OSPAR COMMISSION

Protecting and conserving the North-East Atlantic and its resources

Annual report on discharges of radioactive substances from the non-nuclear sector in 2017

Radioactive Substances Series

2019

Draft Report on Discharges of Radionuclides from the Non-nuclear Sectors in 2017

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 Ms Mette Nilsen Norway, Mr Michel Chartier (Convenor) France, Mr Andy Pynn, United Kingdom, Ms Inge Krol, and Germany; and with the support of Miss Lucy Ritchie 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 were published until 2009.

The 2017 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. 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 assessment of 2017 data shows that there has been little variation since 2005 in discharges of the key radionuclides.

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.

Les données de 2017, 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. Des données sont disponibles pour les autres sous-secteurs non nucléaires (universités et recherche, industrie radiochimique et divers autres), mais ces son secteurs sont considérés comme étant d’importance mineure.

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. L'évaluation des données de 2017 montre qu'il y a eu peu de variations depuis 2005 dans les rejets des radionucléides principaux.

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 2016 data, and for the offshore oil and gas sector, also presents the total discharges from 2005 to 2017.

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	Not present
United Kingdom	Present	Not present	Present	Present	Not Present	Present	Present	Present

2 Assessment of the radioactive discharges from non-nuclear sources in 2016

1. Introduction

1. RSC 2004 agreed that Contracting Parties should report the discharges from their non-nuclear sub-sectors annually using the agreed reporting template. The data for 2016 have been reported in accordance with the Revised Reporting Procedures for Discharges of Radioactive Substances from Non-Nuclear Sectors. Data have been collected since 2005. A number of Contracting Parties (CPs) have provided non-nuclear discharge data for 2017: 6 out of 7 CPs reported for oil/gas; 6 CPs reported on their university and research; and 9 CPs reported on their medical sector.

2. There are sufficient data to make an assessment for 2017. 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.

3. 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

[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.

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. Discharges from the oil/gas sub-sector

4. Data were provided by Norway, the Netherlands, UK, Ireland, Germany and Denmark. The total discharges in 2017 of the three main radionuclides were radium-226 (Ra-226) 0,84 TBq, radium-228 (Ra-228) 0.76 TBq and lead-210 (Pb-210) 0.05 TBq; these are similar to data reported for 2016 and slightly higher than 2014 and 2015.

5. Figure 1 gives the discharges to sea of Ra-226, Ra-228 and Pb-210 for the years 2005–2017.

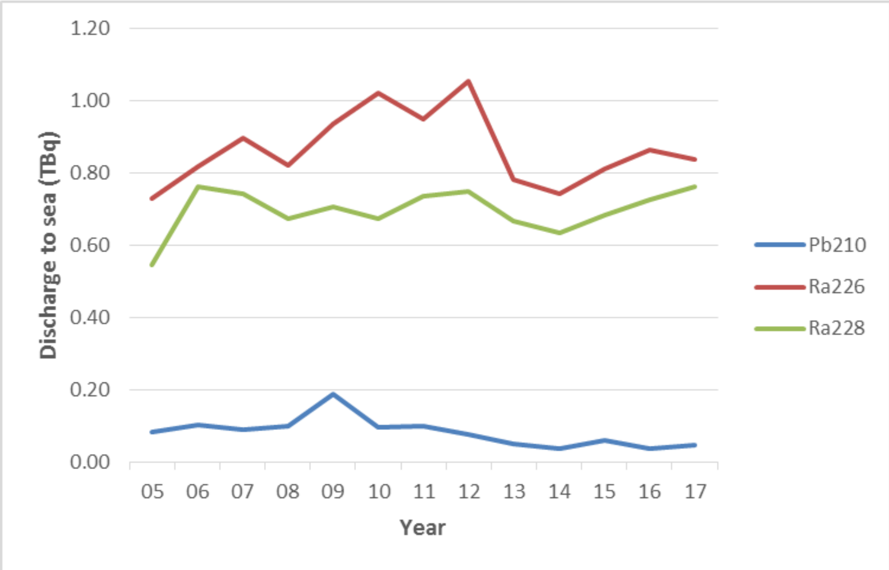

Figure 1: Discharges of Ra-226, Ra-228 and Pb-210 to sea in produced water from the oil/gas sub-sector 2005-2017

Figure 1 shows that there has been little variation since 2005 in discharges of the key radionuclides. The highest discharge of Ra-226 of 1.1 TBq occurred in 2012 and the highest discharge of Ra-228 was 0.76 TBq in 2006.

6. Norway, the UK and the Netherlands are the principal contributors, and in 2017 the relative contributions of discharges in produced water (using Ra-226 as an indicator), were Norway 45%, UK 38% and the Netherlands 11%. The discharges reported by Denmark, Germany and Ireland to about 3%.

8. 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 assumed to be in equilibrium in the respective decay chains. The results of the calculations are presented in Table 1 and Table 2 for total alpha and total beta respectively. The assessments are based on produced water discharge data only, while the quality of the data for discharges from descaling (during normal operations and decommissioning) is improving, the magnitude of discharge from these sources is very small compared to the produced water contribution.

9. The calculation of the total alpha and total beta discharges from the oil/gas sub-sector allows for the comparison of discharges with those from the nuclear sector. The total alpha and beta discharges given for the oil/gas sector are based on measurements of Ra-226, Ra-228 and Pb-210 and assuming, conservatively, that these are all in secular equilibrium with their decay products (see paragraphs 10-14).

a) Total alpha from produced water discharges

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

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

The formula assumes equilibrium in these decay chains at the time of discharge.

11. The total alpha discharges are given below in Table 1; for comparison the reported Ra-226 and the total measured alpha discharge from the nuclear sector are also illustrated.

Table 1: Total calculated alpha and Ra-226 discharges 2005-2017 in produced water from the oil and gas subsector. Total alpha from nuclear sector is presented for comparison (TBq)

Year	Oil/gas		Nuclear
	Total alpha	Ra-226	Total alpha
2005	6.4	0.81	0.52
2006	6.9	0.78	0.34
2007	7.4	0.90	0.19
2008	6.8	0.82	0.17
2009	7.4	0.94	0.18
2010	7.6	1.0	0.18
2011	7.6	0.95	0.17
2012	7.9	1.1	0.19
2013	6.5	0.78	0.20
2014	6.1	0.73	0.22
2015	6.7	0.80	0.23
2016	7.1	0.85	0.29
2017	7.2	0.84	0.22

12. While a large number (>100) of offshore installations contribute to the total alpha discharge, approximately 19% 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

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

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

The formula assumes equilibrium in these decay chains at the time of discharge.

14. The total beta discharges are given below in Table 2; for comparison the equivalent nuclear contributions are also illustrated.

Table 2: Total beta (excluding tritium) discharges 2005-2017 in produced water from the oil and gas subsector. Total beta from nuclear sector is presented for comparison (TBq)

Year	**Oil/gas**	**Nuclear**
2005	4.3	160
2006	4.7	58
2007	4.9	33
2008	4.5	27
2009	5.0	30
2010	4.9	23
2011	5.0	26
2012	5.2	20
2013	4.3	21
2014	4.1	21[2]
2015	4.4	20
2016	4.7	22
2017	4.8	17

c) Tritium and other radionuclides

15. Tritium is used as a tracer in the oil industry, and 0.2 TBq was discharged by the Norwegian sector during 2017 in connection with data collection from exploration wells. The discharges are insignificant compared to the discharges from the nuclear industry.

3. Medical sub-sector

16. 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 2009 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.

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

[2] The data for 2013 and 2014 for nuclear industry are updated due to erratum in the nuclear report

a) Total alpha discharges

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

b) Total beta (excluding tritium) discharges (principally iodine-131)

18. The total reported discharge of iodine-131 for 2017 was 13 TBq, which was similar to previous years 2014 to 2016. Not all CPs reported discharges of iodine-131. Given that iodine-131 is widely used in medicine, it is assumed that the discharges from those CPs that did not report, and do not have delay tanks to allow for decay, is approximately proportional to population. The total discharge of iodine-131, including an estimate for non-reported discharges, in 2017 is 18 TBq. This discharge is of a similar order to the discharge of total beta from the nuclear sector, however iodine-131 is relatively short-lived (half-life = 8 days) compared to many beta-gamma emitting radionuclides discharged by the nuclear sector.

4. University and research sub-sector

19. It is difficult to make an assessment of the discharges from this sector as reporting is very variable. From the data that have been provided it is reasonable to conclude that this sector is not a significant contributor to total beta (<1TBq) or tritium (<1TBq) discharges and there are no reported alpha emitting radionuclide discharges.

5. Radiochemical manufacturing sub-sector

20. Radiochemical manufacturing is carried out in several of the Contracting Parties, however only the UK have reported separately on this sub-sector in 2016. The discharge is of the same order as the previous year. The discharges from this sub-sector in France are included with those from the Research and Development sub-sector due to co-location of sites.

a) Total alpha

21. There was no total alpha discharge reported for 2016.

b) Total beta (excluding tritium)

22. The total reported discharge of beta emitters during 2017 from this sub-sector was 0.14 GBq which was equal to the reported discharge for 2016. The discharge is a minor contribution of the total beta discharges to the marine environment. Of these discharges, all are reported as discharges of carbon-14.

c) Tritium

23. In 2017 the tritium discharge from this sub-sector amounted to 0.07 TBq, which was at a similar level as 2016, 2015 and 2013, whereas less tritium were reported in 2014. These discharges represent a minor contribution to tritium discharges in the OSPAR maritime area. These discharges of tritium are often in the form of tritium labelled organic compounds, which have different environmental pathways to that of tritiated water, which is the most common form of tritium discharged by the nuclear industry.

6. Other non-nuclear sub-sectors.

24. Discharges were also reported for titanium dioxide pigment manufacture and rare earth mineral production, neither of these sub-sectors made a significant contribution to the overall discharges of total alpha, total beta or tritium.

7. Summary and conclusions.

25. For 2017 the overall summary including comparison with the nuclear sector is shown in Table 3 below.

Table 3: Summary of discharges in 2017 from the non-nuclear sector and a comparison with the nuclear sector (TBq)[3]

	Non-nuclear					**Nuclear**
	Oil/gas	Medical	Univ/R&D	Radiochem	**Total**	
Total alpha	7.2	-	-	-	**7.2**	0.22
Total beta	4.8	18[4]	0.06	0.14	**23**	17
Tritium	0.2	-	0.52	0.07	**0.79**	1.6 E+4

26. The oil/gas sub-sector is the main source of total alpha discharges to the OSPAR area, accounting for about 97% of the total from all sectors (non-nuclear and nuclear). This sub-sector also makes a 10% 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% 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 Data and information 2017

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] Note that total alpha and total beta activities do not provide an accurate indication of radiological impact which depends on radionuclide specific properties.

[4] based on 15 TBq of iodine-131 reported by a number of Contracting Parties and an estimate for other relevant Contracting Parties.

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: data from the offshore oil and gas industry (shaded boxes indicate where reporting is 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)		DE	II	<4E-06	1.64E-04	2.40E-05			
		DK	II	0.00E+00	3.06E-02	1.15E-02			
		ES	IV	7.13E-06	2.43E-04	4.26E-04			
		IE	III	7.94E-07	9.37E-07	1.90E-07			
		NL	II	7.34E-03	9.26E-02	1.13E-01			
		NO	I	2.07E-03	3.52E-02	3.89E-02			
		NO	II	1.66E-02	3.54E-01	3.54E-01			
		UK	II	1.69E-02	3.23E-01	2.43E-01			
		UK	III	4.15E-03	3.11E-03	2.53E-03			
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	I	6.70E-09	4.30E-09	6.70E-09			
		NO	II	9.40E-07	1.27E-06	1.08E-07			
		UK	II	3.39E-06	1.89E-05	1.18E-05	7.29E-06		
	Radioactivity in solution as a result of descaling using acids or scale dissolvers (TBq)	DK	II	0.00E+00	1.97E-07	7.85E-08			
Descaling operations, both offshore and onshore, from decommissioning	Radioactivity in suspended solids arising from water-jet descaling (TBq)	NO	II	1.15E-06	1.94E-06	1.07E-06			
Radioactivity discharged as a result of tracer experiments (TBq)		NO	I					2.04E-01	
Total discharged radioactivity, TBq				4.71E-02	8.39E-01	7.63E-01	6.72E-05	2.71E-02	

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 Produced Water Uncertainty for Pb-210: +/- 9,73E-03;

DK2 Produced Water Uncertainty for Ra-226: +/- 1,16E-02

DK3 Produced Water Uncertainty for Ra-228: +/- 2,85E-03

Ireland

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

The Netherlands

NL1 Produced Water Uncertainty for Pb-210: +/- 10%

NL2 Produced Water Uncertainty for Ra-226: +/- 10%

NL3 Produced Water Uncertainty for Ra-228: +/- 10%

Norway

NO1 Area I Produced Water Uncertainty for Pb-210: +/- 3,19E-04

NO2 Area I Produced Water Uncertainty for Ra-226: +/- 1,07E-03

NO3 Area I Produced Water Uncertainty for Ra-228: +/- 1,1E-03

NO4 Area II Produced Water Uncertainty for Pb-210: +/- 1,27E-03

NO5 Area II Produced Water Uncertainty for Ra-226: +/- 5,05E-03

NO6 Area II Produced Water Uncertainty for Ra-228: +/- 5,05E-03

Table 3.2 reported from non-nuclear sector other than offshore oil and gas (shaded boxes indicate where reporting is not applicable)

Table 3.2. Discharges from non-nuclear sector other than offshore oil and gas in 2015, in terabecquerel (TBq). Shaded boxes are not applicable.

			Discharges of specified radionuclides (TBq)														
Sector	CP	OSPAR Region [1]	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	BE	II	0.00E+00														
	CH	II	5.50E-03														
	DK	II	1.48E+00														
	IE	III	5.68E-01														
	IE	V	9.29E-02														
	NO	I	1.68E-01														
	NO	II	8.03E-01														
	SE	II	8.00E-03														
	UK	II	7.02E+00														
	UK	III	2.48E+00														
Universities & Research centres	BE	II		1.02E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.75E-01								
	CH	II		2.96E-03	2.20E-04												
	CH	II		2.02E-02													
	ES	V		1,66 E-03	8,30 E-04	3,72 E-02	2,48 E-02	0,98 E-03	6,67 E-04								
	IE	III		2.96E-04	2.07E-05	0.00E+00	0.00E+00	0.00E+00	1.05E-04								
	IE	V		4.78E-05	1.85E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00								
	LU	II		2.00E-04	1.50E-04	5.00E-06	4.00E-06		2.50E-05								
	SE	II		4.40E-01	5.00E-03												
	UK	II		1.84E-02	3.56E-02	5.02E-03	6.75E-03	1.23E-03	1.56E-02								
	UK	III		4.05E-02	8.03E-04	2.05E-03	2.57E-03	1.10E-05	1.26E-01								
Titanium dioxide pigment manufacturers	BE	II										5.32E-03	1.28E-03				
	ES	IV								3.00E-05	3.00E-05	2.00E-05	<5.00E-03				
	NO	II								1.26E-06	8.90E-05	1.80E-07					
	NL	II											2.70E-03				
Rare Earth	FR	IV											3.96E-05	3.96E-05			

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 Medical sector: Holding tanks are used to reduce the concentration if I-131 in the liquid discharges to below 10 Bq/l.

BE2 Universities & Research centres: Holding tanks are used to reduce concentration of P-32, S-35 and Cr-51.

BE3 Phosphate industry: End of phosphate production in December 2013.

BE4 Pb-210 and Po-210 are not monitored in titanium dioxide pigment manufacturers.

BE5 According to our knowledge, release of Pb-210/Po-210 from the steel industry would rather affect atmospheric discharge.

BE6 There are no primary rare earth productions in Belgium. Production only occurs on basis of recycling what makes a significant release of natural nuclides unlikely.

Ireland

IE1 The discharges from the education and research sectors are likely to vary from year to year and are (1) highly dependent on the specific research projects that are currently being undertaken by the institutions that use unsealed radionuclides and (2) the disposal of unused materials held in storage.

IE2 This year, the discharges from the medical sector (I-131) were comparable to those observed in 2016.

Luxembourg

LU1 there has been no change in the data regarding the discharges of radioactive substances from the non-nuclear sectors and the data published in the last report therefore remain valid.

Netherlands

NL1 In the Netherlands, delay tanks may be used, and there is no requirement for detailed reporting. For the years prior to 2008, the reported estimate of discharges from the medical sector of the Netherlands 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.

Norway

NO1 Medical subsector:

Estimation of discharges of I-131 from hospitals for OSPAR reporting

2) Describe briefly the nature of discharges, including their origin and their essential physical and chemical properties. Describe briefly how the amounts of radioactivity discharged were estimated, explaining how the non-reporting of the discharges not reaching the reporting threshold have been handled.

The discharges of I-131 from hospitals have been calculated in the following way:

The (administrated activity* the number of administrations)*0,5*patients staying in the hospital %. The (administrated activity* the number of administrations)*0,3*patients going home %, when this is known. The (administrated activity* the number of administrations)*0,5, when it's unknown where the patients went after administration. The numbers are then combined for all the hospitals and treatments in the different regions, to provide the wanted output for the excel sheet.

For thyritoxikose it is assumed that all patients are leaving the hospital after administration. For therapy it is assumed that 100 % stays in the hospital.

The reduction in activity from 2016 to 2017 in region I is due to a reduction of patient receiving treatment from 74 patients in 2016 to 24 patients in 2017.

The reduction in activity from 2016 in region II is caused by a calculation error in 2016 (reported number for ablation was 1,7 TBq, but the correct number was 0,79 TBq).

Ablasjon sør for Ålesund i 2017				
sykehus	antall	gj.dose	100 %	
Bergen	**49**	4210,06122	206293	
OUS-Radium	96	3424	328704	
OUS-Riks	32	5905,125	188964	
sum			723961	MBq
			0,723961	TBq

Ablasjon nord for Ålesund i 2017							
sykehus	antall	gj.dose	100 %			NB! Tall i MBq	
Ålesund							
Bodø							
Trondheim							
Tromsø	24	5140	123360				
sum			123360	MBq			
			0,12336	TBq			

thyrotoxikose sør for Ålesund						inneliggende %
sykehus	antall	gj.dose	inne(50%)	ute(30)	ukjent(50)	
OUS-Ullevål	5	581		871,5	1452,5	ikke oppgitt
Stavanger	54	515		8343	13905	0 %
Ahus	75	584		13140	21900	0 %
Bergen	68	803		16381,2	27302	ikke oppgitt
Haugesund	18	700		3780	6300	0 %
Førde	23	850		5865	9775	4,50 %
OUS-aker				0	0	0 %
OUS-Radium	1	502		150,6	251	
OUS-Riks	43	554		7146,6	11911	0 %
Elverum	43	382		4927,8	8213	0 %
Lillehammer	12	370		1332	2220	ikke oppgitt
SiV -Tønsberg	26	638		4976,4	8294	ikke oppgitt
Kristiansand				0	0	0,00 %
Skien				0	0	0 %
Kalnes -Sykeh	15	490		2205	3675	0 %
VV - Drammen	49	642		9437,4	15729	0 %
sum			0	78556,5	130927,5	
				0,0785565		TBq

thyrotoxikose nord for Ålesund						Inneliggende %
sykehus	antall	gj.dose	inne(50)	ute (30)	ukjent(50)	
Molde	9	470		1269	2115	ikke oppgitt
Ålesund	22	428		2824,8	4708	0 %
Levanger	12	417		1501,2	2502	0 %
Bodø	14	602		2528,4	4214	ikke oppgitt
Trondheim	72	1541		33285,6	55476	3 %
Tromsø	18	616		3326,4	5544	0 %
summer			0	44735,4	74559	
				0,0447354		TBq

Spain

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

ES2 In 2011, one of the two Spanish plants producing phosphate fertilizers in the OSPAR area (Fertiberia) ceased the production of phosphoric acid by treating the phosphate rock with sulfuric acid (process in which phosphogypsum is generated). Since then the phosphoric acid to be used in the process is imported from Morocco. Additionally, the other plant (FMC Foret) was shutdown in 2012. Therefore, there is no production of phosphogypsum anymore.

ES3 There is only one titanium dioxide plant that is located on the South West coast. 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 not 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 Radiochemical production is not present in Spain.

Switzerland

CH1 Discharges from holding tanks in hospitals.

CH2 Swiss authorities require universities and research centres to use holding tanks to reduce concentration of P-32, S-35 and Cr-51 in liquid discharges.

CH3 Manufactures of gaseous Tritium Light Devices (GTLD) and tritium-labelling service of various organic compounds; it is therefore neither a university neither a research center but an industry, but as there is no “other sector” the discharge were also indicated in the sector “UNI_RC”.

United Kingdom

Table 3.3 Percentage contribution to universities and research sector discharges.

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

Percentage contribtuion to Universities and Reserch sector discharges						
Radionuclide	Region II			Region III		
	Others *	Pharmaceuticals	Laboratories	Others *	Pharmaceuticals	Laboratories
H-3	54.5%	43.0%	2.4%	8.7%	0.0%	91.3%
C-14	12.3%	50.7%	37.0%	100.0%	0.0%	0.0%
P-32	99.1%	0.0%	0.9%	29.2%	0.0%	70.8%
S-35	98.4%	1.6%	0.0%	99.0%	1.0%	0.0%
Cr-51	98.1%	1.9%	0.0%	100.0%	0.0%	0.0%
I-125	13.4%	86.6%	0.0%	0.0%	0.0%	100.0%

[*] 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.

UK1 Phosphate Industry: There is no phosphate industry in the UK.

UK2 Titanium Dioxide Industry: Two operators reported discharges of Th-232 (1.68E-02 TBq) and one reported total alpha (4.75E-02 TBq) and total beta/gamma (excluding tritium) (2.91E-02 TBq) to controlled waters in 2016.

UK3 Primary Steel Manufacturing: In 2016 there were 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). 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.

UK4 Rare Earth production: There is no rare earth production in the UK.

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