OSPAR COMMISSION

Annual report and assessment of discharges of radionuclides from the non-nuclear sectors in 2024

Radioactive Substances Series

2026

Report on discharges of radionuclides from the non-nuclear sectors in 2024

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 namely Rune Pettersen (Norway) with the support of the OSPAR Secretariat.

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Executive summary

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 2024 have been reported in accordance with the Revised Reporting Procedures for Discharges of Radioactive Substances from Non-Nuclear Sectors. Data has been collected since 2005. A number of Contracting Parties (CPs) have provided non-nuclear discharge data for 2024: 6 CPs reported for oil/gas; 7 CPs reported on their university and research; and 6 CPs reported on their medical sector.

There is sufficient data to make an assessment for 2024. 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.

Récapitulatif

Le Comité substances radioactives (RSC) est convenu en 2004 que des Parties contractantes devraient notifier les rejets provenant des sous-secteurs non-nucléaires tous les ans en se servant du formulaire de notification agréé. Les données pour 2024 ont été notifiées conformément aux Procédures révisées pour la notification des rejets de substances radioactives provenant des secteurs non-nucléaires. Les données ont été recueillies à partir de 2005. Plusieurs Parties contractantes ont notifié leurs données sur les rejets non nucléaires pour 2024 : 6 Parties contractantes ont soumis des données pour le secteur pétrolier/gazier ; 7 Parties contractantes ont soumis les données pour les rejets provenant des universités/de la recherché ; et 6 Parties contractantes ont soumis les données pour le secteur médical.

Les données sont suffisantes pour permettre une évaluation pour 2024. Les rapports sur les rejets d'eau de production du sous-secteur du pétrole/gaz couvrent les principales contributions et, bien qu'ils soient incomplets, il est possible d'évaluer la contribution relative du sous-secteur médical. Les autres sous-secteurs sont soit bien rapportés, soit apportent des contributions relativement insignifiantes.

Il a été nécessaire d'estimer certains rejets à partir de données incomplètes - par conséquent, il convient de faire preuve de prudence dans l'utilisation de ce rapport d'évaluation à des fins autres que celles envisagées par le RSC d’OSPAR. Dans ce rapport d'évaluation, le terme " bêta total " signifie bêta total (à l'exclusion du tritium) - la définition complète est utilisée dans les titres, mais l'abréviation est utilisée dans le texte.

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. In 2021, the North-East Atlantic Environment Strategy (NEAES) 2030 was agreed in Cascais, Portugal to cover the period 2020 - 2030.

The NEAES 2030 sets out OSPAR's vision, objectives, strategic directions, and action for the period up to 2030. In Part I, the new Strategy sets out its 12 strategic objectives. Strategic Objective 3 commits OSPAR Contracting Parties to *Prevent pollution by radioactive substances in order to safeguard human health and to protect the marine environment with the ultimate aim of achieving and maintaining concentrations in the marine environment at near background values for naturally occurring radioactive substances and close to zero for human made radioactive substances*.

Strategic objective 3 is supported by 4 operational objectives setting targets and further details of how Strategic Objective 3 will be achieved. These are:

S3.O1: On an ongoing basis OSPAR will further prevent, progressively reduce or, where that is not practicable, minimise discharges of radioactive substances through the application of Best Available Techniques (BAT), taking into account technical feasibility, radiological impact and legitimate uses of the sea.

S3.O2: By 2025 OSPAR will identify and consider any obstacles in achieving further reductions in environmental concentrations of radioactive substances in the marine environment and examine possible solutions where appropriate.

S3.O3: By 2025 OSPAR will identify the different types of loss of radioactive substances that may contribute to pollution of the marine environment. By 2027 OSPAR will determine if any additional measures are required to prevent such pollution, to the extent that such pollution is not already the subject of effective measures agreed by other international organisations or prescribed by other international conventions.

S3.O4: By 2028 OSPAR will, following the outcome of the Quality Status report 2024, address, where appropriate, any uncertainties by reviewing and updating methodologies to better determine the possible impact of releases, emissions and losses of radioactive substances on marine ecosystems.

The NEAES 2030 provides a means to achieve a clean, healthy and biologically diverse North-East Atlantic Ocean, which is productive, used sustainably and resilient to climate change and ocean acidification. The OSPAR Commission will continue to monitor and assess the status of the marine environment of the OSPAR maritime area ensuring that data collection and assessment programmes are kept under continuous review. The effective use and management of data and information is required to support the production of robust assessments.

To this end, the Radioactive Substances Committee (RSC) continues the annual collection of data on discharges of radionuclides from the non-nuclear sector. Regular reporting is required in order to review progress towards the radioactive strategic and operational objectives of the NEAES 2030.

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 updated in 2021). 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 2024 data, and for the offshore oil and gas sector, also presents the total discharges from 2005 to 2024.

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	Not present[2]
Netherlands	Present	Not present	Present	Present	Not present	Present	Present	Present[3]
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	Not

[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] There is only chemical labeling of pharmaceutical molecules (tracers) with isotopes (mainly from Mo-99 - Tc-99m generator) in hospitals' nuclear medicine departments for diagnosis (+ extremely low-activity labeling in research labs on mice/rats or blood samples). But there is no production of isotopes in Luxembourg.

[3] In the Netherlands discharges by radiochemical production are reported under the discharges of the Nuclear Research and Development subsector, because the most important production facility is located on the same site as the Research Reactor HFR and the liquid discharges are combined.

					ppresent			present
Sweden	Not present	Not Present	Not present	Not Present	Not present	Present	Present	Not present
Switzerland	Not present	Not present	Not present	Not Present	Not present	Present	Present	Not present
United Kingdom	Present	Not present	Present	Present	Present	Present	Present	Present

2 Assessment of the radioactive discharges from non-nuclear sources in 2022

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 2024 have been reported in accordance with the Revised Reporting Procedures for Discharges of Radioactive Substances from Non-Nuclear Sectors. Data has been collected since 2005. A number of Contracting Parties (CPs) have provided non-nuclear discharge data for 2021: 5 CPs reported for oil/gas; 7 CPs reported on their university and research; and 6 CPs reported on their medical sector. There is sufficient data to make an assessment for 2024. 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. Discharges from the oil/gas sub-sector

2. Discharge data were provided by Denmark, the Netherlands, United Kingdom and Norway. Ireland reported zero discharges in 2024 for this sub-sector.

3. The total discharges in 2024 of the three main radionuclides were radium-226 (Ra-226)0,625 TBq, Radium-228 (Ra-228) 0,538 TBq and lead-210 (Pb-210) 0,030 TBq and includes discharges from both produced water and descaling operations. Discharge from produced water is the main contributor with ~99% of the total for all the nuclides. The total discharges from 2024 are the lowest reported in the period (2005-2024) and continue the overall downward trend from previous years Pb-210 discharges show lesser year on change as nearly all reported discharges are based on data below detection limits.

4. Data provided by Denmark and UK shows a decrease in the discharge of all radionuclides while Norway and the Netherlands report a slight increase in discharges of all radionuclides. There are now fewer Contracting Parties that have discharges of radionuclides from the oil and gas sub-sector to the OSPAR marine environment.

5. Figure 1 gives the discharges to sea of Ra-226, Ra-228 and Pb-210 for the years 2005–2024.

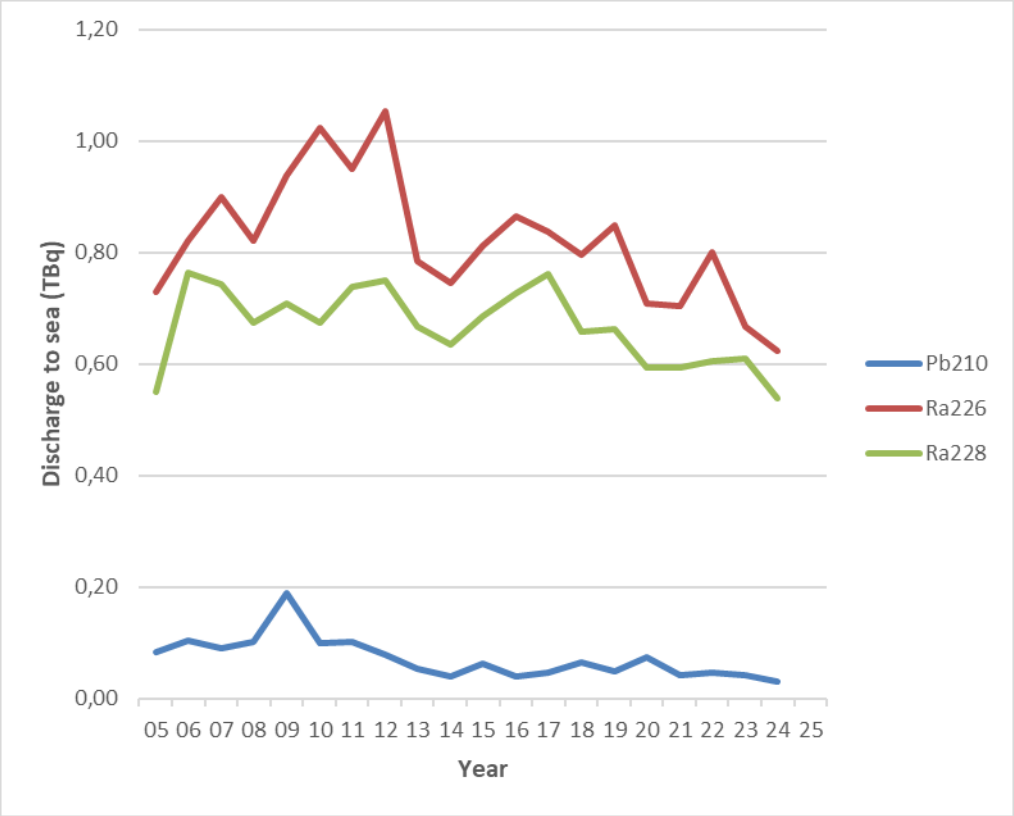

Figure 1: Discharges of Ra-226, Ra-228 and Pb-210 to sea in produced water from the oil/gas sub-sector 2005-2024

Figure 1 shows the reported discharges of Ra-226, Ra-228 and Pb-210 to sea from the oil and gas subsector in the period 2005 – 2024.

6. Norway and the UK are the principal contributors to the discharge of radionuclides from the oil and gas sub-sector. In 2024 the relative contributions of discharges in produced water (using Ra-226 as an indicator), were Norway 64%, UK 32 %, the Netherlands 3% and Denmark 2 %.

7. 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.

8. 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

9. 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.

10. 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 2005-2024 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
2018	6.5	0.80	0.19
2019	6.8	0.85[4]	0.19
2020	5.9	0.71	0.15
2021	5.8	0.70	0.16
2022	6.3	0.80	0.11
2023	5.8	0.67	0.12
2024	5.2	0.62	0,10

[1] Error from non-nuclear report to RSC 20 226Ra was reported as 0.66 however the correct number was 0.85.

11. While a large number (>100) of offshore installations contribute to the total alpha discharge, approximately 26.5 % 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

12. 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.

[4] Error from non-nuclear report to RSC 20 226Ra was reported as 0.66 however the correct number was 0.85.

13. 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 2005-2024 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[5]
2015	4.4	20
2016	4.7	22
2017	4.8	23[6]
2018	4.8	17
2019	5.0	14
2020	4.2	13
2021	3.9	14
2022	4.1	12
2023	3.9	10
2024	3.5	9,6

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

[3] The data for 2017 for nuclear industry is updated based on data from the nuclear assessment report for RSC20

c) Tritium and other radionuclides

14. Tritium is used as a tracer in the oil industry, and 0.036 TBq was discharged by the Norwegian sector during 2024 in connection with data collection from exploration wells. The discharges are insignificant compared to the discharges of tritium from the nuclear industry.

3. Medical sub-sector

15. 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.

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

[6] The data for 2017 for nuclear industry is updated based on data from the nuclear assessment report for RSC20

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

a) Total alpha discharges

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

    It has been reported to OSPAR that alpha emitting radionuclides are currently being used for medical purposes and that a decision by RSC is pending as to whether such data needs to be reported.

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

17. The total reported discharge of iodine-131 for 2024 was 14.2TBq, which is comparable to previous years. The following CPs have reported discharges of iodine- 131: Switzerland, Denmark, Ireland, Norway, Sweden and the United Kingdom. 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.

4. University and research sub-sector

18. 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. Discharge of tritium was 0.08 TBq, which is similar to the previous years.

5. Radiochemical manufacturing sub-sector

19. Radiochemical manufacturing is carried out in several of the CP, however only the UK have reported separately on this sub-sector in 2024. 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

20. There was no total alpha discharge reported for 2024.

b) Total beta (excluding tritium)

21. The total reported discharge of beta emitters during 2024 from this sub-sector was 0.060 TBq which is lower than the previous years. The discharge is a minor contribution to the total beta discharges to the marine environment. Of these discharges, all are reported as discharges of carbon-14.

c) Tritium

22. In 2024 the tritium discharge from this sub-sector amounted to 0.048 TBq, which was at a similar level as previous years. 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.

23. Discharges were also reported for gaseous tritium light devices and tritium-labelling services, primary steel manufacturing, titanium dioxide pigment manufacture and phosphate industry, neither of these sub-sectors made a significant contribution to the overall discharges of total alpha, total beta or tritium.

7. Summary and conclusions.

24. For 2023 the overall summary including comparison with the nuclear sector is shown in Table 3 below.

Table 3: Summary of discharges in 2024from the non-nuclear sector and a comparison with the nuclear sector (TBq)[7]

	Non-nuclear					Nuclear
	Oil/gas	Medical	Univ/R&D	Radiochem	**Total**	
Total alpha	5.2	-	-	-	**5.2**	0,10
Total beta	3.5	14,2	0.02	0.006	**17**	9,6
Tritium	0,036	-	0.08	0.0003	**0.119**	$1{,}19*10^4$

25. The oil/gas sub-sector is the main source of total alpha discharges to the OSPAR area, accounting for about 98 % of the total from all sectors (non-nuclear and nuclear). This sub-sector also makes a 12,8% contribution to the overall total beta from all sectors (nuclear and non-nuclear). In total, the non-nuclear sector contributed an estimated 64 % of the total beta discharges from all sectors, with the largest single contribution 51%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 2024 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);

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

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).

The data can be viewed and downloaded here
https://odims.ospar.org/en/submissions/ospar_rnuclides_non_nuclear_2024_06/

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