OSPAR COMMISSION

Protecting and conserving the North-East Atlantic and its resources

Overview of national statements on the implementation of PARCOM Recommendation 91/4

Radioactive Substances Series

2016

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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.

This document provides an overview of the national statements on the implementation of PARCOM Recommendation 91/4 provided by Contracting Parties following RSC 2015.

1. In 2012, at the time of adopting the overview assessment of the 5th round of reporting on the implementation of PARCOM Recommendation 91/4 prepared by Germany, RSC agreed on a set of recommendations to simplify the next overview. These recommendations were revisited in 2015, in the context of preparations for the overview assessment of the 6th round of implementation reporting on PARCOM Recommendation 91/4.

2. In discussing the arrangements for conducting that overview, all Contracting Parties favoured the adoption of a more practical and straightforward approach. Different options were explored to streamline the development of the overview assessment of the 6th round of implementation reporting, with Contracting Parties opting for the practical solution of building on national statements for preparing an overall statement. RSC 2015 put in place arrangements in that direction, by inviting Contracting Parties to provide their national statements on the implementation of PARCOM Recommendation 91/4, based on guidance provided by the Secretariat, in conjunction with the Chair of RSC.

3. After examination of the national reports submitted by Belgium, France, Germany, the Netherlands, Spain, Sweden, Switzerland and the United Kingdom at the 6th round of implementation reporting on the PARCOM Recommendation 91/4, the Secretariat invited Contracting Parties to provide the information below in their national statements:

   a. *National arrangements for the implementation of BAT*: brief overview of national legislation implementing BAT; with a focus on new legislation in place since the last round of reporting;

   b. *Systems and abatement techniques to reduce discharges*: short summary of systems and abatement technologies employed by Contracting Parties individually or in combination and the extent to which abatement techniques are in line with BAT in the industry;

   c. *Effectiveness of BAT in reducing liquid discharges:* short description of overall trends in the discharges of alpha, beta and gamma emitters; and

   d. *Conclusion*s: closing paragraph stating whether in light of the information provided BAT is applied in the nuclear installations.

4. National statements were received from Belgium, Denmark, Germany, Norway, Spain, Sweden, Switzerland and the United Kingdom. All of them are compiled in Annex 1, together with the French and the Netherlands Executive Summaries of their BAT reports on the implementation of PARCOM Recommendation 91/4. Portugal has not been able to provide its national statement.

5. The information presented in Annex I indicates that:

   a. National legislation is in place for the implementation of BAT in the nuclear industry, with Contracting Parties having incorporated BAT into their legislative and regulatory texts;

   b. Abatement techniques have been applied by Contracting Parties, individually or in combination, in order to reduce, prevent or eliminate discharges of radioactive substances into the marine environment. Systems and abatement techniques vary from country to country and in countries from one nuclear installation to another. Mechanisms are in place to ensure that procedures and techniques applied in the nuclear industry are consistent with international best practices on the abatement of discharges;

c. There has been an overall reduction in alpha discharges and beta/gamma discharges over the last two decades. As regards tritium, there is an overall downward trend, although in some countries the discharges of tritium from specific facilities have slightly increased in the past five years;

d. Contracting Parties applied BAT and BET in their nuclear installations, as the evaluations of BAT/BEP indicators for discharges, environmental impact and radiation doses to the public show.

Annex 1

National Statements

Belgium

1. National arrangements for the implementation of BAT/BET in terms of the OSPAR Convention in Belgian legislation and regulation

The Royal Decree of July 20th 2001 *(General Regulations for the Protection of the population, workers and the environment against the dangers of Ionising Radiation - GRPIR*) and the Belgian policy are based on EC Directives, on international conventions and on recommendations of appropriate international bodies like the International Commission on Radiological Protection (ICRP) and the International Atomic Energy Agency (IAEA).

The major principles in these regulations are justification of exposure, optimisation (ALARA), dose limits. The Royal Decree introduces also a notion of dose constraint (optimisation principle-ALARA): the discharge limits have to be based on a fraction of the public annual limit of 1 mSv (20 to 55% of the annual limit depending of the nuclear site, see the sixth Belgian Parcom Report of 2015).

2. Systems and abatement techniques to reduce discharges

For an overview, refer to the sixth Belgian PARCOM report.

Nuclear sites have followed the development of best techniques and use a vast variety of systems and best available efficiency abatement techniques to reduce dischages: delay tanks, chemical precipitation, ion-exchange, filtration (HEPA, active carbon), osmosis and evaporation. Depending of the system, efficiencies of 90% to 99,9% are reached.

For the 2001-2014 period, following factors have influenced the reduction of radioactive liquid releases: i.e. more liquid wastes are evaporated to solid wastes instead of being released in rivers, replacements of steam generators allow to recover the “blow-down” waters which induced a significant decrease of liquid releases.

3. Effectiveness of BAT in reducing liquid discharges

Trends lines figures of the discharges of nuclear sites (see sixth Belgian PARCOM report) show that, for the last 10-15 years, alpha, beta and tritium releases have strongly decreased.

Comparisons with UNSCEAR ranges show that: Tritium discharges are near the lower end limit of the range, Non-tritium discharges into water are always below the level of the range since more than 10 years, Liquid releases have decreased.

4. Conclusions

For nuclear sites, calculations made for liquid (and atmospheric) discharges under conservative assumptions show that the maximum effective doses to the population in the vicinity of the nuclear sites are well below the national limits of 1 mSv/a (maximum limit including all atmospheric and liquid contributions). The average effective dose for the years 2004 – 2013 was less than 2 % of the legal limit and less than about 5% of the constraint dose limits, despite being calculated in a conservative manner.

In 2013, total doses to the most critical person due to those releases (1-2 years children) is 0.049 mSv for Tihange and 0.020 mSv for Doel NPPs.

The radiological surveillance programme conducted in Belgium shows that the radiological situation of the Belgian territory is in general perfectly satisfactory.

In the marine environment, natural radioactivity (^{40}K) is mainly responsible for the radioactivity of the different sections of the marine environment. Artificial radioactivity is generally not detectable: concentrations are of the order of the detection limits. Traces of ^{137}Cs are revealed in the marine sediments and the fish (barely significant). No other artificial radioactivity is demonstrated in fish.

In Belgium, nuclear sites apply the latest BAT and BEP.

Switzerland

1. National arrangements for the implementation of BAT

The national legislation defines dose guide values, dose limits, discharge limits, environmental monitoring programs, as well as the national authority responsible for the supervision and the nature of inspections and surveillance. The Federal Act and the Ordinance on Radiological Protection, for example, limit the concentration of radioactive substances in the atmosphere and water at locations accessible to the public, requiring that the weekly mean values of the concentration are below the emission limits. The Ordinance on Foreign Substances and Ingredients defines limits for radioactivity in food and drinking water and, as an additional restriction, tolerance values. The tolerance values fulfill the 10 microSv per year concept. Since 2000 the ordinance for ratification of international resolution and recommendations is enforced. This legislation requires that the PARCOM-recommendation 91/4 has to be considered at the implementation of environmental protection regulations. In 2005 new nuclear energy legislation came into force. The legislation requires the performance of periodic safety assessments by the licensee of nuclear power plants in a time interval of ten years. The periodic safety assessments are evaluated by the Nuclear Safety Inspectorate (ENSI). Within the frame of the periodic safety assessment the licensee has to assess the liquid and gaseous discharges of his plant and on request of the Inspectorate to benchmark against the corresponding discharges of similar European reactors. If the discharges of a nuclear power plant are higher than the benchmark, the licensee has to analyze the reasons and to suggest measures to reduce the discharges in the view of the appropriateness of the means.

2. Systems and abatement techniques to reduce discharges

In Switzerland there are four NPPs, a waste treatment and interim storage facility (ZWILAG) and a research facility (PSI) with relevant liquid discharges. In all Swiss nuclear facilities the waste water is collected and treated in batches.

The used abatement techniques are different in every nuclear facility. Evaporation, centrifugation, chemical precipitation, ion exchange, cross-flow-nanofiltration and sorption with an inorganic ion exchange powder are used in different combinations.

3. Effectiveness of BAT in reducing liquid discharges

The Swiss nuclear facilities with relevant liquid discharges are in the catchment area of the river Rhine. The total sum of the liquid discharges of radioactive substances excluding tritium from the nuclear facilities in Switzerland were reduced from 35 GBq in 2005 to 2,2 GBq in 2014 by applying BAT. In detail the following improvements were introduced: since 2007 the nuclear Beznau pressurized water reactors apply cross-flow-nanofiltration of waste water and achieved by this the required reduction of the radioactivity to a target value of less than 1 GBq per year in the liquid discharges excluding tritium. At the Gösgen pressurized water reactor the discharges of radioactive substances without tritium are the lowest among the European pressurized water reactors. Nevertheless from 1994 up to now the Gösgen NPP has reduced discharges by a factor of 5. The liquid discharges of radioactive substances excluding tritium from the Mühleberg and Leibstadt boiling water reactors show a downward trend. The licensee of Mühleberg had performed a periodical safety review in 2005. The Inspectorate has evaluated this review in depth. As a result the Inspectorate required the licensee to reduce the activity without tritium in the liquid discharges to a target value of 1 GBq per year until 2010. To reach this aim, the licensee of Mühleberg has studied possibilities to reduce the quantity of waste water as well as separating different qualities of waste water for specific treatment. This work has resulted in an obvious decrease of the activity released per year. For maintenance purposes every four years the torus of Mühleberg has to be emptied, resulting in higher liquid discharges in these years. In 2013 Mühleberg started a project to clean the water of the torus. In January 2009 as a result of an inspection the Inspectorate has required the licensee of ZWILAG to study the possibilities to reduce the liquid discharges. As a result of this study in 2010 the licensee reduced the Cs-137 content in the liquid discharges by sorption with an inorganic ion exchange powder. At the research facility (PSI) the discharges of radioactive substances excluding tritium show a downward trend.

4. Conclusions

Based on the above information, the Inspectorate concludes that the BAT principles are implemented in the Swiss legislation and regulatory practices. Furthermore progress has been made in the application of such principles in the Swiss nuclear facilities with the clearly stated objective to reduce discharges according to the OSPAR strategy on radioactive substances.

Denmark

Response to questions on the implementation of BAT in Danish legislation

1. National arrangements for the implementation of BAT: brief overview of national legislation implementing BAT; with a focus on new legislation in place since the last round of reporting;

The application of BAT as part of the national radiation protection programme has been implemented indirectly into Danish law. The terms "justification" and "optimization" have always been the centerpieces of the Danish legislation, and are important tools to administer this area. This ensures an ongoing review of all practices where radiation is used in order to minimize the use and to promote substitution of radioactive substances.

There are no nuclear reactors in operation in Denmark. Recent activities within the nuclear area are decommissioning of research reactors and related facilities at the Risø-site. The following laws and regulations are very important in regulating the decommissioning of the research facilities.

Decommissioning of the research reactors and management of radioactive waste at the Risø-site:

- Law no. 170 of 16th May 1962 on nuclear installations, Ministry of the Interior (now Ministry of Health).
- Law no. 244 of 12th May 1976 on safety and environmental issues in relation to nuclear facilities, Ministry of Defense.
- Ministry of the Interior and Health order no. 192 of 2nd April 2002 on exemptions from law on the use of radioactive substances.
- Order no. 823 of 31st of October 1997 on dose limits of ionization radiation, Danish Health Authority.
- Operational Limits and Conditions for Danish Decommissioning, the National Institute of Radiation Protection under the Danish Health Authority and the Danish Emergency Management Agency.

2. Systems and abatement techniques to reduce discharges: short summary of systems and abatement technologies employed by Contracting Parties individually or in combination and the extent to which abatement techniques are in line with BAT in industry;

In Denmark, Danish Decommissioning is responsible for the decommissioning and maintaining the Risø nuclear facilities until these are fully decommissioned. Besides handling the radioactive waste from the decommissioning of the Risø-site, Danish Decommissioning also receives treats and stores radioactive waste from Danish users of radioactive materials. The operation of Danish Decommissioning is regulated in cooperation between the National Institute of Radiation Protection under the Danish Health Authority and the Danish Emergency Management Agency by issuing ***Operational Limits and Conditions for Danish***

Decommissioning. The ***Operational Limits and Conditions for Danish Decommissioning*** states the maximum levels of H-3 and Cs-137 in the discharged wastewater to Roskilde Fjord per year, which is set to respectively 1,000,000 GBq/y and 400 GBq/y. The water from the Risø-site has a β-activity below 1.5 Bq/ml, when transferred to the biological water treatment plant at DTU Risø Campus for discharge.

The discharges to the atmosphere and the marine environment are monitored and reported to the National Institute of Radiation Protection and the Danish Emergency Management Agency by the means of the following reports:

1. Surveillance report (once a year)
2. Discharge report (twice a year)
3. Operation and decommissioning report (once a year)

3. Effectiveness of BAT in reducing liquid discharges: short description of overall trends in the discharges of alpha, beta and gamma emitters; and

As BAT is not directly implemented in Danish legislation, it makes no sense to relate to whether such implementation has influenced the discharge of radionuclides to the marine environment.

The following is, however, a brief overview of the discharges from Danish Decommissioning into the marine environment over the past 8 years. The emission of H-3 from the management of radioactive waste and decommissioning of nuclear facilities in the period from 2008 to 2013 has varied between 0.05 and 0.4 TBq/y. However in 2014, the H-3 emissions had decreased to 2.4*10-04 TBq/y. The discharge of total β-activity (excl. H- 3) in 2008 was 0.13 TBq/y. In the period 2019-2014 emissions varied between 6.8*10-05 and 2.6-04 TBq/y. The overall emission of β-activity has decreased during the period.

Danish Decommissioning does not monitor the discharges of α-activity, however from 2016 and onward, the monitoring of α-activity will be implemented in the discharge measuring program.

4. Conclusions: closing paragraph stating whether in light of the information provided BAT is applied in the nuclear installations.

BAT as such is not implemented directly in Danish legislation. However, justification and optimization are the cornerstones of the radiation protection in Denmark and as such BAT is implemented.

Germany

1. National arrangements for the implementation of BAT/BET in terms of the OSPAR Convention in German legislation and regulation

The Atomic Energy Act (AtG) promulgated on 23 December 1959 ensures that the Federal Republic of Germany meets its international obligations in the field of nuclear energy and radiation protection. It also includes the general national regulations for protective and preventive measures, radiation protection, disposal of radioactive waste and irradiated fuel elements in Germany and is the basis for associated ordinances.

The principles of radiation protection, dose limits, requirements for the organisation of radiation protection, personal monitoring, environmental monitoring, accident management, design against incidents and accident planning values are regulated in the Radiation Protection Ordinance (StrlSchV).

Further legal regulations are regulatory guidelines, general administrative provisions and KTA safety standards.

The two most important regulatory guidelines are the “Guideline on Emission and Environmental Monitoring (REI)”, which specifies the requirements for discharge and emission monitoring and contains mandatory measurement programmes, and the “Verification of the Licensee’s Monitoring of Radioactive Effluents from Nuclear Power Plants” defining a control measurement programme by an independent organisation. Regulations concerning the calculation of radiation exposure of members of the public are described in the “General Administrative Provision to § 47 StrlSchV”. For nuclear installations in Germany, the state of scientific and technological advancement, taking into account the BAT, is defined in technical guidelines, such as safety standards, issued by the “Kerntechnischer Ausschuss (KTA)”.

Furthermore conventional technical standards, in particular the national standards of the German Institute for Standardisation (DIN) and also the international standards of ISO and IEC, are applied just as they are in the design and operation of all technical installation, as far as the conventional standards correspond to the state of the art in science and technology.

2. Systems and abatement techniques to reduce discharges

Nuclear sites have followed the development of best techniques and use a vast variety of systems and best available efficiency abatement techniques to reduce discharges: for example delay tanks, chemical precipitation, ion-exchange, filtration (HEPA, active carbon), osmosis and evaporation. Depending of the system, efficiencies of more than 90 % are reached.

3. Effectiveness of BAT in reducing liquid discharges

The analyses of environmental samples (river water, plants, milk, meat, fish, soil) show that there are no detectable alpha- and beta-activity concentrations – excluding tritium – referring to radioactive discharges from the nuclear power plants. The environmental annual measurement data are documented in "Environmental Radioactivity and Radiation Exposure" published annually by the German Ministry of Environment, Nature Conservation and Nuclear Safety.
(http://www.bfs.de/en/bfs/publikationen/berichte/umweltradioaktivitaet)

Trends lines figures of the discharges of nuclear sites (see sixth German PARCOM report) show that, for the last five years, alpha, beta and tritium releases have decreased for boiling water reactors. For pressurized water reactors the tritium as well as the non-tritium releases are at a constant level.

The comparisons of the normalised discharges from German nuclear power plants with normalised releases given by UNSCEAR shows that:

- Normalised non-tritium discharges are far below the ranges of UNSCEAR;
- Normalised tritium discharges are within the ranges of UNSCEAR and in general below the mean value of UNSCEAR.

4. Conclusions

Calculations made under conservative assumptions as described in Chapter 2 of the sixth German PARCOM report show that the maximum effective annual dose to the population in the vicinity of all nuclear installations are well below the national limit of 0.3 mSv both for the water and for the air pathway. The calculated annual effective dose for adults due to the discharges of radionuclides from nuclear power plants regarding the water pathway is less than 0,001 mSv/a, the one for the air pathway less than 0,005 mSv/a.

The low levels of radioactivity discharges from all nuclear power stations and low levels of radiation exposure in general show the high standards of technology in Germany. Therefore German nuclear sites apply the latest BAT and BEP.

Spain

1. National arrangements for the implementation of BAT

The instruction IS-26, of 16th June 2010, sets the basic nuclear safety requirements applicable to nuclear installations.

According to Point 3.21 the nuclear installations must carry out, within the framework of the Periodic Safety Review, the appropriate modifications to converge, whenever it is feasible, with the best nuclear safety and radiological protection practices and standards internationally in effect at the time.

Points 3.24 to 3.27 deal with Dose Limits and Restrictions. In accordance with Point 3.25 the release of radioactive effluents into the environment must comply with the established limits, aiming, in addition, that it must be as low as possible by taking socioeconomic factors and the best available techniques into consideration. In addition, Point 3.27 specifies that the design of nuclear installations must ensure that the radiological consequences that are reasonably foreseeable in future generations are not greater than those allowed for the current generation.

2. Systems and abatement techniques to reduce discharges

A policy to minimise the production of waste is applied in Spanish nuclear power plants. This policy includes aspects such as:

- Surveillance and control of defects in the fuel cladding during operation and refuelling, and the chemical quality and conditions of the coolant systems.
- Reinforcement on the maintenance programs.
- Revision of the operating procedures, optimising the methods applied.
- Segregation and piping of drains.
- Use of low radioactive water for conditioning of solid wastes instead of demineralised water.
- Improvements in the ion-exchange resin treatment system according to the liquid waste characteristics.
- Improvements in the procedures of sampling and analysis.
- Improvements in the procedures of the effluent management and control.
- Decay of the primary coolant prior to its evaporation treatment in the boric acid recovery system.

In Trillo NPP, throughout the period 2008-2013 the following additional measures have being introduced to minimise the production of radioactive wastes:

- A reduction of the activity concentration value required to treat the radioactive liquid waste by evaporation.
- Implementation of a program of periodic cleaning of the liquid effluents tanks (storage and discharge).

- In 2013 it was re-established the plan that was launched in 1994 to replace components with Stellite (alloy of cobalt and chromium) in its composition as a source of Co-60 in the primary coolant and, consequently, in the radioactive effluents.
- During the last two refuelling outages, various practices have been implemented to reduce the primary coolant radiochemical contamination and therefore of the effluents, such as a longer primary coolant purification; recirculation of the water from the reactor cavity through filters; and vacuum cleaning of the cavity bottom of the reactor.
- Also during the last two refuelling outages, an additional resin for retaining the antimony has been added to those which already exist in the ion exchanger that it used to treat the primary coolant.

3. Effectiveness of BAT in reducing liquid discharges

For the period 2008-2013, in the nuclear power plants the absolute total activity excluding tritium shows a global downward trend, while the tritium activity presents a slight global increasing trend. It is important to have in mind that, nowadays, no abatement techniques of tritium are available.

In the dismantling of Zorita both tritium and total activity excluding tritium exhibit a downward trend, as well as in Juzbado fuel fabrication plant where alpha activity in the liquid discharges has decreased in the last years.

4. Conclusions

The Spanish regulatory system in the field of controlling radioactive substances sets up a framework for the effective application of a clearly stated policy under which the application of BAT is required. This policy follows closely the requirements and recommendations of competent international bodies and adopts several principles to ensure the application of the precautionary principle and the prevention of pollution.

Throughout the years 2008-2013 the doses to the critical group living in the vicinity of the installations, due to radioactive liquid and gaseous effluents, is about one percent of the authorized limit (0,1 mSv/a).

From the evaluations of the BAT/BEP indicators for discharges, environmental impact and radiation doses to the public it is concluded that BAT is applied in the nuclear Spanish installations.

Norway

1. National arrangements for the implementation of BAT

Since the last implementation round the Pollution Control Act 13 March 1981 on Protection against Pollution and Concerning Waste entered into force for radioactive pollution and radioactive waste on 1 January 2011. The act was established for the purpose of preventing and reducing harm and nuisance from pollution. This is reflected in the main rule of the act, which says that pollution is forbidden, unless it is specifically permitted by law, regulations or individual permits. The act shall secure a satisfactory environmental quality based on a balance of interests, which includes costs associated with any measures and other economic considerations. Pursuant to the act, three regulations concerning radioactive pollution and radioactive waste have been issued:

- Regulation on the application of the Pollution Control Act on Radioactive Pollution and Radioactive Waste of 1 November 2010
- Regulation on the Recycling of Waste of 1 June 2004
- Regulation on Pollution control of 1 June 2004

The regulation Radioactive Pollution 1 November 2010 defines radioactive pollution and radioactive waste.

The Regulation on the Recycling of Waste 1 June 2004 establishes requirements for waste in general, chapter 16 deals with radioactive waste. This chapter entered into force November 2010.

The Regulation on Pollution control 1 June 2004 defines procedures for applications for permits and establishes administrative provision for radioactive pollution and waste.

Nuclear installations are also regulated in accordance with the Nuclear Energy Act 12 May 1972 on Nuclear Energy Activities, Radiation Protection Act on Radiation Protection and Use of Radiation 12 May 2000 and Regulation on Radiation Protection and Use of Radiation 29 October 2010.

When issuing authorisations for nuclear installations, Norwegian practice is to focus on BAT, ALARA-principle and the precautionary principle. Use of BAT regarding discharge of radioactive substances is implemented in the Pollution Control Act 13 March 1981 section 2-3:

> *Section 2 Guidelines*
> *The Act shall be implemented in accordance with the following guidelines:*
> *3. Efforts to avoid and limit pollution and waste problems shall be based on the technology that will give the best results in the light of an overall evaluation of current and future use of the environment and economic considerations.*

2. Systems and abatement techniques to reduce discharges

The following abatement systems for liquid radioactive discharges are employed in Norway:

- Delay tanks
- Sedimentation
- Ion exchange filtration system
- Evaporation system
- He-3 decontamination system

For emissions, HEPA filtration and active charcoal filtration are employed.

3. Effectiveness of BAT in reducing liquid discharges

No downward trends in the discharges are observed. This is mainly caused by variations in the research activity.

4. Conclusions

Based on the evaluation of BAT/BEP concerning discharges, environmental impact and radiation dose to the public, it is generally concluded that BAT/BEP is applied in the nuclear installations in Norway.

Sweden has reported compliance with PARCOM Recommendation 91/4 during all six implementation rounds. The first three reports from Sweden also included the Barsebäck nuclear power plant, which discharges in close proximity to the Convention waters.

This national statement concerns the implementation of BAT in the nuclear power plant at Ringhals, the only Swedish nuclear facility concerned, in accordance with PARCOM Recommendation 91/4. The national statement covers the years 2012–2014.

The national statement from Sweden will only describe changes from the last sixth round of reporting (Sixth Implementation Report, Report in accordance with PARCOM Recommendation 91/4 on radioactive discharges, SWEDEN [1]).

1. National arrangements for the implementation of BAT

The Swedish legislation for implementation of BAT has not changed since the sixth implementation report [1]. Since the latest implementation round as described in the Swedish report from 2011[1], there are no new systems and abatement techniques or changes in systems to reduce discharges.

2. Effectiveness of BAT in reducing liquid and emissions

Discharges

The absolute liquid discharges of H-3, beta-emitters excluding H-3 and total alpha emitters (Bq/a) from reactor units 1 – 4 have remained stable or declined over the time period studied, see Figures 1.1 – A-D, in Appendix 1.

Emissions

Emissions to air of C-14 and H-3 have been measured since 2002 when a revised version of discharge regulations entered into force. Before 2002, emissions to air of C-14 were estimated based on international experience. Figure 1.2, in appendix 1, shows the emissions of C-14 and H-3 for 2004-2014. Measurements of emissions of I-129 are not requested by the SSM. The increase in emissions of tritium from Ringhals 2 during 2014, is mainly due to that the boron concentration was higher during this year, which induces a higher tritium production and that the turn-over time of the water was lower due to better recycling of the water. Hence, better recycling of the water implies less discharges to the water although a higher contribution to air emissions from tritium.

Environmental impact

The environmental monitoring is performed in a way that is relevant for judging long-term trends, for performing model verification, and for judging compliance with environmental goals. The data indicate low environmental concentrations of key nuclides and do not reveal increasing trends. Although there are no systems in place to assess impact on non-human biota, present knowledge indicates that the discharges from the Ringhals nuclear power plant cause no harm to the marine ecosystems.

Doses
The annual average effective dose to individuals of the critical group from discharges and emissions for the period 2002–2014 are given in Figure 1.3, in appendix 1. Annual effective dose to members of the critical group around Ringhals, have remained stable or declined over the time period studied.

3. Conclusions

From the evaluations of the BAT/BEP indicators for discharges, environmental impact and radiation doses to the public it is concluded that BAT is applied at the Ringhals nuclear power plant during the time period covered by this national statement.

United Kingdom

This report for the Radioactive Substances Committee of the OSPAR Commission is an update to the UK statement of 2013 (covering the period 2008-2011) on the implementation of PARCOM Recommendation 91/4 on Radioactive Substances[1] (the 2013 Report). This recommendation relates to the application of Best Available Technology (BAT)[2] to minimise and, where appropriate, eliminate any pollution caused by radioactive discharges from the nuclear industry into the marine environment.

1. National arrangements for the implementation of BAT

The regulation of discharges to the environment from nuclear licensed sites in the UK is exercised through the Radioactive Substances Act 1993 (as amended) (RSA93)[3] in Scotland and in Northern Ireland, and the Environmental Permitting (England and Wales) Regulations 2010 (EPR10). Both RSA93 and EPR10 require BAT (or its equivalent) for the control of discharges in accordance with OSPAR commitments. More details are provided in the 2013 Report.

2. Systems and abatement techniques to reduce discharges

The procedures and techniques applied in the UK nuclear industry are consistent with BAT. What represents BAT for a particular source will change with time in the light of technological advances, economic and social factors, as well as changes in scientific knowledge and understanding. Measures are in place, as part of the authorisation and permit review process, to ensure that technological developments continue to be reviewed and implemented where appropriate. For example, a recent regulatory review concluded that BAT continues to be applied at operational Advanced Gas Cooled (AGR) power stations.

Where the regulators believe it is justified and proportionate they can, and do, impose improvement conditions including the requirement to review and report, periodically, on international best practice on the abatement of discharges. The 2013 Report included comparisons of the performance of UK plants with similar plants

[1] UK Report on application of Best Available Techniques (BAT) in civil nuclear facilities (2008-2011). Implementation of PARCOM Recommendation 91/4 on radioactive discharges. OSPAR Commission 2013. http://www.ospar.org/work-areas/rsc

[2] In PARCOM Recommendation 91/4, the term BAT is related to 'technology'. However, in the UK the term 'techniques' is more commonly used to include both equipment and management practices. See 2013 Report for description of equivalent concepts used in the UK.

[3] Regulations to replace the Radioactive Substances Act 1993 in Scotland will be consulted on in 2016.

worldwide where appropriate and concluded that abatement approaches were consistent with those identified in recent international reports. The development of effluent technologies is supported by R&D programmes; for example sponsored academic research is coordinated by Sellafield Ltd's Centre of Expertise for effluent technology.

The 2013 Report described in some detail the technologies in use or under development in the UK such as filtration, caustic scrubbers, ion exchange and adsorption, hydrocyclone centrifuges, and electrochemical and electrophysical processes. Developments in the application of BAT since the period covered in the 2013 Report include:

- Robust fuel to reduce fuel failure rates continues to be implemented at operational AGR stations and secondary neutron sources have been removed at the Sizewell B Pressurised Water Reactor in order to reduce tritium discharges.
- Hydrocyclone technology continues to be used to remove particulates during pond de-sludging at the Magnox decommissioning power stations at Hinkley Point A and Bradwell, and submersible ion exchange filters have helped reduce discharges at Hinkley Point A and Chapelcross.
- Magnox Ltd no longer plans to use dissolution for treatment of the Fuel Element Debris stored at Hinkley Point A, Sizewell A and Oldbury. Fuel Element Debris will instead be packaged as solid waste further decreasing liquid discharges from the decommissioning of Magnox sites.
- Operational discharges from Sellafield will decrease when the Magnox and Thorp reprocessing programmes are completed. Meanwhile discharges associated with reprocessing operations continue to be minimised by the application of BAT. For example, spent fuel storage conditions at the Sellafield Fuel Handling Plant (FHP) and the operation of the Site Ion eXchange Effluent Plant (SIXEP) continue to be optimised.
- Significant progress is being made with the retrieval of fuels and wastes from a number of Sellafield legacy facilities which will ultimately remove a significant source of discharges.
- At former R&D sites that are being decommissioned the Replacement Effluent Treatment Plant at Harwell began operation in 2014 while the greater use of ion exchange has helped reduce caesium-137 discharges from Dounreay.

3. Effectiveness of BAT in reducing liquid discharges

There has been an overall reduction in discharges over the past two decades which followed the major reductions made in the 1970s and 1980s in the reprocessing sector, noting that discharges from this sector in the UK include arisings from legacy management activities including decommissioning.

Alpha: Overall alpha discharges have reduced in the decade up to 2014 by about 60%. The majority of alpha discharges arise from the reprocessing sector (about 90% in 2014), which are now about 0.1% of the peak seen in the 1970s. Since 2011, annual discharges from Sellafield have increased from 0.12 TBq to 0.17 TBq, mainly related to reprocessing activities.

Beta/gamma (excluding tritium): Discharges are now less than 10% of what they were in 2004 and since 2011 have reduced from around 24 TBq per year to around 16 TBq per year; this is less than 1% of the peaks seen in the 1970s. In 2014 about 60% of discharges arose from the reprocessing sector with the remainder split mainly between power generation and fuel fabrication/enrichment.

Tritium: Discharges are now about 40% lower than they were a decade ago and since 2011 have reduced to around 3,200 TBq per year. Discharges are dominated by the power generation (approx. 60%) and reprocessing sectors.

Technetium-99: Discharges from the reprocessing sector are about 1% of their peak in the late 1990s. Since 2011 the annual discharge has reduced from around 1.6 TBq to 1.3 TBq.

4. Conclusions

The application of BAT in the UK brought about, for example, by stringent regulation, considerable investment in abatement plant, process optimisation and better application of the waste management hierarchy, including waste minimisation, has been effective in reducing discharges.

The UK will continue to apply BAT rigorously. Further substantial reductions in discharges may be increasingly difficult to achieve in some areas; in recent years we have seen fluctuations in discharges in line with operational throughputs and essential work to reduce hazards and decommission redundant facilities

Executive Summaries

France

The control of nuclear safety and radiation protection in France has been completely revised since 2006. The 13th June 2006 Act concerning transparency and security in the nuclear field, called the “TSN Act” (now codified in books I and V of the Environment Code), extensively overhauled the BNI legal system. It has in particular given this system an “integrated” nature, that is to say that it seeks to prevent the hazards and detrimental effects of any type that the BNIs could create: accidents - whether nuclear or not, pollution - whether radioactive or not, waste – whether radioactive or not, noise, etc. Decree 2007-1557 of 2nd November 2007 as amended concerning BNIs and regulation of the nuclear safety of the transport of radioactive substances, known as the “BNI Procedures” decree, defines the framework in which the BNI procedures are carried out and covers the entire lifecycle of a BNI, from its authorization decree to commissioning, to final shutdown and decommissioning. These foundation texts have been recently supplemented by the Order of 7th February 2012 setting the general rules relative to basic nuclear installations, called the “BNI” order, and ASN (French nuclear safety authority) resolution 2013-DC-360 of 16th July 2013 relating to the control of detrimental effects and of the impact on health and the environment of BN. France has fully incorporated the best available techniques (BAT) into its legislative and regulatory texts. The best available techniques appear in the front rank of the principles that control nuclear activities in France. Even if the radiologic impact associated with liquid radioactive discharges is very low, France is determined that its regulatory framework and operator practices will led, through the application of the best available techniques, to achieve a high level of control over radioactive discharges and to obtain reductions in discharges, in line with the OSPAR strategy. France will ensure that this approach is applied in a fully transparent manner, and will involve the various stakeholders. Although that in general effluents discharges decrease, France considers that the reduction of radioactive discharges continues in line with technical progress. This is achieved by proceeding with the overhaul of the discharges permits of the basic nuclear installations. France requires that the limits be set as low as the best available techniques will allow, taking into account feedback from experience with the discharges produced at the facilities. France has set up a system for monitoring environmental radioactivity that meets the objectives of the OSPAR strategy both in terms of coverage of the French portion of the OSPAR area, and of the quality of the monitoring data provided under the agreement concerning the program for monitoring radioactive substances in the marine environment.

Netherlands

Executive Summary PARCOM Recommendation 91/4 concerns the use of Best Available Technologies (BAT) to minimise and, as appropriate, eliminate any pollution caused by radioactive discharges from all nuclear industries, including research reactors and reprocessing plants, into the marine environment. The guidelines for the implementation of this Recommendation request that Contracting Parties to the OSPAR Convention report on a four-year basis on progress in the implementation of BAT in such facilities. This is the report of the Netherlands for the sixth round of implementation reporting (2012 - 2015). The information is submitted according to the OSPAR “Guidelines for the submission of information about, and assessment of, the application of BAT in nuclear facilities” (OSPAR Agreement 2004-03). The information presented in this report indicates that BAT/BEP has been applied to all nuclear installations in the Netherlands: the only operational nuclear power plant in the Netherlands, the nuclear fuel enrichment plant, two research reactors (since 2010 the Low Flux Reactor in Petten is no longer in use), and the nuclear waste treatment and storage plant. For completeness, we note that the nuclear power plant Dodewaard, which ceased operations in 1997 and is presently in the state of Safe Enclosure, has discharged no radionuclides to water since July 2005.

Appendix 1

Appendix 1 to Swedish national statement

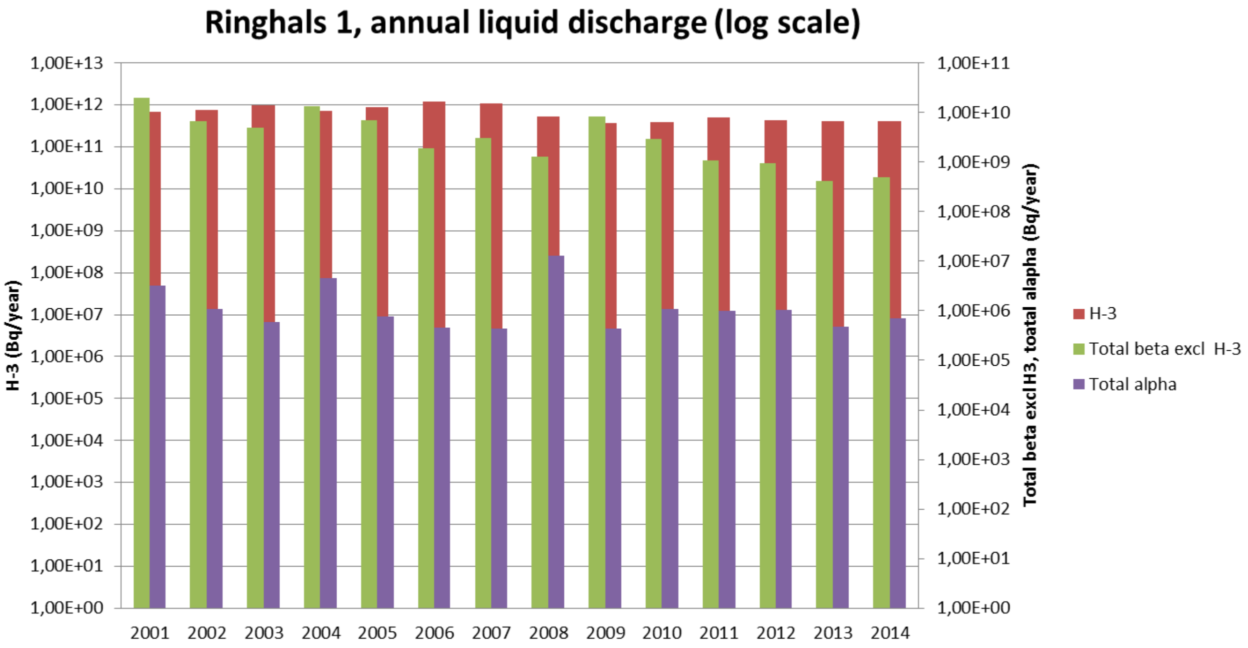

Figure 1.1A *Liquid discharges in Bq from Ringhals Unit 1, 2001–2014, for H-3, total beta excl. H-3 and total alpha, note the logarithmic scale.*

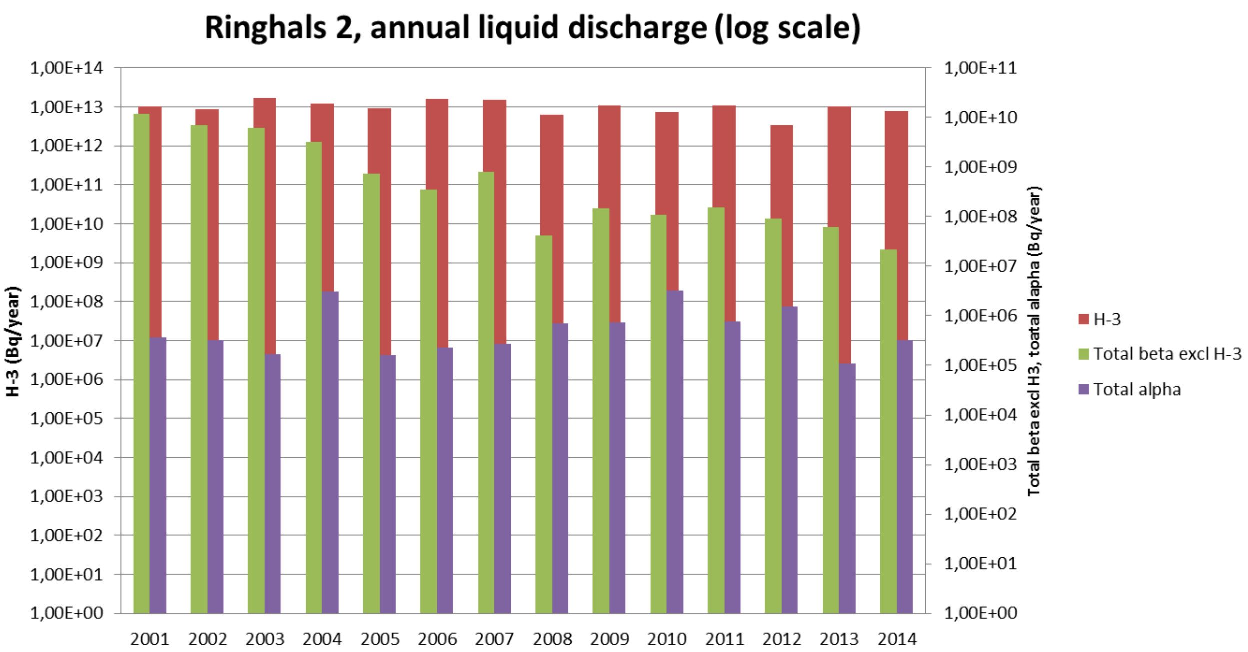

Figure 1.1B *Liquid discharges in Bq from Ringhals Unit 2, 2001–2014, for H-3, total beta excl. H-3 and total alpha, note the logarithmic scale.*

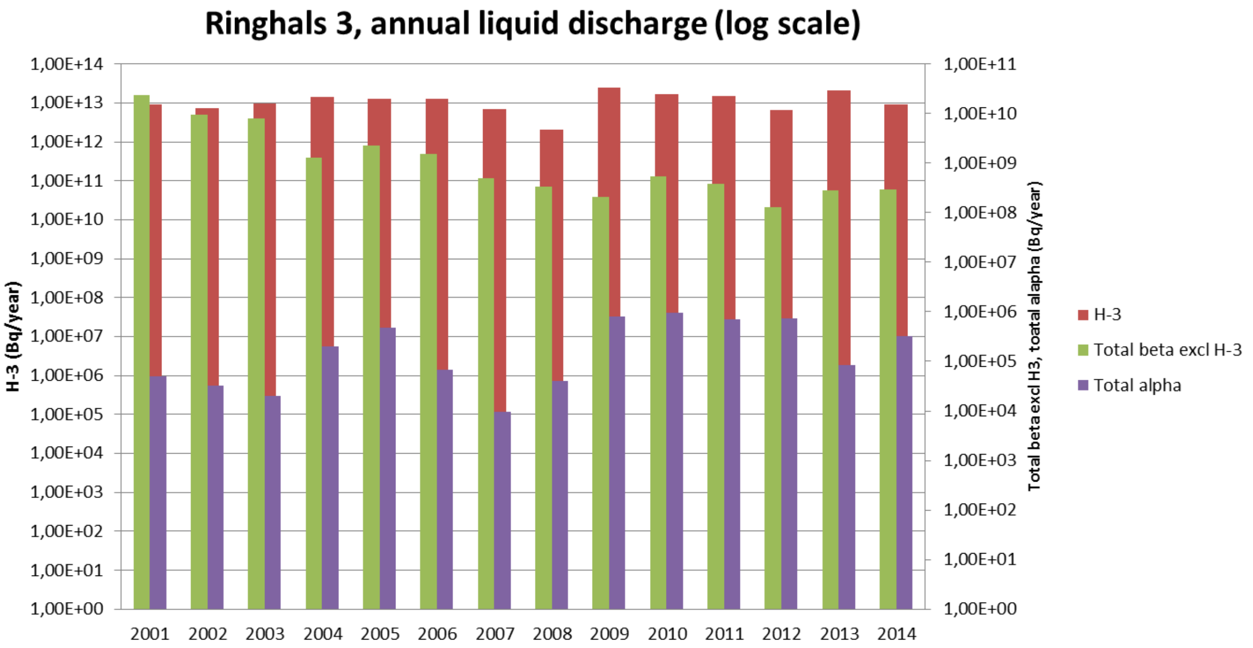

Figure 1.1C *Liquid discharges in Bq from Ringhals Unit 3, 2001–2014, for H-3, total beta excl. H-3 and total alpha, note the logarithmic scale.*

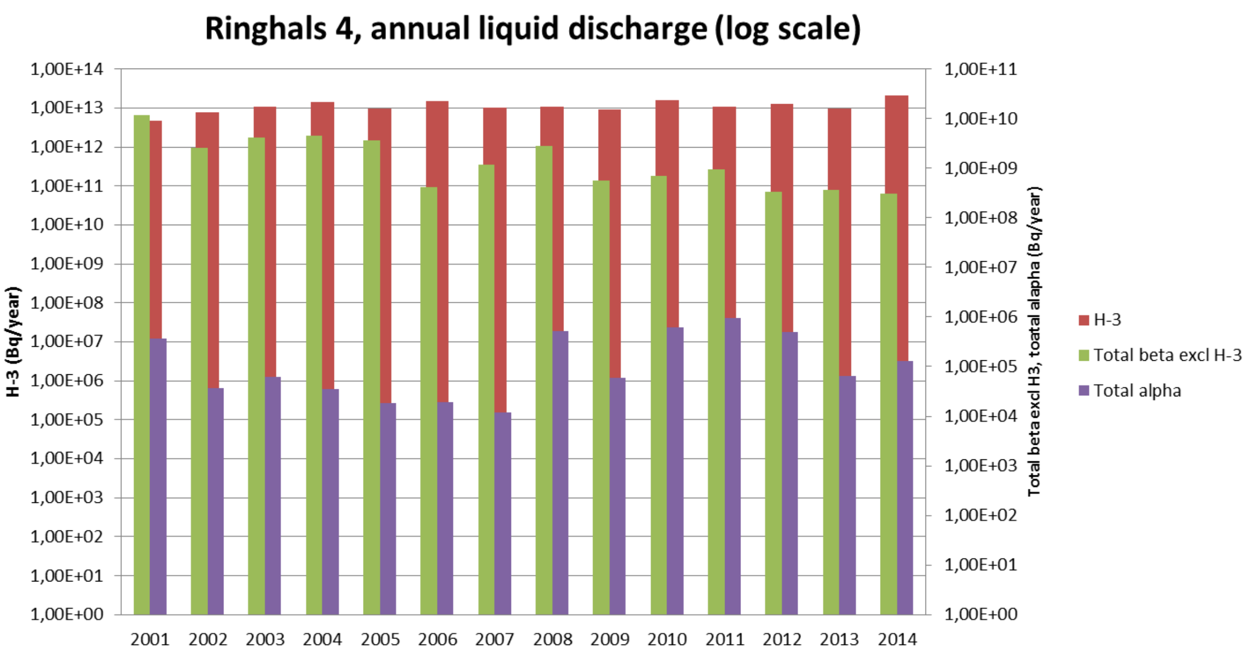

***Figure 1.1D** Liquid discharges in Bq from Ringhals Unit 4, 2001–2014, for H-3, total beta excl. H-3 and total alpha, note the logarithmic scale.*

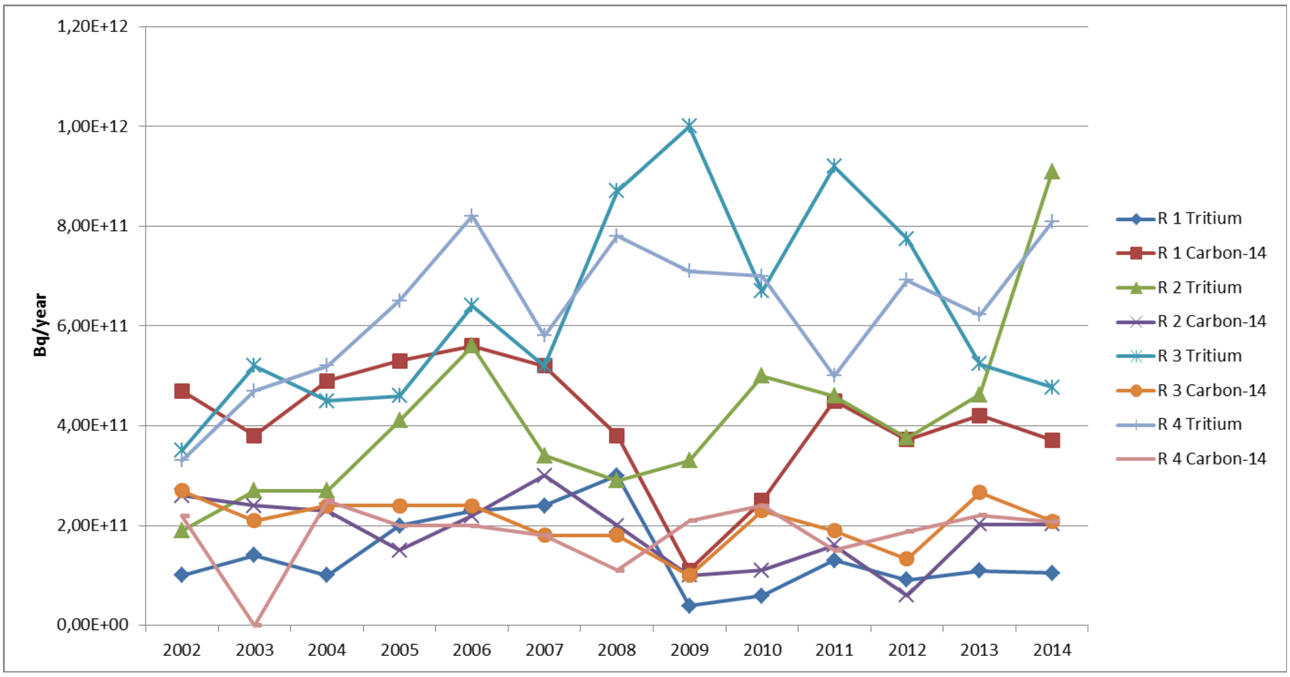

***Figure 1.2** Emissions of tritium and Carbon-14 (Bq) to air from Ringhals 1-4.*

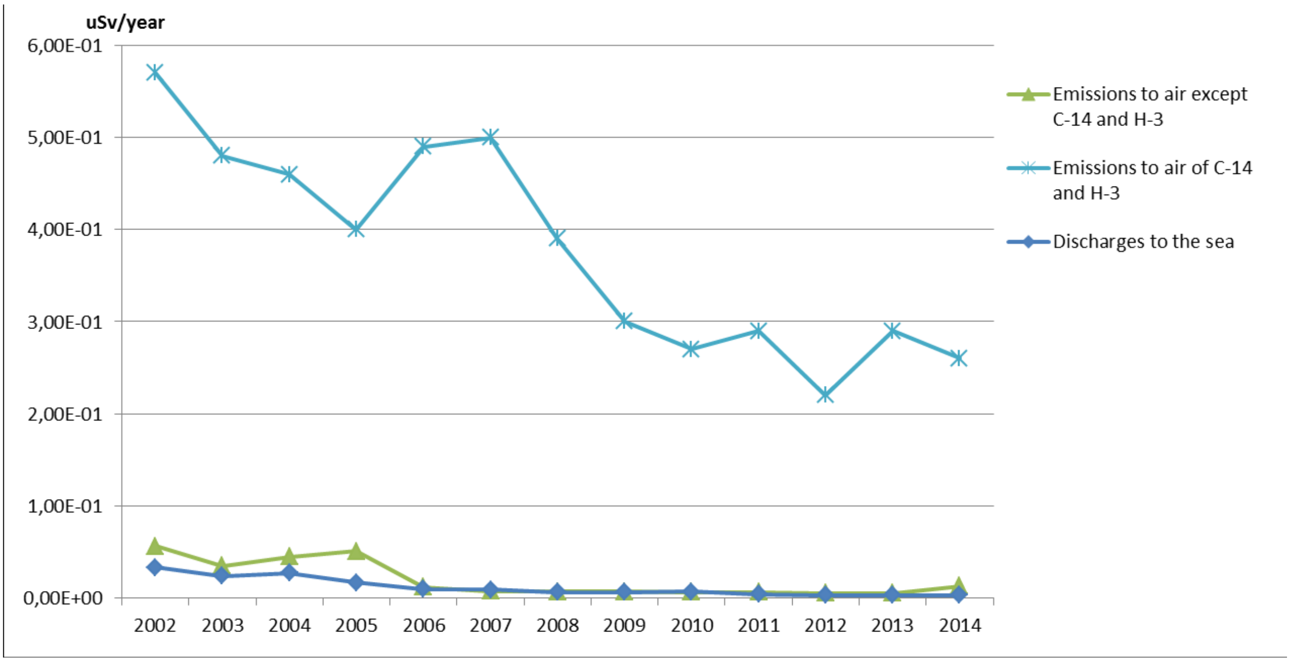

Figure 1.3 *Annual effective dose (microSv) to members of the critical group around Ringhals.*

OSPAR COMMISSION

Protecting and conserving the North-East Atlantic and its resources

Overview of national statements on the implementation of PARCOM Recommendation 91/4

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