waste is substantially smaller and that the quantity with activity concentrations above 10 Bq/g is around 70 tonnes per year.

Key International Instruments for transboundary shipment of NORM Wastes

There are a range of international conventions and agreements that relate to the transboundary movement of wastes in general and to the control and movement of radioactive wastes in particular. NORM wastes test the boundaries of such agreements; NORM may or may not be considered to fall within the remit of these instruments, depending on the definition of the terms 'radioactive' and of 'waste'. This issue is explored below in relation to broad international agreements related to the transboundary shipment of waste and of radioactive waste followed by a consideration of the relevant EC Directives and Regulations, that implement these requirements.

Basel Convention

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal is the most comprehensive global environmental agreement on hazardous and other wastes. The Convention has 175 Parties and aims to protect human health and the environment against the adverse effects resulting from the generation, management, transboundary movements and disposal of hazardous and other wastes.

The Basel Convention came into force in 1992 (Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1989)[3] and was established in order to address the uncontrolled movement and dumping of hazardous wastes, including incidents of illegal dumping in developing nations by companies from developed countries. It is a global agreement, for addressing the problems and challenges posed by hazardous waste[4]. The key objectives of this convention are:

- to minimize the generation of hazardous wastes in terms of quantity and hazardousness;
- to dispose of them as close to the source of generation as possible;
- to reduce the movement of hazardous wastes.

The Convention covers toxic, poisonous, explosive, corrosive, flammable, ecotoxic and infectious wastes. For the purposes of this Convention 'wastes' are defined as *substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law*. Hazardous waste is not explicitly defined within the definitions of the convention. However, 'categories of wastes to be controlled' or requiring 'special consideration' are specified in Annexes I and II of the Convention, respectively. The waste streams identified in Annex I include the following, which may be of relevance to the subject of this paper:

- Wastes from the production, formulation and use of organic solvents;

[2] The working group comprised representatives of Ministries, relevant regulatory and oil and gas industry groups

[3] http://www.basel.int/index.html

[4] As indicated above, within the European Union, the provisions of this Convention are incorporated within Regulation (EC) No. 1013/2006

— Waste mineral oils unfit for their originally intended use;
— Waste oils/water, hydrocarbon/water mixtures, emulsions;
— Waste substances and articles containing or contaminated with polychlorinated biphenyls (PCBs) and/or polychlorinated terphenyls (PCTs) and/or polybrominated biphenyls (PBBs).

However, Article 1 (3) states that wastes, *which, as a result of being radioactive, are subject to other international control systems, including international instruments, applying specifically to radioactive materials, are excluded from the scope of [the Basel] Convention*. It is therefore necessary to determine the extent to which NORM wastes are subject to other international controls as a consequence of their radioactive properties in order to determine whether the Basel Convention may be considered to apply.

Joint Convention

The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (generally referred to as the Joint Convention) includes, under its miscellaneous provisions, Article 27 on Transboundary Movement[5] (International Atomic Energy Agency, 1997). In this context, the preamble to the Convention refers to the *desirability of strengthening the international control system applying specifically to radioactive materials as referred to in Article 1(3) of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (1989).*

Under the Joint Convention, 'radioactive waste' is defined as *radioactive material in gaseous, liquid or solid form for which no further use is foreseen by the Contracting Party or by a natural or legal person whose decision is accepted by the Contracting Party, and which is controlled as radioactive waste by a regulatory body under the legislative and regulatory framework of the Contracting Party*'. However, within the scope of application of the convention to 'radioactive waste', it is stated that it '*shall not apply to waste that contains only naturally occurring radioactive materials and that does not originate from the nuclear fuel cycle, unless it constitutes a disused source or it is declared radioactive waste for the purposes of this Convention by the Contracting Party*'.

It therefore appears that wastes involving naturally occurring radioactive materials may be considered within the scope of the Convention, if the material is considered to be radioactive waste by the Contracting Party and if declared as such within the context of the Convention.

The preamble of the Joint Convention recognizes that:

— *'...radioactive waste should, as far as is compatible with the safety of the management of such material, be disposed of in the State in which it was generated, whilst recognizing that, in certain circumstances, safe and efficient management of spent fuel and radioactive waste might be fostered through agreements among Contracting Parties to use facilities in one of them for the benefit of the other Parties, particularly where waste originates from joint projects;*
— *'...any State has the right to ban import into its territory of foreign spent fuel and radioactive waste'.*

Thus, this Convention specifies the desirability of waste being disposed of in the State of origin, although alternative arrangements are acceptable if subject to agreement between Contracting Parties. The preamble to the Convention also makes specific reference to '*the interagency "International Basic Safety Standards for Protection against Ionizing Radiation*

[5] Under the Joint Convention, *transboundary movement* means any shipment of spent fuel or of radioactive waste from a State of origin to a State of destination.

and for the Safety of Radiation Sources" (1996), in the IAEA Safety Fundamentals entitled "The Principles of Radioactive Waste Management" (1995), and in the existing international standards relating to the safety of the transport of radioactive materials.

It therefore appears that it is possible that this Convention could provide a mechanism for establishing a consent process for the transboundary movement of NORM waste, if two or more Contracting Parties were to agree to declare it to be waste, for the purposes of the Convention. Furthermore, its reference to the International Safety Standards, and the standards for the safe transport of radioactive materials provides a direct means of placing controls on the waste materials that are based on their radioactive properties.

Directive 2006/117/EURATOM of 20 November 2006 on the supervision and control of shipments of radioactive waste and spent fuel(EC, 2006)

The main instrument for placing controls on the transfrontier shipment of radioactive waste into, out of and within the European Union is Directive 2006/117/Euratom. For the purposes of this Directive, radioactive waste is defined as: '*Radioactive material in gaseous, liquid or solid form for which no further use is foreseen by the countries of origin and destination, or by a natural or legal person whose decision is accepted by these countries, and which is controlled as radioactive waste by a regulatory authority under the legislative and regulatory framework of the countries of origin and destination'*.

The key issue with regard to the applicability of this Directive to NORM wastes from the North Sea oil and gas industry is the interpretation of the term 'practices'. This term is not defined within the Directive itself. However, a 'practice' is defined as follows in the Euratom Basic Safety Standards, Directive 96/29/Euratom(EC, 1996):

'*A human activity that can increase the exposure of individuals to radiation from an artificial source, or from a natural radiation source where natural radionuclides are processed for their radioactive, fissile or fertile properties, except in the case of an emergency exposure'*.

Oil and gas production would thus not be considered to be a practice under this definition; wastes containing natural radionuclides are not produced from processing for their '*radioactive, fissile or fertile properties'*, but as a by-produce of unrelated processes. Directive 2006/117/Euratom therefore does not apply to this waste stream.

Regulation (EC) No. 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste (EC, 2006)

Among other things, this regulation seeks to include the provisions of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes (Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1989) and their Disposal into Community legislation. It also includes provisions from the revision of the Decision on the Control of Transboundary Movements of waste destined for recovery operations, adopted by the OECD in 2001 (OECD, 2001). The Regulation covers shipments of waste:

- Between Member States,
- Within the Community or with transit through third countries
- Imported into the Community from third countries
- Exported from the Community to third countries
- In transit through the Community, on the way from and to third countries

The scope of the regulation relates to almost all types of waste, except radioactive wastes (as defined by Directive 92/3/Euratom) (EC, 1992) and other forms of waste that are subject to separate controls. Thus, if not defined as 'radioactive waste' under the above Directive or its successor, shipments of wastes are covered by this Regulation. This is presumed to be the case for NORM wastes. However, it should also be noted that the following wastes are among those excluded from the Regulation:

The offloading to shore of waste, including waste water residues, generated by the normal operation of ships and offshore platforms, provided that such waste is subject to the requirements of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (Marpol 73/78), or other binding international instruments.

The precise scope of the Regulation and the Marpol convention in relation to NORM wastes from oil and gas platforms will need to be considered further by a legal specialist. If NORM wastes are considered to fall within the remit of Regulation (EC) No. 1013/2006, it is important to note that this regulation includes general safety-related provisions but does not include requirements specific to the radioactive characteristics of the NORM materials. There is therefore a need to supplement these controls by more specific requirements.

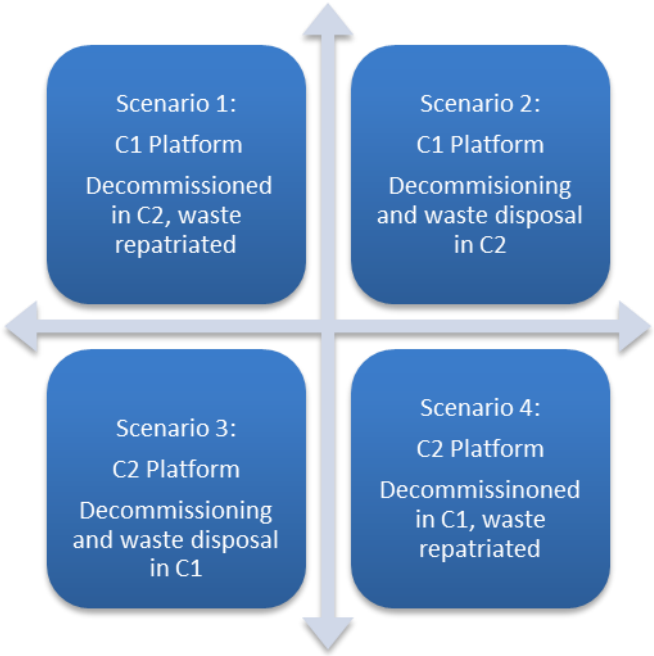
Clarification of Regulatory Issues

Although worded differently, the relevant Conventions place requirements on the competent authorities to ensure that waste is not shipped unnecessarily and to ensure that it is neither imported nor exported unless the country of destination has the competence to deal with the material. There is also a presumption that waste should be disposed of in the country of origin and that it will not be subject to transboundary movement, unless it is required by 'safe and efficient management' to do so.

The main instrument for placing controls on the transfrontier shipment of radioactive waste into, out of and within the European Union is Directive 2006/117/Euratom. However, the scope of this directive excludes NORM containing wastes from the oil and gas industry by virtue of the definition of practice in this directive. Regulation (EC) No. 1013/2006 specifically excludes radioactive wastes, where they are specified in the predecessor to Directive 2006/117/Euratom. Thus, if NORM wastes are not considered to be 'radioactive wastes' within the context of these Directives, it is presumed that they fall within the remit of Regulation (EC) No. 1013/2006. This regulation includes general safety-related provisions but does not include requirements specific to the radioactive characteristics of the NORM materials. There is therefore a need to supplement these controls by more specific requirements. Such requirements may be specified in individual contracts, but this is a potentially time-consuming process. An alternative approach would be to develop a consent process between countries that have oil and gas production within the North Sea area and those that might seek to condition or deal with NORM wastes that arise from operation or decommissioning operations.

It was recognized that the development of such a consent process would need to take account of the international and national definitions of waste and radioactive waste; national policies on the import and export of waste and radioactive waste, and any associated requirements for the return of waste materials. In order to clarify the practical regulatory issues associated with the transboundary movement of NORM materials and wastes arising during decommissioning of oil platforms in the North Sea, 4 basic scenarios were identified, as illustrated in Fig. 1.

Figure 1. Illustration of decommissioning scenarios that involve transfrontier shipment



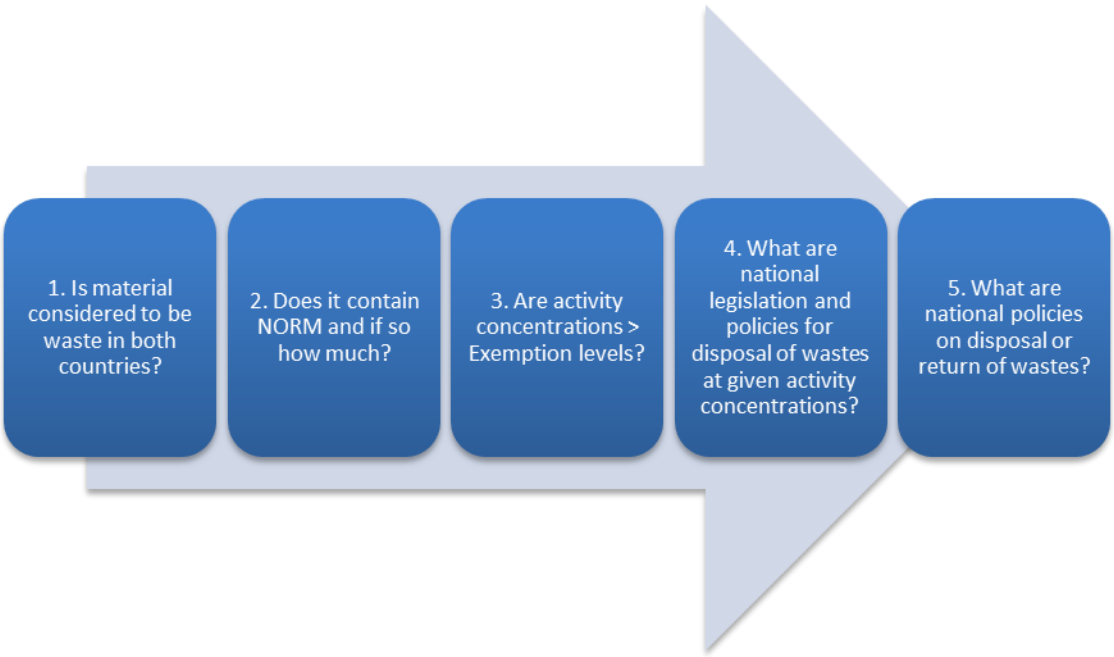
Each scenario involves the movement of a platform and/or contaminated equipment from one part of the Continental Shelf to a country other than that under which operations have been administered. If C1 is assumed to be the 'home country', then scenarios 1 and 2 involve the export of equipment containing NORM wastes that may or may not be returned following cleaning and decommissioning. Scenarios 3 and 4 involve the import of equipment containing NORM wastes, which may be disposed of or returned to the country of origin. The regulatory decision processes will be slightly different in each case. These scenarios were used as the basis for identifying the key regulatory issues that would need to be addressed, with the objective of developing a common approach and protocols for responding to any future applications for transfrontier shipment of facilities or equipment and for establishing the baseline for associated disposal arrangements.

The following inter-related issues were identified:

— Legislative basis and conditions for transfrontier shipment of equipment contaminated with hazardous or radioactively materials;
— Legislative basis and conditions for transfrontier shipment of waste and radioactive waste (and the definition and distinction between them)
— National and international policies associated with the import, export and disposal of radioactive waste.

Regulatory requirements are associated with the transfrontier shipment of wastes (for which no further use is foreseen) rather than materials (for which further or alternative use is foreseen). The key questions facing regulatory bodies in the country of origin and destination were identified as illustrated in Fig. 2.

Figure 2. Key issues for clarifying regulatory conditions for transfrontier shipment of NORM wastes



Question 1

If the equipment to be transferred is considered to be waste in both countries, international agreements and requirements related to the transfrontier shipment of wastes apply. If the material to be transferred is considered to be waste in one country and not in the other, then the situation may be more complex.

Questions 2 & 3

If the equipment contains NORM, it is necessary to determine the activities involved in order to determine whether the waste is subject to regulatory provisions for radioactive substances. In the event that activity concentrations exceed exemption levels specified in the country of origin, then the materials will be subject to regulatory controls and the competent authority will have information available on which to make decisions about the suitability of transboundary transfer and disposal routes. If, however, the material contains activity concentrations less than those specified by exemption levels in the country of origin, the relevant competent authority would have no such information. This becomes an issue if the exemption levels in the destination country are lower than those in the country of origin.

In this context, it may be seen from the related paper (Stackhouse et al, 2012) that there are potential inconsistencies between the application of exemption criteria for NORM between the UK and Norway. In Norway, wastes with activity concentrations exceeding 1 Bq/g will be regulated, and specific requirements for disposal will be applied depending on activity. In the UK, exemption levels of 5 or 10 Bq/g may apply, depending on the level of assessment provided to the authorities. The UK authorities will not have information available about quantities and movements of wastes with activity concentrations in the range of 1 – 5 Bq/g, which would be subject to regulation in Norway. A possible solution may be to require notification of large-scale quantities of materials (e.g. whole platforms), even at exempt levels. The implications of these differences are being investigated further.

Questions 4 & 5

The disposal options available for NORM wastes varies with level of radioactivity present and depending on the national legislation and policies in different countries. In considering whether it is reasonable to export or import NORM containing materials and wastes, it is

necessary to consider the international and national policies for the disposal or return of wastes.

Government policy in the UK on the long-term management of low level radioactive waste (DECC, 2007) specifies that the export of LLW to other OECD (Organisation for Economic Co-operation and Development) and EU (European Union) countries may only be authorised or consented to by the competent UK authority in light of an assessment of all practicable options, and should not be permitted except:

- for the recovery of re-useable materials; OR
- for treatment that will make its subsequent storage and disposal more manageable.

In all cases where such processes would add materially to the wastes needing to be disposed of in the country of destination, the presumption should be that they will be returned to the UK, to a timescale agreed by regulators and competent authorities (as defined in the Transfrontier Shipment Regulations) in the UK and in the country of destination. The import of LLW from other countries may also be authorised on similar reciprocal terms.

Import or export of radioactive waste (including NORM wastes) to or from Norway requires a licence. The Regulation relating to the application of the Pollution Control Act on radioactive pollution and radioactive waste gives quite specific requirements for when a license may be given (Norwegian Ministry of Environment 2011). For instance under the arrangements, export of radioactive waste would only be possible in the event that this action was necessary to achieve an environmentally secure solution. Given that Norway has established an engineered facility for NORM waste, it would be difficult to make a case for export.

Work in Progress

The working group is now working towards developing practical processes for the transboundary shipment of NORM wastes from the oil and gas industry in the North Sea. In order to achieve this, it is seeking to establish robust arrangements for seeking either notification or consent between the countries of origin and destination.

The group also is working towards developing guidance to oil and gas companies on the requirements and procedures associated with the movement of NORM wastes between different countries in the North Sea area. This will include information about what is considered to be waste, the organisations and criteria involved and flow charts of issues will need to be considered for each of the different scenarios and countries involved.

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