OSPAR COMMISSION

Discharges of Radionuclides from the Non-nuclear Sectors in 2012

Radioactive Substances Series

2014

OSPAR Convention

The Convention for the Protection of the Marine Environment of the North-East Atlantic (the "OSPAR Convention") was opened for signature at the Ministerial Meeting of the former Oslo and Paris Commissions in Paris on 22 September 1992. The Convention entered into force on 25 March 1998.

The Contracting Parties are Belgium, Denmark, the European Union, Finland, France, Germany, Iceland, Ireland, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Convention OSPAR

La Convention pour la protection du milieu marin de l'Atlantique du Nord-Est, dite Convention OSPAR, a été ouverte à la signature à la réunion ministérielle des anciennes Commissions d'Oslo et de Paris, à Paris le 22 septembre 1992. La Convention est entrée en vigueur le 25 mars 1998.

Les Parties contractantes sont l'Allemagne, la Belgique, le Danemark, l'Espagne, la Finlande, la France, l'Irlande, l'Islande, le Luxembourg, la Norvège, les Pays-Bas, le Portugal, le Royaume-Uni de Grande Bretagne et d'Irlande du Nord, la Suède, la Suisse et l'Union européenne.

Acknowledgement

This report has been prepared by the Expert Assessment Panel of the OSPAR Radioactive Substances Committee, comprising of Mr Henning Natvig (convenor), Norway, Mr Michel Chartier, France, Ms Inge Krol, Germany and Mr Andy Mayall (United Kingdom) with the support of Ms Luisa Rodriguez Lucas and Ms Corinne Michel of the OSPAR Secretariat.

Contents

Executive summary

Annual data collection by OSPAR on discharges from the non-nuclear sector has only been taking place since 2006 (collecting data from 2005). Due to the incompleteness of datasets, no data have been published until 2009. This is the sixth annual report and assessment of discharges from the non-nuclear sector published by OSPAR.

The 2012 data reported by Contracting Parties were sufficient to make an assessment of discharges from the offshore oil and gas sub-sector, which is the major non-nuclear source. It is also possible to judge the relative contribution from the medical sub-sector. Only sparse data are available for the other non-nuclear sub-sectors (universities and research, radiochemical manufacturing and various others), but they are considered to be of minor importance.

The radionuclides reported from the offshore oil and gas industry are: Ra-226, Ra-228, Pb-210, discharged via produced water. The data are converted into total alpha and total beta (excluding tritium) activity in order to be able to compare the magnitude with discharges from other sectors.

In 2013, it has been agreed that a baseline could be established for Ra-226 and Ra-228 based on reported discharge data from 2005 – 2011 although a baseline for Pb-210 had not been considered, as datasets available needed further examination.

The offshore oil and gas sub-sector is the principal source of total alpha discharges, accounting for 97,9% of the total. This sub-sector also makes an 12,6 % contribution to the overall total beta from all sectors (nuclear and non-nuclear). In total, the non-nuclear sector contributed an estimated 55 % of the total beta discharges from all sectors, with the largest single contribution (41.6 %) coming from the iodine-131 discharges from the medical sub-sector. Tritium discharges from the non-nuclear sector are insignificant in comparison with those from the nuclear sector.

Récapitulatif

Le recueil annuel, par OSPAR, des données sur les rejets provenant du secteur non-nucléaire n’a lieu que depuis 2006 (recueil des données de 2005). Aucune donnée n’a été publiée avant 2009, les séries de données étant jusque-là incomplètes. Il s’agit donc du sixième rapport annuel, et évaluation, des données sur les rejets provenant du secteur non nucléaire publié par OSPAR.

Les données de 2012, notifiées par les Parties contractantes, sont suffisantes pour permettre une évaluation des rejets provenant du sous-secteur pétrolier et gazier offshore, qui représente la source principale non nucléaire. Il est également possible d’évaluer la contribution relative du sous-secteur médical. On ne dispose que de données clairsemées pour les autres sous-secteurs non nucléaires (universités et recherche, industrie radiochimique et divers autres), mais on les considère de peu d’importance.

Les radionucléides notifiés, provenant de l’industrie pétrolière et gazière d’offshore, sont les Ra-226, Ra-228, et Pb-210, rejetés avec l’eau de production. Les données sont converties en activité alpha total et activité bêta total (à l’exception du tritium) afin de pouvoir en comparer la magnitude avec les rejets provenant d’autres secteurs.

En 2013, il a été convenu qu'une ligne de base pouvait être établie pour le Ra-226 et le Ra-228 sur la base des données de rejet notifiées à partir de 2005-2011, bien qu’aucune ligne de base n'ait été envisagée pour le Pb-210, car les ensembles de données disponibles doivent faire l'objet d'un examen supplémentaire.

Le sous-secteur de l’industrie pétrolière et gazière d’offshore est la source principale de rejets d’alpha total représentant 97,9 % du total. La contribution de ce sous-secteur aux rejets de bêta total provenant de tous les secteurs (nucléaires et non nucléaires) s’élève à 12,6 %. Au total, le secteur non-nucléaire contribue à une quantité estimée représentant 55 % des rejets de bêta total provenant de tous les secteurs, la contribution unique la plus importante (41,6 %) provenant des rejets d’iodine-131 par le sous-secteur médical. Les rejets de tritium provenant du secteur non-nucléaire sont négligeables par rapport à ceux du secteur non nucléaire.

1. Introduction

Work to prevent and reduce pollution from ionising radiation in the North-East Atlantic was first undertaken within the framework of the former 1974 Convention for the Prevention of Marine Pollution from Land-based Sources (the “Paris Convention”) and then under the 1992 Convention for the Protection of the Marine Environment of the North-East Atlantic (the “OSPAR Convention”), which replaces the Paris Convention and establishes the OSPAR Commission.

At the first Ministerial Meeting of the OSPAR Commission (20-24 July 1992, Sintra, Portugal) an OSPAR Strategy for Radioactive Substances was adopted to guide the future work of the OSPAR Commission on protecting the marine environment of the North-East Atlantic against radioactive substances arising from human activities. This strategy was revised at the third Ministerial Meeting of the OSPAR Commission (23-24 September 2010, Bergen, Norway), where the Strategy of the OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic 2010-2020 (the “North-East Atlantic Environment Strategy”) was adopted.

The North-East Atlantic Environment Strategy sets out OSPAR’s vision, objectives, strategic directions and action for the period up to 2020. In Part I, the new Strategy gives prominence to the overarching implementation of the ecosystem approach and the need for integration and coordination of OSPAR’s work across themes and groups. In Part II, the Strategy provides its thematic strategies for Biodiversity and Ecosystems, Eutrophication, Hazardous Substances, Offshore Oil and Gas Industry and Radioactive Substances.

The Radioactive Substances thematic Strategy (Radioactive Substances Strategy) sets the objective of preventing pollution of the OSPAR maritime area from ionising radiation through progressive and substantial reductions of discharges, emissions and losses of radioactive substances, with the ultimate aim of concentrations in the environment near background values for naturally occurring radioactive substances and close to zero for artificial radioactive substances. In achieving this objective the following issues should, *inter alia*, be taken into account: (1) radiological impacts on man and biota, (2) legitimate uses of the sea, and (3) technical feasibility.

As its timeframe, the Radioactive Substances Strategy further declares that the OSPAR Commission will implement this Strategy progressively by making every endeavour, through appropriate actions and measures to ensure that by the year 2020 discharges, emissions and losses of radioactive substances are reduced to levels where the additional concentrations in the marine environment above historic levels, resulting from such discharges, emissions and losses, are close to zero.

The Radioactive Substances Strategy provides that in accordance with the provisions of the OSPAR Convention and the findings of the Quality Status Report 2010, the OSPAR Commission will, where appropriate, develop and maintain programmes and measures to identify, prioritise, monitor and control the emissions, discharges and losses of the radioactive substances caused by human activities which reach, or could reach, the marine environment.

To this end, the Radioactive Substances Strategy requires the OSPAR Commission to continue the annual collection of data on discharges from the non-nuclear sector. Regular reporting is therefore required in order to review progress towards the targets of the Radioactive Substances Strategy.

The OSPAR Commission adopted in 2005 a set of reporting procedures to be used for annual reporting of data on discharges from the non-nuclear sector which were updated in 2013 (OSPAR Agreement number 2013-11). Trial runs of reporting made in accordance with the procedures were conducted in 2006 and 2007 with data from 2004 and 2005. Both these datasets and the 2006 data reported in 2008 were incomplete and could not be published. This report presents and assesses the 2012 data, and for the offshore oil and gas sector, also presents the total discharges from 2005 to 2012.

This report includes an estimate on uncertainty (given as +/- numerical values after the value of discharged water) for Ra-226, Ra-228 and Pb-210 for the oil and gas sectors. The estimate was requested by the Expert Assessment Panel so that they can report on discharge data measurement uncertainty.

An overview of potential non-nuclear sources of radioactive discharges is given in Table 1 below.

Table 1

Non-nuclear sectors with the potential to discharge radioactive substances to the OSPAR maritime area

Contracting Party	Oil/gas extraction (inc. on-shore)	Phosphate Industry	Titanium-Dioxide Pigment	Steel	Rare Earth	Medical	Universities and Research Centres	Radio chemical production
Belgium	Not present	Present	Present	Present	Not present	Present	Present	?
Denmark	Present	Present	Not present	Not present	Not present	Present	Present	?
Finland	Not present	Present	Present	Present	Not present	Present	Present	?
France	Present	Present	Present	Present	Present	Present	Present	?
Germany	Present	Not present	Present	Present	Not present	Present	Present	?
Iceland	Not present	Not present	Not present	Not present	Not present	Present	Present	?
Ireland	Present	Not present	Not present	Not present	Not present	Present	Present	Not present[1]
Luxembourg	Not present	Not present	Not present	Present	Not present	Present	Present	?
Netherlands	Present	Present	Present	Present	Not present	Present	Present	?
Norway	Present	Not present	Present	Present	Not present	Present	Present	?
Portugal	Not present	Present	Not present	Present	Not present	Present	Present	?
Spain	Present	Present	Present	Present	Not present	Present	Present	Not present
Sweden	Not present	Not Present	Not present	Not Present	Not present	Present	Present	?
Switzerland	Not present	Not present	Not present	Not Present	Not present	Present	Present	Present (GTLD manufacture)
United Kingdom	Present	Not present	Present	Present	Present	Present	Present	Present

[1] Fluorine (F-18) is produced in Ireland for Positron Emission Tomography (PET). However, F-18 has a half life of 109,8 minutes and so is not reported.

2. Assessment of the radioactive discharges from non-nuclear sources in 2012

2.1 Introduction

RSC 2004 agreed that Contracting Parties (CPs) should report the discharges from their non-nuclear sub-sectors annually using the agreed reporting template. The data for 2012 have been reported in accordance with the Revised Reporting Procedures for Discharges of Radioactive Substances from Non-Nuclear Sectors. Data has been collected for the years from 2005 to 2012. Not all CPs have provided data, for 2012: 6 out of 8 CPs reported for oil/gas; 8 CPs reported on their university and research; and, 7 CPs reported on their medical sector. The number of CPs reporting and the completeness of the reports seem to have reached a plateau somewhere short of 100%.

There is sufficient data to make an assessment for 2012. The reports for produced water discharges from the oil/gas sub-sector cover the major contributions and, although incomplete, it is possible to judge the relative contribution from the medical sub-sector. Other sub-sectors are either well reported or make relatively insignificant contributions.

It has been necessary to estimate certain discharges from incomplete data – consequently care needs to be taken in using this assessment report for purposes other than those envisaged by OSPAR RSC. In this assessment report the term “total beta” means total beta (excluding tritium) – the full definition is used in headings, but the abbreviation is used in the text.

2.2 Discharges from the oil/gas sub-sector

Data was provided by Norway, Netherlands, UK, Ireland, Germany and Denmark. The total discharges of the three nuclides Ra-226, Ra-228 and Pb-210 from this sub-sector in 2012 was 1.78 TBq, an increase of 0.2 TBq from the previous year. The discharges of Ra-226 increased with 0.9 TBq and the discharges of Ra increased with 0.62 TBq relative to the 2011 numbers. The UK, Norway and the Netherlands are the principal contributors, and in 2012 the relative contributions, based on produced water activities, were: Norway 43 %, UK 37 %, Netherlands 17 %. The Danish contribution was about 3 %. The other CPs reported amounted less than 0.2 %. The relative contributions from Norway decreased with about 6 % compared with 2011 while the relative contributions from UK and Netherlands increased with about 4.5 % and 2.5 % respectively. There is an unknown, but probably minor, contribution from the other 2 CPs with an oil/gas industry. Five of the CPs have included estimates of uncertainty for discharges of radioactive substances with produced water. Ireland noted that all the numbers were below the detection limits. The methods for calculating uncertainty in the five CPs are, however, not described in their notes. A baseline for discharge of Ra-226 and Ra-228 nuclides from the oil and gas sub-sector was established based on the reported discharges in the years 2005 – 2011 to evaluate if there is a trend in the yearly total discharges of these radionuclides from the oil and gas sub-sector. The assessments below are based on produced water discharge data. The data on scale discharges are improving, but they are very small compared to the produced water contribution.

Total alpha and total beta discharges from produced water have been estimated based on reported measured values for Pb-210, Ra-226 and Ra-228 and using the formulae agreed at RSC to include contributions from key radioactive daughter products in the respective decay chains.

Although the formulae for calculating the total alpha and total beta discharges from the oil/gas sub-sector were derived so that comparison could be made with the equivalent discharges from the nuclear sector, it should be remembered that total alpha and total beta discharges for the oil/gas sector are estimated values, rather than directly measured values. To that extent they differ from the measured values reported for the nuclear sector.

a) total alpha from produced water discharges

The agreed formula for the calculation of total alpha discharges from produced water is:

Total alpha (TBq) = (5xRa-228)+(4xRa-226)+(1xPb-210).

The formulae assume equilibrium in these decay chains at the time of discharge.

The total alpha discharges, not including scale, are given below; for comparison the reported radium-226 and the equivalent nuclear contributions are also illustrated.

Total alpha 2005-2012

	Oil/gas		[**Nuclear**]
	Total alpha	[**Ra-226**]	[**Total alpha**]
2005	6.4 TBq	[0.81 TBq]	[0.52 TBq]
2006	6.9 TBq	[0.78 TBq]	[0.34 TBq]
2007	7.4 TBq	[0.90 TBq]	[0.19 TBq]
2008	6.76 TBq	[0.82 TBq]	[0.17 TBq]
2009	7.4 TBq	[0.94 TBq]	[0.18 TBq]
2010	7.6 TBq	[1.03 TBq]	[0.18 TBq]
2011	7.6 TBq	[0.95 TBq]	[0.17 TBq]
2012	8.0 TBq	[1.05 TBq]	[0.19 TBq]

There is a large number (>100) of offshore installations contributing to this total, but it is understood that approximately 16 % arises from just two installations in the Troll Oilfield in the Norwegian sector of the North Sea.

b) total beta (excluding tritium) from produced water discharges

The agreed formula for the calculation of total beta discharges from produced water is:

Total beta (TBq) = (4xRa-228)+(2xRa-226)+(2xPb-210)

The formulae assume equilibrium in these decay chains at the time of discharge.

The total beta discharges, not including scale, are given below; for comparison the equivalent nuclear contributions are also illustrated.

Total beta (excluding tritium) 2005-2012

	Oil/gas	[Nuclear]
2005	4.25 TBq	[160 TBq]
2006	4.67 TBq	[58 TBq]
2007	4.94 TBq	[33.4 TBq]
2008	4.54 TBq	[27.2 TBq]
2009	5.02 TBq	[29.8TBq]
2010	4.94 TBq	[23.1 TBq]
2011	5.03 TBq	[25.9 TBq]
2012	5.2 TBq	[20.1 TBq]

As mentioned above a baseline for the discharges of Ra-226 and Ra-228 was established to evaluate if there is a trend in total alpha; a baseline for Pb-210 also needs to be established. It is therefore too early to establish if there are any trends in the level of total alpha and total beta discharges from this sub-sector.

c) Tritium

Tritium is used as a tracer in the oil industry, and 0.01 TBq was used in the Norwegian sector during 2011. This is about half of the 2011 number. The nuclear industry discharges of tritium are more than one and a half million times higher than this.

2.3 Medical sub-sector

RSC originally agreed that iodine-131 and technetium-99 (arising from the decay of the medical product technetium-99m) should be reported from the medical sub-sector. At RSC 09 it was decided that so little technetium-99 was generated from the medical use of technetium-99m that data collection for technetium-99 could cease, and consequently no data has provided for the years after 2009.

Reporting of iodine-131 discharges is not required where delay tanks are used to deal with liquid effluents.

a) total alpha discharges

No alpha emitting radionuclides are reported from this sub-sector.

b) total beta (excluding tritium) discharges

The reported yearly discharges of iodine-131 over the period have been in the range 16 TBq to 21 TBq. In 2010 there was an increase in the discharges from the medical sector and the sum of data provided amounts to 26 TBq. In 2011 the total reported discharges of Iodine-131 were 22 TBq and in 2012 there was a further decrease in the discharges to 14.5 TBq. The total amount reported is however an under-estimate of the total discharges, as not all CPs reported. Iodine-131 is widely used in medicine, and in Europe its use is assumed to be approximately proportional to population. In the absence of data from CPs on their populations living on the NE Atlantic watershed/catchment area, a very rough estimate has been made to allow for those CPs that did not report their medical discharges; the actual discharge of iodine-131 is likely to be 18.5 + 5 TBq/y. This is about 1.8 TBq lower than the discharges of total beta from the nuclear industry, which in 2012 amounted to 20.1 TBq.

2.4 University and research sub-sector

It is difficult to make an assessment of the discharges from this sector as reporting is very variable. From the data that has been provided it has been possible to conclude that this sector is not a significant contributor to total beta (< 0.2 TBq/y) or tritium (< 0.5 TBq/y) and there are no reported alpha emitting radionuclide discharges.

2.5 Radiochemical manufacturing sub-sector

Radiochemical manufacturing is carried out in several of the Contracting Parties, however only the UK and Switzerland have reported separately on this sub-sector in 2012. The discharges from this sub-sector are usually included in those for the nuclear site on which the processes are carried out. The data below reflects the discharges from UK and Switzerland.

a) total alpha

The reported total alpha discharge for 2012 was 9.3 MBq. This is a very minor contribution to the overall total alpha discharge to the maritime area.

b) total beta (excluding tritium)

The sum of the reported beta emitters plus the reported total beta during 2012 amounts to 0.1TBq, which is half of the discharges the previous year and is a minor contribution of the total beta discharges to the marine environment. The discharges are principally due to discharges of carbon-14.

c) tritium

In 2012 tritium discharges amounted to 0.2 TBq, This is the same amount as the previous year. The UK contribution decreased from 0.165 TBq in 2011 to 0.01 TBq in 2012. These discharges represent a minor contribution to tritium discharges; nuclear sector discharges of tritium are nearly 80 000 times greater than this. However, this discharges of tritium is in the form of tritium labelled organic compounds, which have significantly different environmental pathways/fates to that of tritiated water, as discharged by the nuclear industry, and cannot be compared directly.

2.6 Other non-nuclear sub-sectors

Discharges were reported for the phosphate industry and titanium dioxide pigment manufacture. None of these sub-sectors made a significant contribution to the overall discharges of total alpha, total beta or tritium.

2.7 Summary and conclusions

For 2012 the overall summary including comparison with the nuclear sector is shown below:

Non-nuclear sector (TBq)						**Nuclear sector (TBq)**
	Oil/gas	Medical	Univ/R&D	Radiochem	Total	
Total alpha	8.5	-	-	-	8.5	0.19
Total beta	5.62	18.5 + 5*	0.17	0.1	24.4 + 5	20.1
Tritium	0.01	-	0.31	0.17	0.5	15856

* estimate based on 14.5 TBq reported by 7 Contracting Parties

The oil/gas sub-sector is the principal source of total alpha discharges, accounting for 97.9 % of the total. This sub-sector also makes a 12.6 % contribution to the overall total beta from all sectors (nuclear + non-nuclear). In total, the non-nuclear sector contributed an estimated 55 % of the total beta discharges from all sectors, with the largest single contribution (41.6 %) coming from the iodine-131 discharges from the medical sub-sector. Tritium discharges from the non-nuclear sector are insignificant in comparison with those from the nuclear sector.

3. 2012 data and information

In this section of the report, data and information on discharges from the non-nuclear sectors are presented for each Contracting Party.

The columns, headings and abbreviations used in the tables correspond to the reporting requirements set out in the reporting format (OSPAR Agreement number 2013-11). The following abbreviations for radionuclides (elements) are used in the tables:

C:	Carbon	Po:	Polonium
Cr:	Chromium	Ra:	Radium
H-3:	Tritium	S:	Sulphur
I:	Iodine	Th:	Thorium
P:	Phosphorus	Pu:	Plutonium
Pb:	Lead		

3.1 Data reported on discharges from the offshore oil and gas industry

Contracting Parties have been invited to report the estimated discharges from offshore installations of radioactive substances:

a. in produced water (Pb-210, Ra-226, Ra-228);

b. from descaling and decommissioning operations (Pb-210, Ra-226, Ra-228, Th-228);

c. from tracer experiments (H-3, other beta and gamma emitters).

Table 3.1 shows the data from the offshore oil and gas industry.

Table 3.1. Discharges from the offshore oil and gas industry in 2012, in terabecquerel (TBq). Shaded boxes are not applicable.

		CP	OSPAR Region [1]	Pb-210	Ra-226	Ra-228	Th-228	H-3	Other b/g emitters
Produced water, TBq [(DE1 - DE3) (NL1 - NL3) (NO1 - NO6) (IE1) (ES1) (UK1 - UK5)]		DK	II	1.29E-02	3.35E-02	1.35E-02			
		DE	II	1.10E-05	4.14E-04	2.60E-05			
		IE	III	1.40E-06	2.04E-06	3.56E-07			
		NL	II	9.20E-03	9.80E-02	1.20E-01			
		NO	I	5.39E-03	5.71E-02	4.57E-02			
		NO	II	3.71E-02	3.80E-01	3.27E-01			
		UK	II	1.35E-02	3.82E-01	2.24E-01			
		UK	III	3.00E-04	1.03E-01	4.00E-04			
Descaling operations, both offshore and onshore, from normal production that leads to discharges [(UK6)]	Radioactivity in suspended solids arising from water-jet descaling (TBq)	NO	II	1.58E-06	5.59E-06	2.26E-06			
		UK	II	2.62E-05	1.57E-03	4.35E-05	2.41E-05		
	Radioactivity in solution as a result of descaling using acids or scale dissolvers (TBq) [(UK7)]								
Descaling operations, both offshore and onshore, from decommissioning of oil and gas installations that leads to discharges [(UK8)]	Radioactivity in suspended solids arising from water-jet descaling (TBq)	NO	II	3.19E-08	1.13E-08	1.39E-08			
		UK	II						
	Radioactivity in solution as a result of descaling using acids or scale dissolvers (TBq)								
Radioactivity discharged as a result of tracer experiments (TBq) [(UK9)]		NO	I					8.40E-03	
		NO	II					3.40E-03	
		UK	II						
Total discharged radioactivity, TBq [(UK10)]									

Further details on the data reported in Table 3.1 are given below.

1. The five OSPAR sub-regions are:

   (I) The Arctic,

   (II) The Greater North Sea (including the English Channel),

   (III) The Celtic seas,

   (IV) The Bay of Biscay/Golfe de Gascogne and Iberian coastal waters, and

   (V) The wider Atlantic.

   The definitions of these and a map are given in the Strategy for the Joint Assessment and Monitoring Programme.

Denmark

DK1 Uncertainty for Pb-210: +/- 0,00324

DK2 Uncertainty for Ra-226: +/- 0,00754

DK3 Uncertainty for Ra-228: +/- 0,00324

Germany

DE1 Activity of Pb-210 in the produced water of Platform A6-A is lower than the MDA (minimal detectable activity). Total activity is lower than 11 MBq. Based on volume of produced water x MDA.

DE2 Uncertainty for Ra-226: +/- 3%.

DE3 Uncertainty for Ra-228: +/- 9%.

Ireland

IE1 Uncertainties in the discharges were not quoted as all the radioactivity measurements were below detection limits.

The Netherlands

NL1 Uncertainty for Pb-210: [+/- 0,00092

NL2 Uncertainty for Ra-226: +/- 0,0098

NL3 Uncertainty for Ra-228: +/- 0,0124

Norway

NO1 Uncertainty for Pb-210, Region I: +/- 0,005

NO2 Uncertainty for Ra-226, Region I: +/- 0,012

NO3 Uncertainty for Ra-228, Region I: +/- 0,009

NO4 Uncertainty for Pb-210, Region II: +/- 0,037

NO5 Uncertainty for Ra-226, Region II: +/- 0,069

NO6 Uncertainty for Ra-228, Region II: +/- 0,057

Spain

Two Spanish offshore gas production platforms are located in the OSPAR area. One of them produces gas and the other is only used to store gas. According to the current Spanish legislation (Royal decree adopted in 2000 under Article 32 of the Law on Hydrocarbons) no discharges are allowed from offshore installations. Produced water is re-injected or treated onshore. Therefore, no radioactive substances in produced water and scale are discharged to the marine environment.

United Kingdom

UK1 Around 98-99% of the data in Table 3 arises from discharges to the North Sea (OSPAR sub-region II). In 2012, two operators reported discharges to OSPAR Region III of Ra-226 (0,103 TBq), Ra-228 (0,0004 TBq) and Pb-210 (0,0003 TBq).

UK2 The total activity of each radionuclide analysed per installation was calculated using the activity concentrations provided in EEMS and multiplying by the mass of particulate and solution for the produced water discharged over the period. The total activity provided in the report is based on the sum of the average activity for each of the specified radionuclides per installation.

UK3 The uncertainty values presented Table 3 were derived by subtracting the average activity concentration values (Bq/g) from the upper limit activity concentration (Bq/g) for combined dissolved and particulate fractions of produced water samples collected during 2006-2008. It should be noted in addition to the uncertainty presented in Table 3, it is estimated that between 30% (of the total dissolved activity) and 70% (of total particulate activity) of the reported discharges for Ra-226 and Ra-228 were derived from data that are below detection limits (LoD); around 90% of reported Pb-210 discharges are derived from below LoD measurements. This is likely to have resulted in overestimation of annual discharges reported by the UK oil and gas industry.

Uncertainty for Pb-210: +/- 0,002

Uncertainty for Ra-226: +/- 0,022

Uncertainty for Ra-228: +/- 0,019

UK4 There is no information currently collected on the amount of Pb-210 in produced water. The figure for Pb-210 in produced water is derived from the analysis of Po-210 by assuming that Pb-210 and Po-210 are in secular equilibrium.

UK5 The figure for Ra-228 is determined from the reported activity of Ac-228 in EEMS on the assumption that Ac-228 and Ra-228 are in secular equilibrium.

UK6 Discharges of 0,0014 TBq total alpha and 0,0009 TBq total beta/gamma (excluding tritium) from onshore descaling were reported to the statutory regulators during 2012. The data in the main table reflects the activity from scale only. In previous years, some data relating to activity in sand may have been included.

UK7 A protocol for discharges resulting from use of acids/dissolvers is yet to be developed. It is understood, however, that because the use of acids and scale dissolvers is less widespread, the activity discharged is primarily due to jet washing.

UK8 No operator reported discharges of scale from decommissioning operations during 2012.

UK9 The data generally provided under this heading is the amount of the particular tracer administered. No operator reported carrying out tracer experiments during 2012.

UK10 The total figures given in the report are for the contributions due to produced water and activity in discharges from offshore descaling activities (for both normal and decommissioning operations, as appropriate).

3.2 Data reported on discharges from other non-nuclear sectors

Contracting Parties have been invited to report the estimated discharges from the following other non-nuclear sources of radioactive substances:

a. the medical sector (I-131);

b. universities and research centres (H-3, C-14, P-32, S-35, Cr-51, I-125);

c. phosphate industry (Pb-210, Po-210, Ra-226);

d. titanium dioxide pigment manufactures (Pb-210, Po-210, Ra-226, Ra-228);

e. primary steel manufacture (Pb-210, Po-210);

f. radiochemical production (H-3, C-14, S-35, Cr-51, I-125, Pb-210, Po 210).

Table 3.2 shows the data reported from non-nuclear sector other than offshore oil and gas.

Table 3.2. Discharges from non-nuclear sector other than offshore oil and gas in 2012, in terabecquerel (TBq). Shaded boxes are not applicable.

Sector	CP	OSPAR Region [1]	Discharges of specified radionuclides (TBq)														
			I-131	H-3	C-14	P-32	S-35	Cr-51	I-125	Pb-210	Po-210	Ra-226	Ra-228	Th-228	Am-241	Total Alpha	Total Beta/ Gamma
Medical Sector [(BE1) (DK1) (CH1) (NL1) (ES1) (UK1)]	BE	II	0.00E+00														
	CH	II	8.10E-03														
	DK	II	2.15E+00														
	IE	III	6.19E-01														
	IE	V	1.11E-01														
	NO	I	4.32E-01														
	NO	II	7.86E-01														
	SE	II	8.14E-01														
	UK	II	6.74E+00														
	UK	III	2.86E+00														
Universities & Research centres [(BE2) (IE1) (IE2) (LU1) (UK2)]	BE	II		5.79E-03	2.89E-03	0.00E+00	0.00E+00	0.00E+00	1.76E+00								
	CH	II		9.00E-03	1.40E-03												
	IE	III		7.57E-04	6.22E-04	1.76E-06	2.60E-14	0.00E+00	1.05E-04								
	IE	V		2.90E-06	0	7.40E-05	0	0	0								
	LU	II		2.00E-04	1.50E-04	5.00E-06	4.00E-06		2.50E-05								
	NO	I		1.92E-04	7.09E-06	1.00E-07	0.00E+00	0.00E+00	3.00E-06								
	NO	II		3.86E-05	1.33E-05	1.00E-06	5.00E-08	2.00E-06	3.00E-12								
	ES	V		1.94E-03	9.20E-04	4.63E-03	2.82E-02	1.11E-03	7.30E-04								
	SE	II		6.00E-04	1.20E-04	1.54E-04	4.00E-06	1.00E-04	1.00E-04								
	UK	II		4.65E-02	7.40E-02	1.84E-02	1.88E-02	1.82E-03	3.44E-02								
	UK	III		2.47E-01	9.81E-03	3.15E-03	4.42E-03	4.30E-05	2.65E-04								
Phosphate industry [(BE3) (ES2) (UK3)]	NL	II															
Titanium dioxide pigment manufacturers [(ES3) (UK4)]	NL	II								3.70E-03	3.70E-03	3.70E-03	1.30E-03				
	ES	IV								3.00E-05	3.00E-05	2.00E-05	<5.00E-03				
Primary steel manufacture [(BE4) (ES4) (UK5)]	NL	II															
Rare Earth [(BE5)(ES5)]	FR																
Radiochemical production [(CH2) (ES5)]	CH	II		2.37E-02													
	SE	II		1.35E-01	6.00E-03				3.00E-05								
	UK	II		1.13E-04	1.02E-01		n/d	2.65E-05	n/d	n/d	n/d					9.30E-06	1.04E-03
	UK	III		1.14E-02	1.01E-03		n/d	n/d	0.00E+00	n/d	n/d					n/d	n/d

Further details on the data reported in Table 3.2 are given below.

1. The five OSPAR sub-regions are:

   (I) The Arctic,

   (II) The Greater North Sea (including the English Channel),

   (III) The Celtic seas,

   (IV) The Bay of Biscay/Golfe de Gascogne and Iberian coastal waters, and

   (V) The wider Atlantic.

   The definitions of these and a map are given in the Strategy for the Joint Assessment and Monitoring Programme.

Belgium

BE1 I-131: Holding tanks are used to reduce concentrations of I-131 in the liquid discharges to below 10 Bq/l.

BE2 Holding tanks are used to reduce concentrations of P-32, S-35 and Cr-51.

BE3 Pb-210 and Po-210 are not monitored.

BE4 Belgium notes that release of Pb-210/Po-210 from the steel industry would rather affect atmospheric discharge.

BE5 There are no primary rare earth production in Belgium. Production only occurs on basis of recycling what makes a significant release of natural nuclides unlikely.

Denmark

DK1 Denmark has not collected data on releases of isotopes from the medical sector in 2012; the reported activities are calculated by projection of the data from 2010 and 2011.

Ireland

IE1 Region III: The significant decrease in C-14 discharges between 2011 to 2012 is due to the reduction in the discharges from one particular licensee from 5,1E-03 to 7,57E-04 TBq. In the past, this licensee had stockpiled significant quantities of C-14 waste originating from a particular hospital. As the continued storage of this waste was not a viable long-term option, RPII’s regulatory service has put pressure on this licensee to deal with this waste. It is likely that the majority of this waste has been disposed of in 2011, and in subsequent years we will continue to see significant reductions in the amount of C-14 being discharged by this licensee.

IE2 Region V: The discharges from the educational sector is likely to vary from year to year and is highly dependent on the specific research projects that are currently being undertaken by the colleges that use unsealed radionuclides. In this regard, almost all the discharges of P-32 originated in 2012 from one particular licensee, and between 2011 to 2012 their discharges decreased from 1,27E-04 to 7,4E-05 TBq.

Luxembourg

LU1 Discharges from research premises in Luxembourg are made into the Moselle, a tributary of the Rhine. The maximum activities estimated to be discharged annually are given.

The Netherlands

NL1 In the Netherlands, delay tanks are used. For the years prior to 2008, the reported estimate of discharges from the medical sector is based on the number of therapeutic and diagnostic procedures, reported to the RIVM institute by the hospitals in the context of a yearly survey, and the recommended activity per procedure.

Spain

ES1 There are holding tanks to reduce the concentration of I-131 in the liquid discharges to below 10 Bq/l.

ES2 Two plants process phosphates and produce both phosphoric acid and phosphate fertiliser. The residual phosphogypsum is piled and no radioactive liquid effluents are released into the river because the system works as a closed circuit.

ES3 There is only one titanium dioxide plant that is located on the South West coast. According to current Spanish legislation, NORM industries are not obliged to report on radioactive discharges. The provided activity values have been estimated from a study that is being carried out by the Sevilla and Huelva Universities. Therefore they are generic values.

ES4 According to the available information, in Spain there are no integrated steel plants. The Spanish steel making plants (conversion of pig iron to steel) operate a dry gas cleaning process and, for this reason, no discharges of Pb-210 and Po-210 take place.

ES5 Not present.

Switzerland

CH1 Discharges from holding tanks in hospitals.

CH2 Manufactures of gaseous Tritium Light Devices (GTLD) and tritium-labelling service of various organic compounds.

United Kingdom

UK1 Medical Sector: This sector has been interpreted as being hospitals, clinics and medically related laboratories. Only I-131 is required to be reported for this sector in 2012.

UK1 Universities and Research Centres: This has been interpreted to include all universities, educational establishments, medical research facilities and research institutes. This category also includes operators involved in pharmaceutical research and the manufacture of pharmaceuticals, as well as non-medical commercial laboratories (laboratories associated with medical activities are included in the Medical Sector). The percentage of the discharge due to the pharmaceutical, commercial laboratories and non-commercial (other) sectors from England and Wales and Scotland are as follows:

- **Table: Percentage contribution to universities & research sector discharges**

Radionuclide	Region II			Region III		
	Others[*]	Pharma-ceuticals	Laboratories	Others[a]	Pharma-ceuticals	Laboratories
H-3	74,2%	22,1%	3,7%	2,2%	97,8%	0,1%
C-14	2%	91,9%	6,0%	2,2%	83,9%	11,6%
P-32	98%	0,5%	1,4%	100%	0,0%	0,0%
S-35	81%	14,7%	4,2%	96,9%	3,1%	0,0%
Cr-51	98,9%	1,1%	0,0%	100%	0,0%	0,0%
I-125	19,4%	79,1%	1,6%	100%	0,0%	0,0%

[*] includes universities, educational establishments and medical research facilities

Due to the range of facilities, the method of estimation and origin is not uniform. Information from previous reviews suggests the majority of organisations determine discharges through direct measurement.

UK3 Phosphate Industry: No longer present in the UK.

UK4 Titanium Dioxide Industry: One operator reported discharges of total alpha and total beta/gamma (excluding tritium) in 2012, however these releases were in the form of transfers to the UK's Low Level Waste Repository at Drigg and are not required to be reported in the OSPAR reporting procedures.

UK5 Primary Steel Manufacturing: There are three primary steel manufacturing plants in the UK, two on the east coast of England (sub-region II) and one in Wales (sub-region III). However, the plants operate a dry gas cleaning process and any dust removed from the stack is either retained, recycled or sent to landfill. There are no liquid discharges arising from this process.

UK6 Rare Earth production: There is no rare earth production in the UK.

OSPAR COMMISSION

Victoria House
37-63 Southampton Row
London WC1B 4DA
United Kingdom

t: +44 (0)20 7430 5200
f: +44 (0)20 7242 3737
e: secretariat@ospar.org
www.ospar.org

OSPAR's vision is of a clean, healthy and biologically diverse North-East Atlantic used sustainably

ISBN: 978-1-909159-70-9
Publication Number: 637/2014