Cyfoeth Naturiol Cymru
Natural Resources Wales

Environment Agency

nuclear sector plan

2014 environmental performance report

We are the Environment Agency. We protect and improve the environment and make it a better place for people and wildlife.

We operate at the place where environmental change has its greatest impact on people's lives. We reduce the risks to people and properties from flooding; make sure there is enough water for people and wildlife; protect and improve air, land and water quality and apply the environmental standards within which industry can operate.

Acting to reduce climate change and helping people and wildlife adapt to its consequences are at the heart of all that we do.

We cannot do this alone. We work closely with a wide range of partners including government, business, local councils, other agencies, civil society groups and the communities we serve.

We are a Welsh Government sponsored body formed in April 2013. We have taken over much of the work of the Countryside Council for Wales, Forestry Commission Wales and the Environment Agency in Wales, as well as certain Welsh Government roles.

It is our job to protect, maintain and improve the environment and natural resources of Wales now and in the future.

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Foreword

We are pleased to introduce this annual report on the environmental performance of the nuclear industry in England and Wales. It shows how the industry performed in 2014 against the objectives and targets in Issue 3 of the nuclear sector plan.

The industry progressed well against most objectives in 2014, maintaining good relationships and sharing best practice.

Highlights included:

- The amount of active waste sent to the Low Level Waste Repository (LLWR) in 2014 was at an all time low of 2,400 tonnes (10% of all low level waste), due to greater use of alternative routes.
- All operators can point to strategies, sustainability plans or vision statements that include long- and medium-term environmental goals.
- All sites have training programmes in place to raise environmental awareness among staff at all levels.

We are pleased that the nuclear industry continues to support and help us develop the nuclear sector plan. We want the industry to use it to share lessons it has learned and to encourage new ideas to further improve its environmental performance.

Recognising the joint effort between the regulators and the nuclear industry, where we use 'we' in the main part of this document, we are referring to the Environment Agency, Natural Resources Wales and the whole nuclear industry.

Organisations involved in the nuclear sector plan are shown below. Recognising the introduction of new nuclear power stations, we hope to widen this group in the coming years.

This is the tenth annual report since the nuclear sector plan was created in 2005 and it will be the last comprehensive benchmark report for existing nuclear sites. Future reports will be more concise for existing sites and will include new nuclear sites.

Harvey Bradshaw – Environment Agency

Ceri Davies – Natural Resources Wales

Summary

1. **Minimise resource consumption and carbon footprint**
The industry has continued to reduce the amount of energy and water it consumes. Since 2013 it has used 780,000 fewer megawatt hours (MWh) of energy, a reduction of 11% and over 672,000m^3 less water (a 5% reduction). Overall, there was a less than 1% increase in the total volume of carbon dioxide emissions in 2014, which is not significant (and less than 2012 and 2011 figures).
2. **Minimise discharges to air and water**
Liquid discharges weighted by dose impact saw a 7% reduction across the industry since 2013. This is largely due to improvements in the way that we calculate the impact of discharges from the fuel fabrication and enrichment sub-sector. The other sub-sectors reported reductions in their recorded discharges when compared to 2013. Gaseous discharges weighted by dose impact remained low but increased by 11% compared with 2013 levels due to fluctuations in ongoing activities. All sub-sectors reported increases in their discharge levels.
3. Promote use of the waste hierarchy
132,000 m^3 less inert and non-hazardous waste was generated in 2014 compared with the previous year. Increasing amounts of waste are being diverted from the Low Level Waste Repository (LLWR). These are being sent for other methods of treatment, recycling or disposal, for example, materials being sent for thermal treatment, or disposal of certain wastes at suitably permitted landfill sites. The amount of active waste sent to the LLWR in 2014 was at an all time low of 2,400 tonnes (10% of all low level waste, down from 13% in 2013), maintaining capacity of a vital national repository resource.
4. Demonstrate environmental management and leadership
All of the sites have training for staff and contractors to make them aware of the environmental considerations about the work that is being done on the sites. A number of sites have implemented career development schemes to help develop and assist with accreditation of environmental professionals.
5. Progress decommissioning and manage land quality
In 2014, as decommissioning and characterisation progressed, the total intermediate level waste (ILW) inventory increased by approximately 930m^3, an increase of 1.3% on 2013. The percentage of conditioned waste is at a 5 year high of 28.2%, an increase of 0.5% on last year's performance. The total volume of conditioned waste, with a final letter of compliance for a future geological deep disposal facility, was 28,610m^3. 86% of operators recognise land quality in their corporate arrangements, up from 79% in 2013.
6. Maintain or improve a very high level of regulatory compliance
All sites and operators continue to consistently comply with national regulations. There was a small increase (from 57 to 60) in the number of minor permit breaches when compared with 2013.

7. Further implement better regulation
As noted in previous performance reports, the Environment Agency has already completed 2 of its improvement goals under this objective: one on the provision of guidance to operators and the other on listening and responding to the views of customers. It is making progress with its other ongoing goals. The Environment Agency has continued to evaluate its performance at providing written feedback to operators and sites about non-compliances. Sometimes there have been delays in completing investigations due to the complexity of root causes. In 2014, it provided 45% of written feedback within 2 months of receiving notification of the event, although in almost all instances the regulators had kept in touch with sites and updated them verbally.
Appendix 1. Details of liquid discharges
The total amount of radioactive discharges into controlled waters in 2014 decreased by 300 TBq (10%) in tritium disposals across the industry since 2013. Both alpha and beta/gamma increased by 2.9% (total of 0.185 TBq) and 1.76% (total of 15.41 TBq) respectively compared with 2013. Out of 14 expected outcomes for 2020 levels, defined in the 2009 UK Strategy for Radioactive Discharges, 7 are already being met. Both the research and defence sub-sectors are meeting all of their baselines.
Appendix 2. Details of gaseous discharges
Total gaseous discharges increased by 5,928 TBq compared with 2013. For the nuclear industry as a whole, out of the 4 reported discharge streams, only tritium showed a decrease in the amount of radioactivity discharged. Total alpha, beta/gamma and krypton-85 increased by 23%, 13% and 12% respectively. Total discharges of tritium from the defence and fuel reprocessing sub-sectors decreased by 43% on 2013 figures.

Introduction

The Environment Agency and Natural Resources Wales (Cyfoeth Naturiol Cymru) regulate the disposal of radioactive waste at and from nuclear sites in England and Wales. The Environment Agency also provides nuclear regulatory services to nuclear sites in Wales on behalf of Natural Resources Wales, ensuring a consistent approach to nuclear regulation across England and Wales. Published by the Environment Agency and Natural Resources Wales, this report has been prepared with the help of nuclear site operators and presents the latest information on environmental performance for the nuclear industry in England and Wales.

Since 2005 the nuclear sector plan has provided insight into both the Environment Agency's and the nuclear industry's progress in working towards a number of objectives. At the end of 2012, Issue 3 of the nuclear sector plan was published, grouping some of the existing objectives and adding new ones.

The nuclear industry is diverse, comprising licensed nuclear sites involved with generating electricity, decommissioning and clean-up of redundant facilities, waste management, research and development, defence and medical & bioscience. This wide range of activities results in variable levels of discharges and use of resources from year to year.

In 2014, 19% of electricity in the UK was generated by the nuclear sector, approximately equivalent to the amount of energy produced by 13.9 million tonnes of oil.

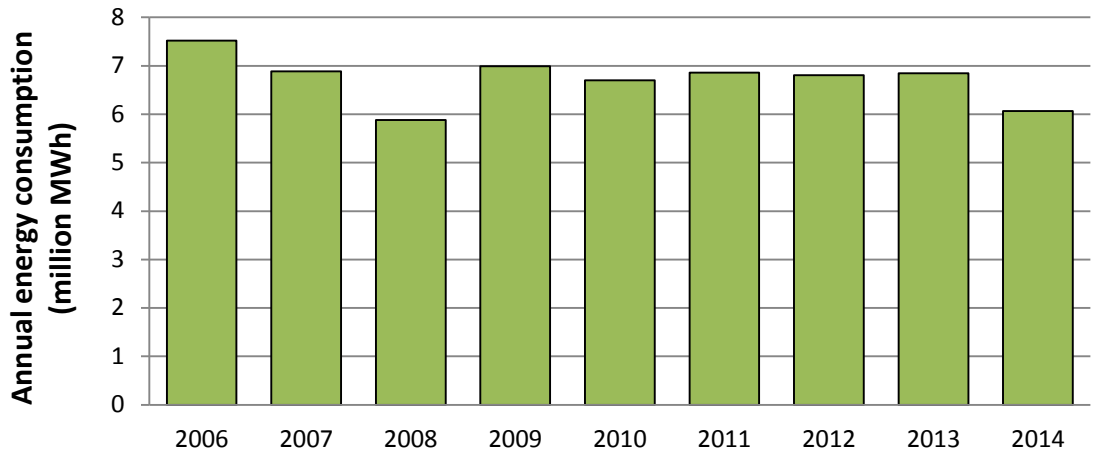
Recognising that new nuclear power stations will be built in the future, this tenth nuclear sector plan performance report will be the last benchmarking report in the current format. Future reports will be more concise for existing sites and the 2015 report will include new nuclear sites for the first time.

Objective 1: Minimise resource consumption and carbon footprint

Both water and energy are important resources. The nuclear industry traditionally consumes a large amount of both, although the amount of resources consumed does largely depend on the nature of the site and the work being carried out. Some projects and technologies require large amounts of water and/or energy.

Minimise energy use

Figure 1: Total energy use

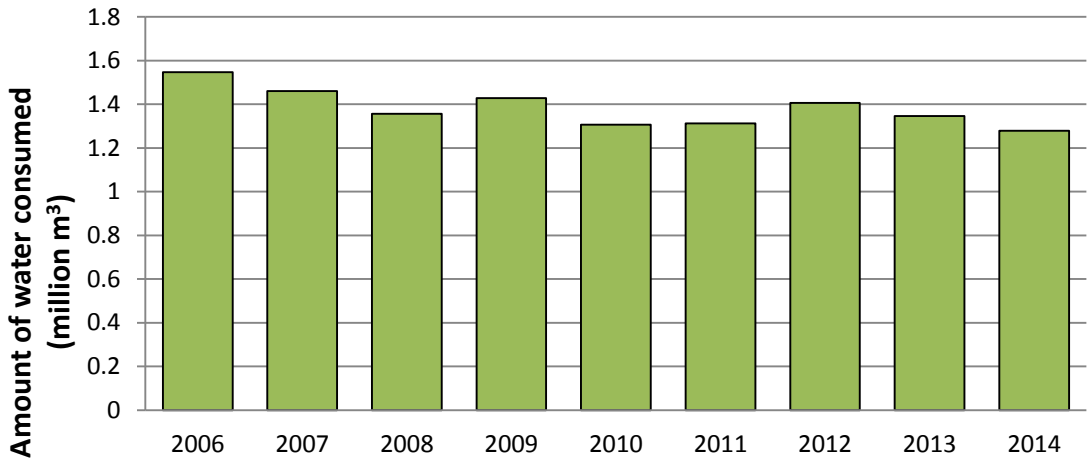


In 2014, 0.78 TWh or 11% less energy was used compared with 2013, with over 80% of the total reduction coming from the energy generation sub-sector. This is due to planned outages at a number of operational nuclear power stations, as well as reductions in the energy requirements from sites undergoing decommissioning. All sub-sectors of the nuclear industry reduced the amount of energy they used, apart from waste management, which showed a small increase of approximately 450 MWh.

All of the operators are working to make staff more aware of the need to reduce the amount of energy used.

Minimise water use

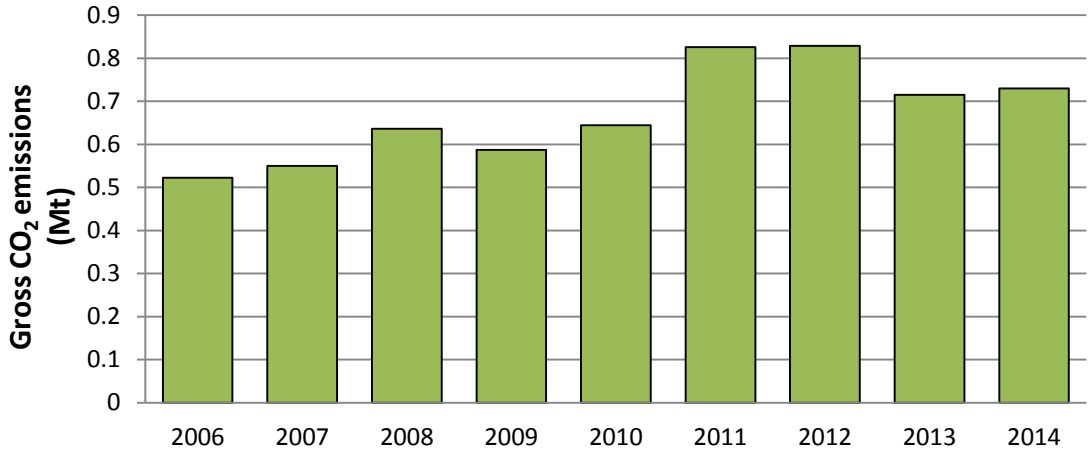
Figure 2: Total water use



Some nuclear sites use water in their production and safety systems and equipment, giving them limited scope to reduce the amount of water they use. However, sites saved approximately 672,000 m^3 of water last year, a decrease of 5%. Overall, the energy generation sub-sector showed the greatest reduction since 2013 due to more efficient equipment and changes in the amount of water needed to support ongoing projects. Most sub-sectors used less water, apart from medical and bioscience, which used slightly more.

Minimise the amount of greenhouse gases generated

Figure 3: Total greenhouse gas emissions



Overall, the nuclear industry showed a small increase (less than 1% compared with 2013) in the amount of carbon dioxide (CO_2) generated. This small increase is not significant and emissions

were still less than for 2011 and 2012 The energy generation, medical & bioscience and waste management sub-sectors showed small increases. The rest of the industry reported reductions in gross CO_2 emissions.

Emissions of CO_2 are estimated by multiplying energy use by a constant called an 'emission factor'. Emission factors are based on the typical products of combustion of a fuel source and vary depending on the chemical composition of the fuel. In the case of electricity generation, the CO_2 emission factor is a composite value. It depends on the mix of energy sources (for example, nuclear, coal, gas, hydroelectric) used to generate the electricity. The CO_2 emission factor for electricity used by the nuclear electricity generation sub-sector is low, as most energy is sourced from its own (nuclear) power generation.

Objective 2: Minimise discharges to air and water

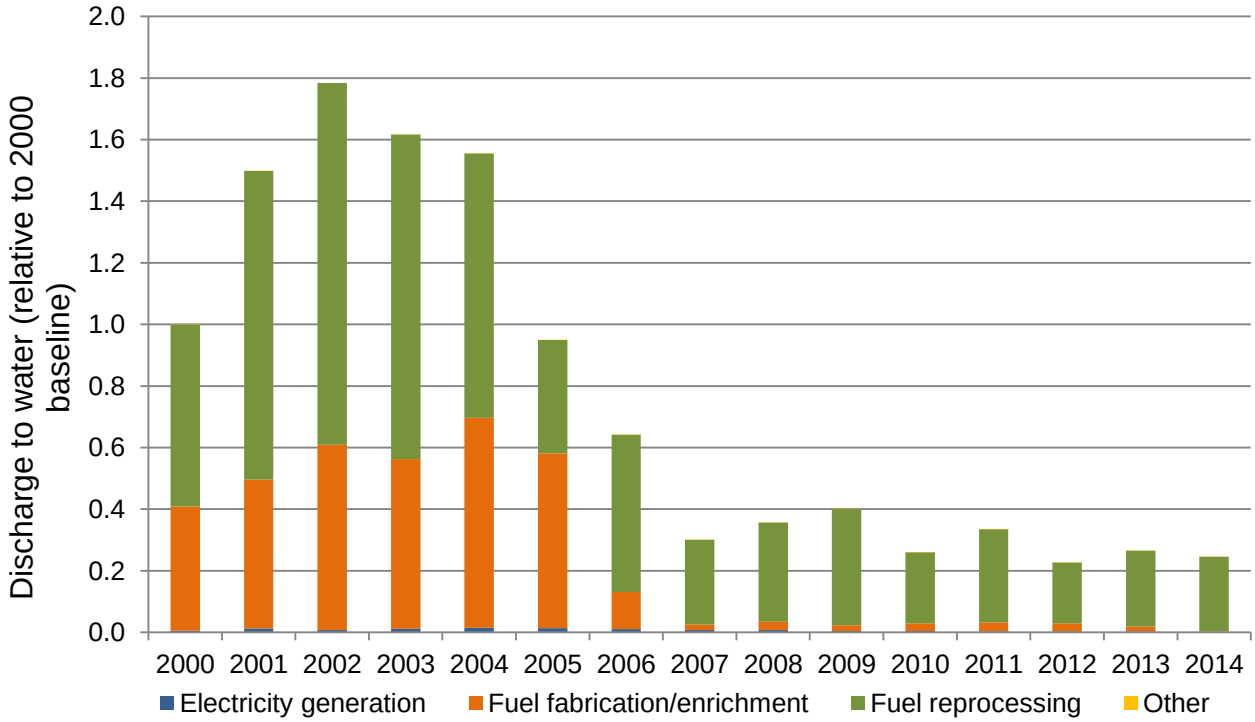
Both the Environment Agency and Natural Resources Wales regulate radioactive discharges to air and water by issuing site-specific permits to nuclear operators. The permit holders must meet specific conditions and agreed discharge limits set within the permit and use best available techniques (BAT) to minimise releases to the environment. The Environment Agency and Natural Resources Wales carry out regulatory work that includes detailed site inspections and audits to verify that the permit holders are complying with the permit conditions.

Minimise discharges to water

In 2009 the 'UK Strategy for Radioactive Discharges' set a number of objectives for discharges to water (liquid discharges) for each of the nuclear sub-sectors. You can find a more detailed description of radioactivity and the discharges from the nuclear industry in the strategy.

Figure 4 below does not show the actual volume or activity of radioactive discharges to water. Rather, the total activity of each radionuclide discharged to controlled waters is multiplied by a specific ‘dose per unit release’ factor, which takes into account the likely concentration in the environment and the different potential effects of each radionuclide discharged. This gives a figure to show the total discharge weighted by (potential) dose impact or by radiotoxicity. The total is then compared to the 2000 levels to show the trend over time. The graph is, therefore, comparative and does not have any units. The ‘other’ category is the collected discharges from the medical & bioscience, defence, research and waste management industry sub-sectors. These are negligible when compared with the fuel reprocessing sub-sector. Appendix 1 shows the actual activities discharged in a more detailed breakdown by type of radiation and industrial sub-sector.

Figure 4: Trends in radioactive discharges to water

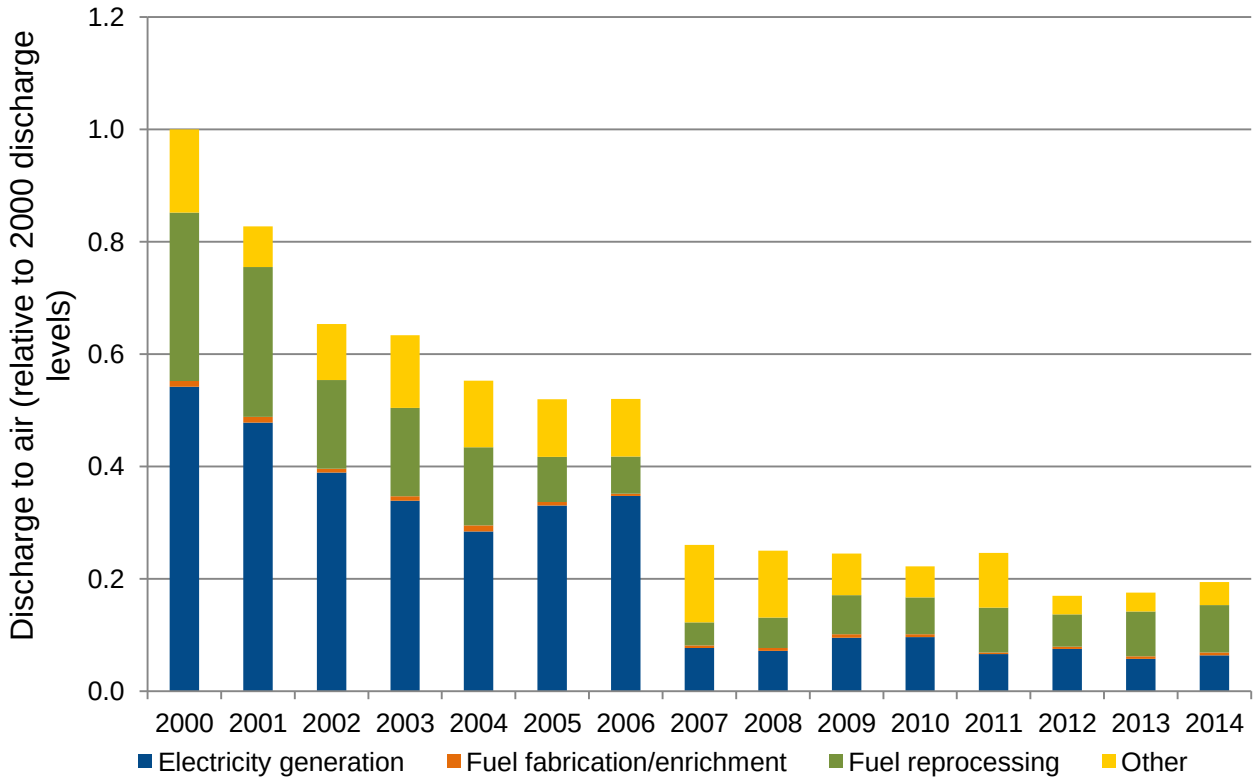


- Total discharges fell by 7% from 2013. This is partly due to improvements in the way that we calculate the impact from the fuel fabrication and enrichment sub-sector. The calculation now better reflects the short-lived nature of its beta/gamma discharges by weighting them less heavily. This has resulted in calculated dose impact from that sub-sector being equivalent to 2% of 2013.
- Discharges fluctuate year-on-year depending on projects and programmes of work being implemented across the diverse sub-sectors of the industry.
- All sub-sectors showed reductions in the weighted activity that was discharged in 2014.
- The fuel reprocessing sub-sector dominates, being responsible for 99% of all discharges. Discharges are related to reprocessing plant throughput. Fuel reprocessing at Sellafield is scheduled to cease around 2020.
- Discharges from the electricity generation, fuel fabrication and enrichment and other sub-sectors are too low to be shown in Figure 4.

Minimise discharges to air

The chart below does not show the actual volume or activity of radioactive discharges to air. Total discharges to air have been calculated in a similar way to those for liquid discharges, but by using standard values of dose per unit inhaled. There is a more detailed breakdown available in Appendix 2.

Figure 5: Total assessed radioactive discharges to air



- There was an increase of 11% on 2013 levels due to increases reported by the generation, reprocessing and ‘other’ sub-sectors. Discharges fluctuate year-on-year depending on projects and programmes of work being implemented across the diverse sub-sectors of the industry.
- Only fuel fabrication and enrichment did not report an increase, with the reported figure for 2014 falling by 1%.
- The largest increase was from the ‘other’ category (consisting of medical and bioscience, defence, research and waste management industry sub-sectors), up 11% since 2013.

Objective 3: Promote use of the waste hierarchy

The nuclear industry generates a range of radioactive and non-radioactive solid waste from activities at its sites. Decommissioning and clean-up of sites produces large amounts of waste, most of which will be lightly contaminated building materials or soils. Waste is disposed of in accordance with permits granted by the Environment Agency and Natural Resources Wales.

Operators must use the 'waste hierarchy', which is designed to prioritise different ways of disposing of all types of waste (reduce, reuse, recycle) based on the benefit to the environment. One of the benefits of this approach is to minimise the need for specialised waste disposal facilities which have limited capacity. Nuclear sector plan objectives encourage operators to try and limit the amount of waste they dispose of at these facilities and to make sure they dispose of the waste at a facility that is appropriate for the hazard the waste presents.

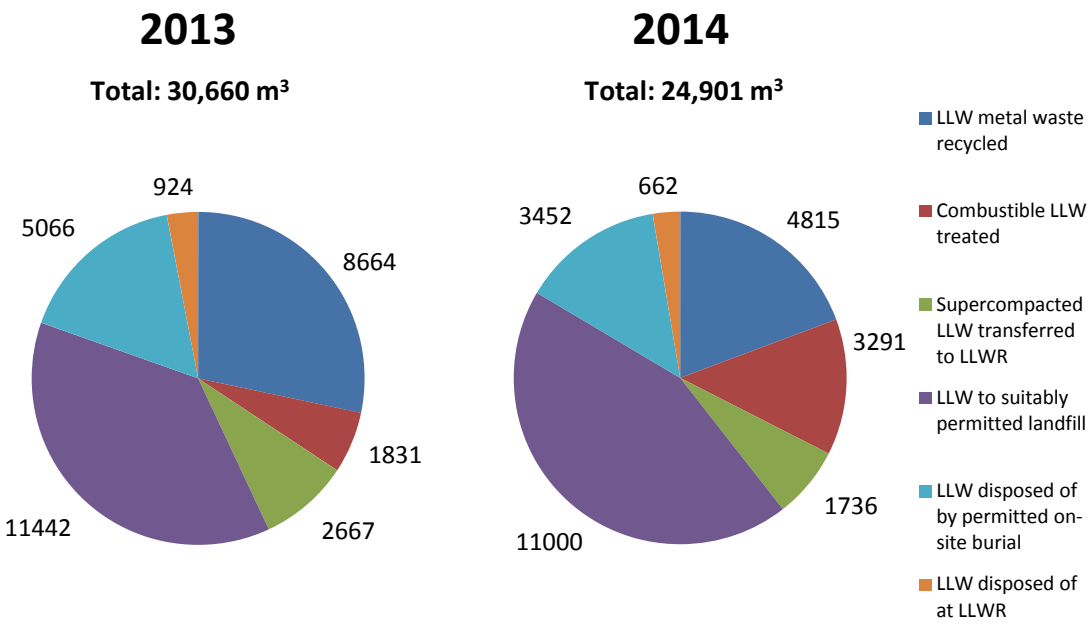
Minimise amount of waste disposed of at the Low Level Waste Repository

Low level waste (LLW) consists of material that has been contaminated by small amounts of radioactive material. 90% of the volume and 1% of activity of the world's radioactive waste is classified as LLW. In the past, most LLW was disposed of at the Low Level Waste Repository (LLWR) near Drigg in Cumbria due to a lack of alternative disposal routes.

Since 2007, there have been more options for disposing of LLW. Some categories of LLW, including very low level waste (VLLW), can now be disposed of at permitted landfill sites. You can find the UK Low Level Waste Strategy on the Low Level Waste Repository website. The strategy encourages operators to use the waste hierarchy, preferring, where practicable, waste prevention, reuse and recycling.

The regulators are now encouraging the nuclear industry to reduce the amount of waste it sends to the LLWR by using the waste hierarchy and other ways of disposing of waste (using incinerators for certain waste or landfill sites permitted to accept LLW). This will help to protect the capacity of a vital national resource.

Figure 6: 2014 LLW disposals (m^3) by method of disposal



Overall, in 2014 the total volume of LLW generated was 5,759 m^3 less than in 2013. Only 10% of LLW (2,398 m^3) was sent to the LLWR for disposal in 2014, either as super-compacted waste or for direct disposal, compared with 13% (3,591 m^3) in 2013. The charts in Figure 6 above compare 2013 and 2014 disposals of LLW and the routes used.

The amount of metal recycled fell by over 3,800 m^3 from 2013 figures. A large proportion of this reduction was due to projects at the Bradwell site being completed in 2014, which caused a sharp decrease in the amount of LLW metal being produced. Other important projects in 2014 produced other waste such as VLLW soil from remediation work and little metallic waste was generated. The Bradwell site now also focuses more on sorting, characterising, segregating and cleaning waste to allow more metal waste to be released as out of scope metal.

Thermal treatment of LLW almost doubled and disposals by permitted on-site burials at Sellafield fell by 1,614 m^3.

Managing non-radioactive waste

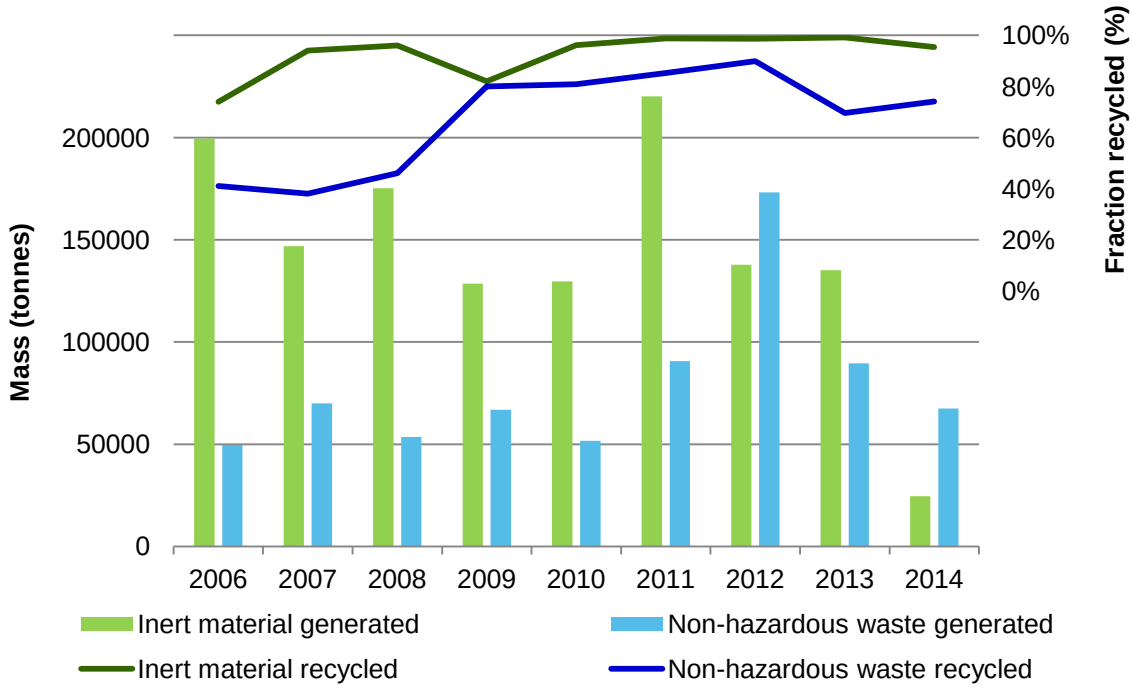
Most of the waste the nuclear industry generates is non-radioactive. Non-radioactive waste is divided into 3 categories: hazardous, inert and non-hazardous waste.

Hazardous waste is harmful to people and the environment and has to be disposed of using a specific technical treatment or sent to a specialist landfill site. Examples include asbestos, solvents, oil and pesticides. There are no performance indicators for hazardous waste in the nuclear sector plan.

Inert waste has no hazardous properties and does not undergo any significant physical, chemical or biological transformations. Sand is an example of inert waste.

Non-hazardous waste, although it doesn't have any hazardous properties, is not inert and could present challenges if not dealt with properly as it may biodegrade. Examples of non-hazardous waste include paper, cardboard and plastic.

Figure 7: Amounts of inert and non-hazardous waste generated and recycled



Overall, there were large reductions in the amounts of waste generated, with 24,540 tonnes of inert waste and 67,540 tonnes of non-hazardous waste produced in 2014. This reduction in total waste generated was forecast in the 2013 report and is due to Magnox stopping dredging operations related to pumping cooling water at Oldbury and the completion of building demolitions at GE Healthcare.

The amount of inert waste recycled slightly reduced from the 2013 figure of 99%, but remained very high at 95%. Non-hazardous waste saw a small increase of 4% of waste sent for recycling.

Objective 4: Demonstrate environmental management and leadership

All of the industry operators have displayed a clear commitment to making sure that they maintain a high level of environmental management, as well as working to share good practice within the industry. Issue 3 of the nuclear sector plan set out a number of challenges for industry. These, and a summary of the industry's response to them, are set out below.

Long-term strategic environmental goals

All operators can point to strategies, sustainability plans or vision statements that include long- and medium-term environmental goals, a number of which have been included below:

- Magnox Ltd has a 5-year mission statement, which details strategy and improvement plans for each site. It also has an overarching operating plan through to each site's final clearance.
- The Atomic Weapons Establishment (AWE) has a number of ongoing environmental objectives, each with regularly updated targets to help evaluate and drive environmental performance.
- Each of EDF's power stations maintains a 5-year environmental plan, detailing 4 areas of focus, and individual sites regularly evaluate and report their progress.

Demonstrate environmental awareness throughout the organisation

All sites have training programmes in place to educate all levels of staff, and some have organised events, such as photography competitions, to encourage staff to maintain a suitable level of environmental awareness.

Retain accredited management systems

All operators have stated that they have a suitable environmental management system in place. Over 80% of sites have an environmental management system that has been, or is in the process of being, independently certified to an international standard (such as ISO 14001). The remaining sites have chosen alternative arrangements, which they maintain to equivalent high standards.

Develop sustainable procurement

All operators and sites either have an official sustainable procurement procedure or are in the process of implementing a scheme to continue to develop sustainable procurement. For example:

- Sustainability remained one of the core parts of Sellafield's supply chain management policy.
- Springfields is in the process of implementing newly developed green procurement guidelines.
- Magnox Ltd has implemented a number of processes and systems to help evaluate the health and sustainability of its supply chain, and is working to make sure it regularly liaises with suppliers, interested groups and other nuclear sites undergoing decommissioning.
- EDF has developed a practical guide to educate suppliers about the high standards of human rights, labour statements, ethical conduct and environmental management within the 10 principles of the UN Global Compact.
- The Atomic Weapons Establishment (AWE) has set objectives and targets for sustainable procurement within its company sustainability plan.
- LLWR has a contract framework in place to make it easier to divert waste to other disposal and treatments facilities. The site shares this framework with all operators using the LLWR.

Share good environmental practice

A number of the site operators stated that they share good practice both internally and externally, either through industry forums, such as the Environment Agencies' Requirements Working Group (EARWG) and the Nuclear Industry Liaison Group for Land Quality (NILG LQ), or with other sites and operators.

Objective 5: Progress decommissioning and manage land quality

The UK has a diverse nuclear legacy, ranging from the complex issues at Sellafield to smaller sites with nuclear research facilities. Generating and managing intermediate level waste (ILW) has become challenging. One of the areas for improvement identified in the plan is managing 'legacy' waste, which is awaiting conditioning and packaging so it can be disposed of safely.

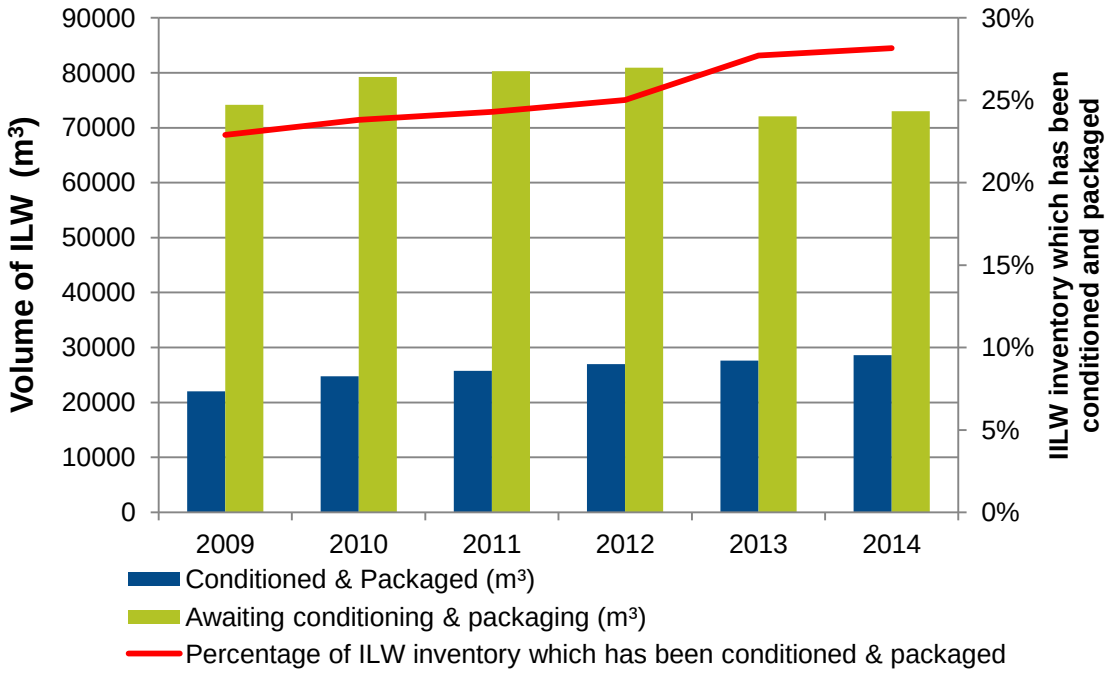
The common method of evaluating the industry's performance in managing ILW is the percentage of the total ILW that has been packaged and issued with a final letter of compliance (FLoC) from Radioactive Waste Management Ltd. The purpose of the FLoC is to certify that the packaged waste meets all requirements and standards for eventual disposal in a geological disposal facility.

Continue to retrieve and package intermediate level waste (ILW)

The current UK ILW strategy is to condition the waste into a more stable and safe form and package it in suitable containers. This packaged waste is then stored in 'fit-for-purpose' stores until a suitable final disposal route is identified.

Radioactive Waste Management Ltd provided the data displayed in Figure 8 below.

Figure 8: Total volume of raw and conditioned/packaged ILW and ratio of packaged waste to total ILW in stock*



*Figures are based on the 2013 UK Radioactive Waste Inventory at 1 April 2014, rounded to whole numbers.

In 2014 with ongoing decommissioning and characterisation, the total ILW inventory increased by approximately 930m^3, an increase of 1.3% on 2013 figures. The percentage of packaged and conditioned waste is at a 5-year high of 28% of the total inventory, an increase of 0.5% on last year's performance. The total volume of conditioned waste was 28,610m^3.

Final disposal of ILW is currently not possible for the majority of the current waste inventory due to the lack of a national geological disposal facility (GDF). While this is the case, interim waste stores have been constructed on a number of nuclear sites to store the waste safely until it can be finally disposed of in the GDF.

Some ILW waste, especially waste with short half lives, will not need to be consigned to the GDF for final disposal. This waste has different waste conditioning and packaging requirements and may be consigned to alternative waste treatment and disposal schemes. The industry continues to research methods and technologies to treat various types of ILW through groups such as the Nuclear Waste Research Forum.

Record progress in managing land quality

- 86% of sites confirmed that they recognise land quality arrangements in their corporate procedures, up from 79% in 2013 (incorrectly reported previously).
- There are people trained and skilled in land quality management at 90% of sites, up from 83% in 2013 (incorrectly reported in 2013 report).
- 76% of sites have a register of known or potential land quality hazards on site, while 86% of sites have a formal process for reviewing known or potential hazards.
- 59% of sites have a prioritised action list and other sites are developing an action list for dealing with known or suspected land quality hazards.
- 86% of operators reported that they have systems for keeping land quality records up to date that they can easily access.
- In 2014, 28% of sites reported to the public on land quality (down from 59% in 2013). This was mainly through reports to local interested groups and liaison committees regarding upcoming projects or proposed policy changes.
- 60% of sites produced a statement against targets on land quality management, the same as in 2013.

Objective 6: Maintain or improve a very high level of regulatory compliance

The nuclear industry continues to achieve a high standard of regulatory compliance. It is a heavily regulated industry, reflecting the significant hazards and risks associated with activities on its sites. Both the Environment Agency and Natural Resources Wales work with industry and the Office for Nuclear Regulation (ONR) to ensure a high level of compliance and to provide support and guidance. In the rare event that a site is non-compliant, they are committed to responding promptly to understand how this occurred and to prevent it happening again.

The Environment Agency and Natural Resources Wales monitor breaches of permit conditions using the Compliance Classification Scheme (CCS). This ranks breaches on a 1 to 4 scale.

Category 1 breaches are the most severe. For radioactive substances this means an incident that could potentially result in significant and extensive radioactive contamination that needs major intervention and measures to deal with it and for which a national response plan may be carried

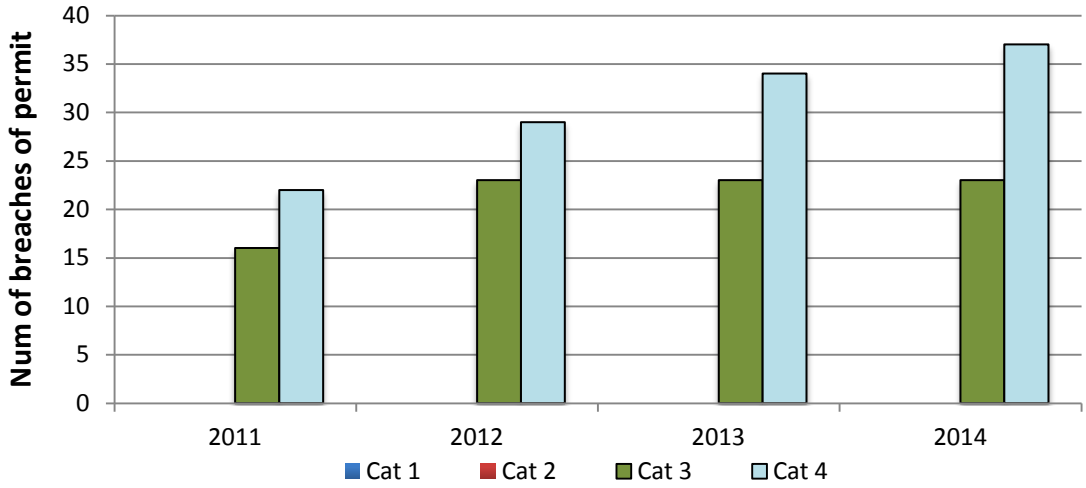
out. It could also refer to an incident in which a member of the public receives a significant dose of radiation.

Category 2 breaches are used when the permit breach could result in localised contamination requiring limited intervention and countermeasures, or an incident that could potentially cause a significant radiation dose. In 2014, there were no category 1 or 2 permit breaches on any nuclear sites.

Category 3 breaches are activities that could cause minor harm to or pollution of the environment, such as monitoring equipment failing. The number of category 3 breaches remained the same as 2013, with a total of 23 breaches recorded in 2014.

Category 4 breaches have no impact or potential impact on the environment. This could include a minor failure in record keeping or other failings in process or procedure. The number of category 4 breaches rose from 34 in 2013 to 37 in 2014. Overall, there was a slight increase in the total number of minor (CCS 3/4) breaches from 57 in 2013 to 60 in 2014.

Figure 9: Total number of permit breaches



In 2010, the Environment Agency changed its internal guidance on scoring non-compliances with environmental permits for radioactive substances activities. This guidance advises that officers should assign CCS scores to both breaches of permit and the root cause of the breach. For example, if an operator failed to take a sample required by a permit, as a result of a member of staff being inadequately trained, then CCS scores will be assigned to both the failure to take the sample and also to the operator's failure to have an adequate management system to ensure training is carried out. Using this root cause analysis has contributed to the year-on-year increase of permit breaches identified as inspectors become more experienced at identifying root causes. Another contributing factor has been an increase in operators self-reporting incidents to regulators.

Table 1: Comparison with other industries

Industry sector	Serious breaches of permit in 2014*	Number of permits 2014	% serious breaches to permits
Nuclear	0	38	0.0
Water	262	23561	1.1
Chemicals	13	463	2.8
Energy	4	382	1.0
Waste	1028	11303	9.1
Mineral products	0	34	0.0
Farming	10	1166	0.9
Food and drink	20	352	5.7
Paper and textiles	2	70	2.9

*'Serious' breaches of permits are classified as Category 1 or Category 2.

While the nuclear industry has a number of unique risks and challenges, it is important to view permit breaches in context with the other industrial sectors. The nuclear industry had no serious permit breaches in 2014, the lowest of any industrial sector apart from the mineral products sector.

The figures above, for sectors other than nuclear, are for England only. Natural Resources Wales is responsible for regulating these sectors in Wales.

Enforcement

There were no events or incidents resulting in formal caution or prosecution in 2014. In March 2014, Studsvik accepted a formal caution. This was issued in relation to category 3 breaches for incorrect transfer of low level radioactive waste to Sellafield which occurred in 2013. There was no environmental impact as a result of the transfer and the company has since completed a programme of improvements to prevent a recurrence.

Objective 7: Further implement better regulation

Reduce requirements for operators to supply data – ongoing

Following the Environment Agency's reduction of some reporting obligations in 2013, there were no specific developments during 2014.

Simplify requirements for keeping records – ongoing

We are working with operators to help them develop guidance to support compliance with Environmental Permitting Regulations (EPR) requirements for keeping records. The target for completing this work is the end of 2015.

Provide guidance - complete

The Environment Agency has met its objective to provide guidance on the information and demonstrations operators are expected to maintain under environmental permits, allowing operators to use and reference information provided for other purposes. This was for completion by June 2013.

RGN RSR2: regulation of radioactive substances activities on nuclear licensed sites was updated in 2012 to provide this guidance.
In 2013 the Environment Agency and Natural Resources Wales published joint guidance on the decommissioning of nuclear facilities.

Review requirements for monitoring – ongoing

The Environment Agency began planning its project to review its own environmental monitoring programmes for nuclear sites in England and Wales. The goal is to have updated environmental monitoring programmes in place for 2016 and this is on track.

Site operators now develop and implement discharge and environmental monitoring programmes through the environmental permit (Radioactive Substances Regulation). Programmes should demonstrate that the operator has applied best available techniques (BAT). Regularly reviewing these programmes may reveal opportunities to improve the link to site lifecycle and even reduce the burden on operators' own programmes in relation to their activities and discharges.

Non-compliance feedback - ongoing

The nuclear sector plan tasks regulators with providing feedback to operators on incidents and permit breaches within 2 months of being told about an event. The Environment Agency has continued to evaluate its performance at providing written feedback to operators and sites about non-compliances.

Detailed investigations by both operators and regulators are needed. These investigations often take longer than 2 months, which, in the past, has led to delays in giving feedback to the operator.

In 2014, the regulators provided written feedback from the operator's original notification of an incident or breach within 2 months in 45% of cases, or agreed in writing with the site that the feedback would take longer due to continuing investigations. The regulators are working to improve their performance in this area. Operators agreed, however, that in the majority of cases the regulators do keep them informed verbally, even if they have not received a formal written communication.

Listen and respond to customer views - complete

In 2013 the Environment Agency sent out an updated customer survey questionnaire to Nuclear Industry Liaison Group (NILG) members. This follows one undertaken in 2012. Very few responses were received. The Environment Agency decided that the small number of responses was insufficient to provide any meaningful indication of views and decided not to pursue this for the time being.

Conclusions

The nuclear industry maintained a good level of environmental performance in 2014. The industry has progressed against almost all sector plan objectives, while continuing to liaise regularly with interested groups.

Despite a continuing small increase in category 4 permit breaches, the nuclear industry has maintained a good level of regulatory compliance. The Environment Agency and Natural Resources Wales are continuing to work with all parts of the industry to help support continued improvement and high performance.

Highlights from 2014 include:

- The amount of active waste sent to the Low Level Waste Repository (LLWR) in 2014 was at an all time low of 2,400 tonnes (10% of all low level waste) due to greater use of alternative routes.
- All operators can point to strategies, sustainability plans or vision statements that include long- and medium-term environmental goals.

- All sites have training programmes in place to raise environmental awareness among staff at all levels.

Significant challenges ahead

The UK government is still working with communities to identify potential sites for a deep geological disposal facility (GDF). Geological disposal is the preferred way of disposing of higher activity radioactive waste from England and Wales. In July 2014, the UK government published a new White Paper 'Implementing Geological Disposal'. This sets out a revised process for selecting a site for a geological disposal facility for higher activity radioactive waste. It primarily focuses on public consultation and the need for community buy-in. Preparatory work will include the preparation of a National Policy Statement for geological disposal and a national screening process.

In Wales, following its own public consultation in 2014, the Welsh Government issued a revised policy in May 2015, which supports geological disposal for the storage of higher activity radioactive waste. Following this, the Welsh Government held a public consultation to seek views on the processes by which a GDF might be sited in Wales, and to provide information to potential volunteer host communities that may want to enter discussions, without commitment, about hosting a geological disposal facility.

The national infrastructure remains fragile for dealing with waste (metal recycling, incineration and capacity at the Low Level Waste Repository/permitted landfills).

The UK Strategy for Radioactive Discharges describes how the UK aims to help meet the Oslo and Paris Convention on the Protection of the Marine Environment of the North East Atlantic (OSPAR) interim objective that, by 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 these discharges, emissions and losses, are close to zero. The UK Strategy does not set individual site limits for radioactive discharges, but it does describe objectives by sub-sectors to be achieved by 2020. The expected outcome of the strategy is for progressive and substantial reductions in radioactive discharges, to the extent needed to achieve the expected sectoral outcomes (taking into account uncertainties such as new nuclear power stations, plant-life extensions for existing power generating sites and closure dates of reprocessing plants). 7 out of 14 objectives to be achieved by 2020 are already being met.

More information

You can find more information on how individual companies have performed by following the links to their websites at the end of this report.

Feedback

We welcome your views on the content and/or format of the report. If you have any queries or comments, please contact nrg.south@environment-agency.gov.uk.

Appendix 1- Detailed breakdown of liquid discharges

In 2002 the UK Strategy for Radioactive Discharges set out a number of expected outcomes, regarding the expected level of discharges by 2020 for certain industry sub-sectors. All current expected outcomes for liquid discharges set out in the 2009 updated strategy document are listed in Table 2 and marked on graphs where relevant. Expected outcomes that have already been achieved are highlighted.

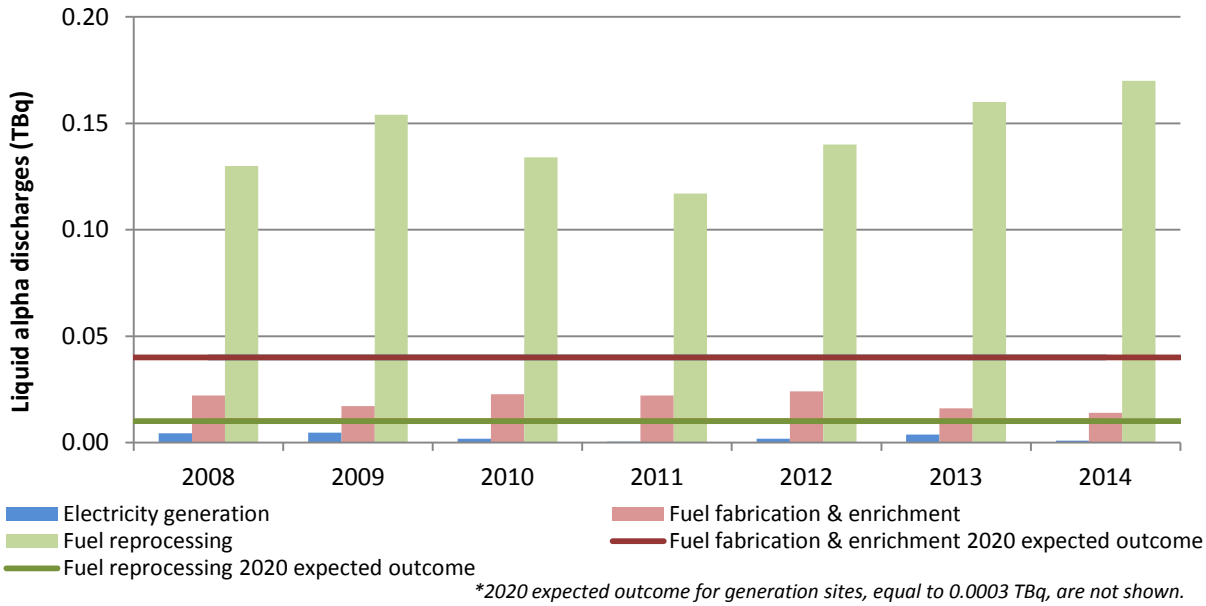
The 2020 expected outcome for the electricity generation sub-sector does not take account of current extended lifetimes of some power stations or potential new nuclear power stations.

Table 2: Breakdown of 2020 expected outcomes for all sub-sectors

	Alpha radionuclides (TBq)		Beta/gamma radionuclides (TBq)		Tritium (TBq)		Tc-99 (TBq)	
	Expected 2020	Reported 2014	Expected 2020	Reported 2014	Expected 2020	Reported 2014	Expected 2020	Reported 2014
Electricity generation	0.0003	0.001	1.5	2.660	850	1323	-	-
Fuel fabrication and enrichment	**0.04**	**0.014**	0.7	2.940	-	-	-	-
Fuel reprocessing	0.01	0.170	**20**	**9.80**	100	1300	1.0	1.3
Research	**0.025**	**0.00**	**0.8**	**0.006**	-	-	-	-
Defence	-	-	**0.003**	**0.00**	**0.4**	**0.0231**	-	-
Medical and bioscience	**0.001**	**0.00**	-	-	-	-	-	-
Waste management	-	-	-	-	-	-	-	-
Sub-sectors already achieving 2020 expected outcomes	3 of 5		3 of 5		1 of 3		0 of 1	

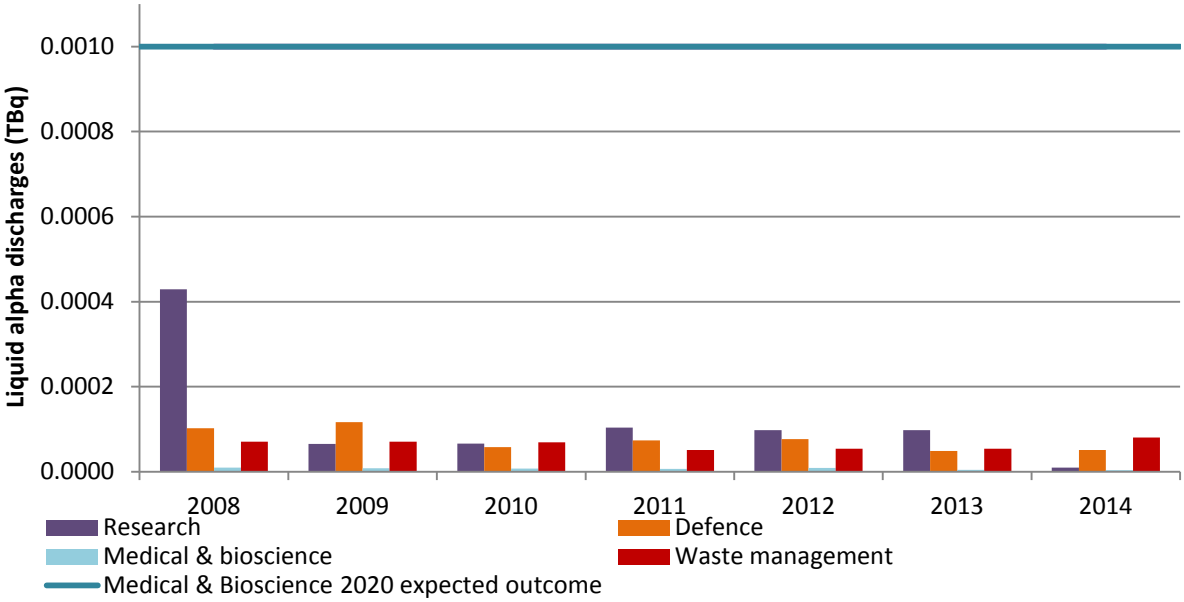
Annual discharges of alpha radioactivity

Figure 10: Annual discharges of alpha radioactivity from generation*, fuel fabrication and enrichment, and fuel reprocessing sites



*2020 expected outcome for generation sites, equal to 0.0003 TBq, are not shown.

Figure 11: Annual discharges of alpha radioactivity from research*, defence, medical and bioscience and waste management sites



*2020 expected outcome for research sites, equal to 0.025TBq, are not shown

- **In 2014, the total industry discharges of alpha radionuclides increased by 2.9% on the 2013 levels, to 0.185 TBq.**
- Discharges from the fuel reprocessing sub-sector increased for the third year in a row, reaching a 6-year high of 0.17 TBq. This makes up 91% of total liquid alpha discharges by the nuclear sector in 2014 and is due to increasing volumes of spent fuel reprocessed annually. Fuel reprocessing is due to stop around 2020.
- In 2014 the recorded discharges from the electricity generation sub-sector dropped to only a quarter of the 2013 levels (equal to 0.001 TBq). This is a 3-year low for this sub-sector.

- Once again the fuel fabrication, research, and medical and bioscience sub-sectors reported discharges below their expected outcomes for 2020. The reported discharges for electricity generation and fuel reprocessing remain above 2020 expected outcomes.

Annual discharges of beta/gamma radioactivity (excluding tritium)

Figure 12: Annual discharges of beta/gamma radioactivity from generation, fuel fabrication and enrichment and fuel reprocessing sites

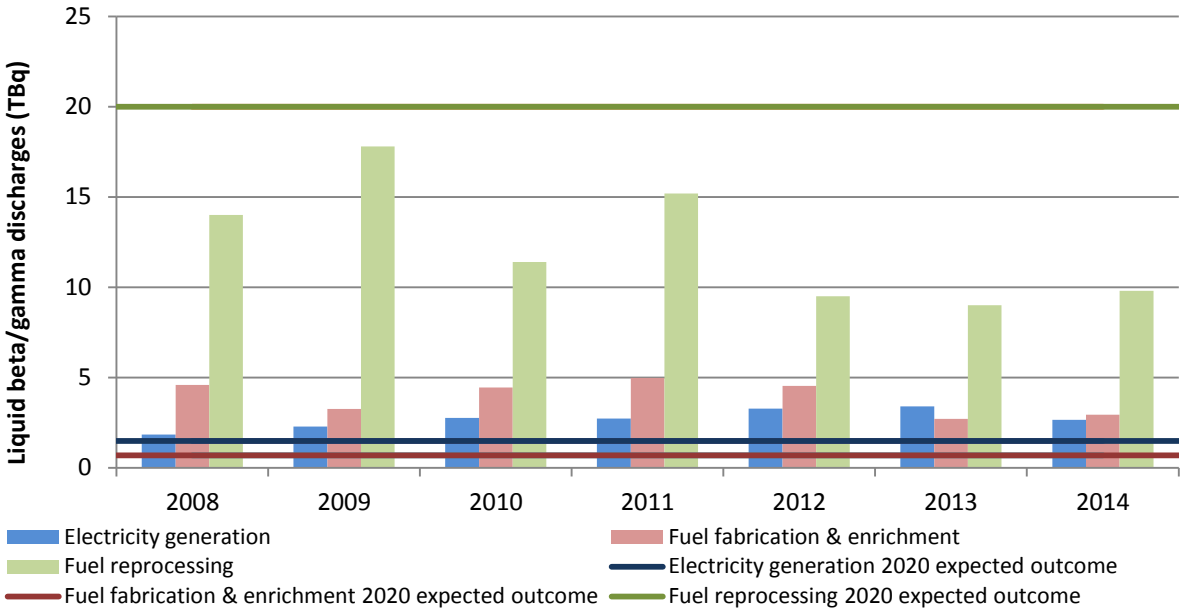
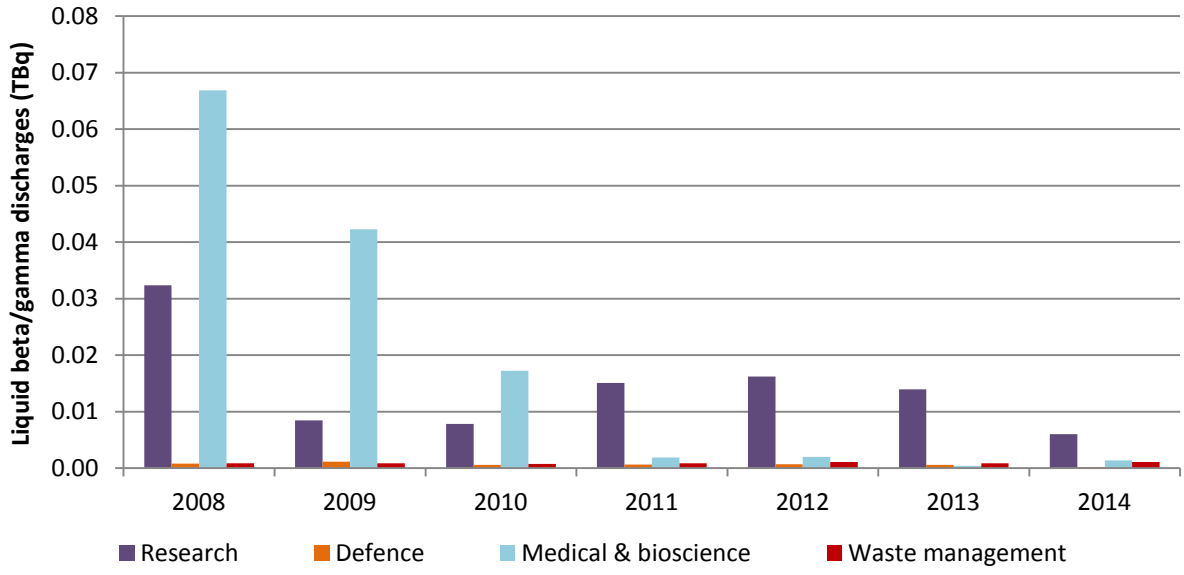


Figure 13: Annual discharges of beta/gamma radioactivity from research*, defence, medical and bioscience and waste management sites



**2020 expected outcome for research sites, equal to 0.8 TBq, is not shown.*

- **Total industry liquid beta/gamma discharges showed a small increase on 2013's recorded discharges and reached a 3-year high, up 1.8% to 15.41 TBq**.

- Only the fuel fabrication, reprocessing, and medical and bioscience sub-sectors showed increases in their reported discharge levels. The largest increase was by the reprocessing sub-sector, with an increase of 0.8 TBq or 8.9% on 2013 levels.
- Fuel reprocessing is also the largest contributor to total liquid discharges, with 63.6% of the total activity, up from 59% in 2013.
- The research and fuel reprocessing sub-sectors were both below the expected outcome for 2020, while electricity generation and fuel fabrication both exceeded their 2020 expected outcomes.

Annual discharges of liquid tritium

Figure 14: Annual discharges of liquid tritium from electricity generation and fuel reprocessing sites

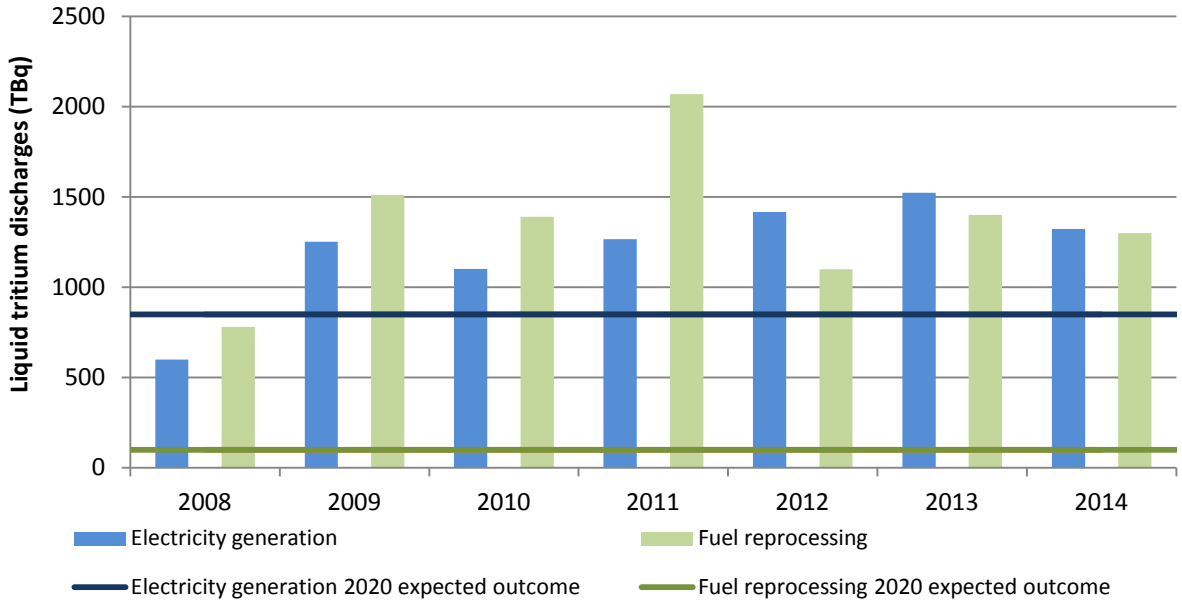
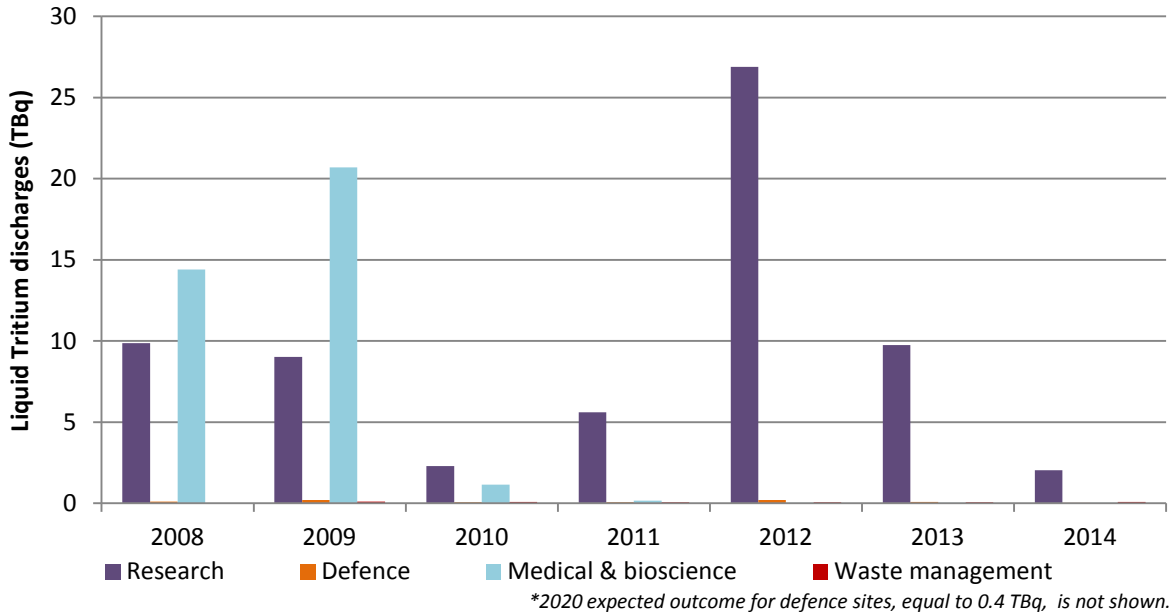


Figure 15: Annual discharges of liquid tritium from research, defence*, medical and bioscience and waste management sites

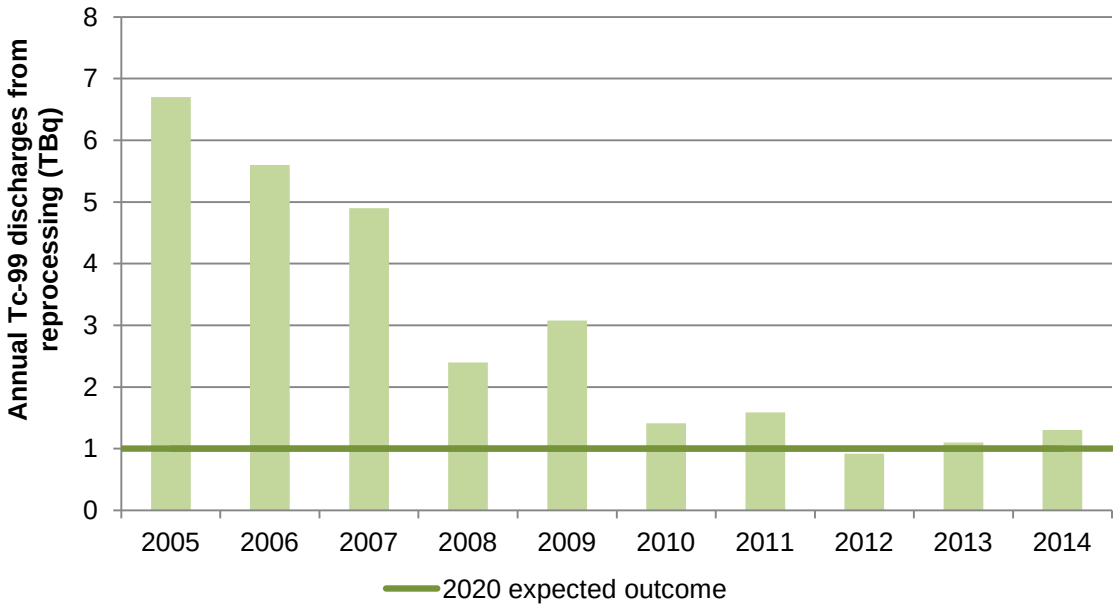


*2020 expected outcome for defence sites, equal to 0.4 TBq, is not shown.

- **The total reported discharges of tritium fell by 10.5% (81 TBq) on 2013 levels due to decreases from all industry sub-sectors apart from the medical and bioscience and waste management sub-sectors.**
- The defence, research, and electricity generation sub-sectors saw decreases of 27%, 79% and 13% respectively.
- Discharges from electricity generation and fuel reprocessing were above the 2020 expected outcome.
- The fuel fabrication and enrichment sub-sector does not discharge tritium to the environment and, therefore, is not shown.

Annual discharges of technetium-99

Figure 16: Annual discharges of technetium-99 from reprocessing



- **In 2014 the total reported discharge of Tc-99 was 1.3 TBq, an increase of 18.1% from the 2013 level due to increased reprocessing activities.**

Appendix 2 – Detailed breakdown of gaseous discharges

Annual discharges of gaseous alpha radiation

Figure 17: Annual discharges of gaseous alpha radiation from generation, fuel fabrication, and reprocessing, waste management, waste management and defence sites

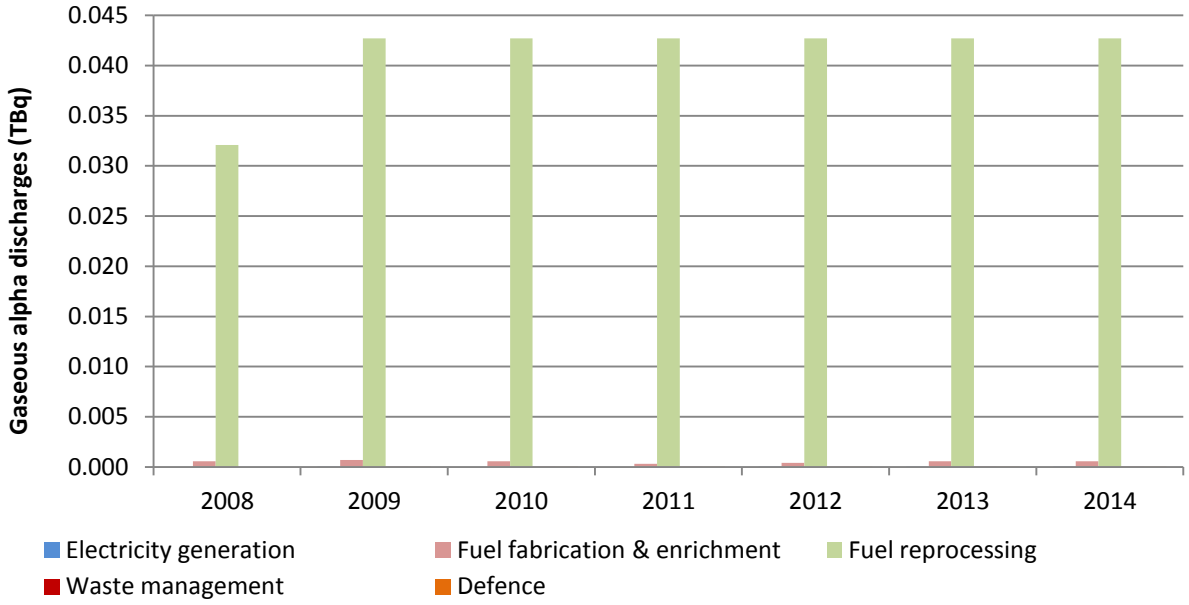
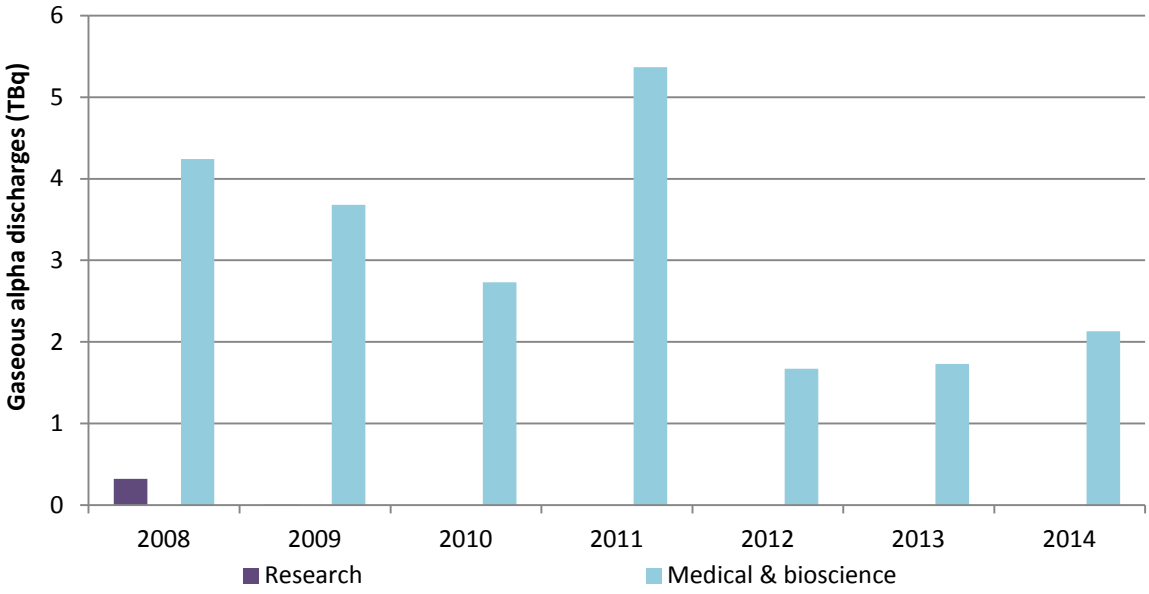


Figure 18: Annual discharges of gaseous alpha radiation from research and medical and bioscience sites



- **The industry total for alpha discharges increased to 2.2 TBq, an increase of 23% from 2013. This is due to a large increase in discharges from the medical and bioscience sub-sector.**

- Once again the medical and bioscience sub-sectors continue to be the largest producers of gaseous alpha discharges, contributing 98% of the industry total. This is due to radon emissions from radium ILW in storage awaiting decommissioning and disposal.
- Only 2 sub-sectors saw a decrease in reported discharges, with the electricity generation and waste management sub-sectors showing reductions of 55% and 36% respectively.

Annual discharges of gaseous beta/gamma radiation

Figure 19: Annual discharges of gaseous beta/gamma radioactivity (excluding tritium and krypton-85) from generation, fuel fabrication and enrichment, fuel reprocessing and medical and bioscience sites

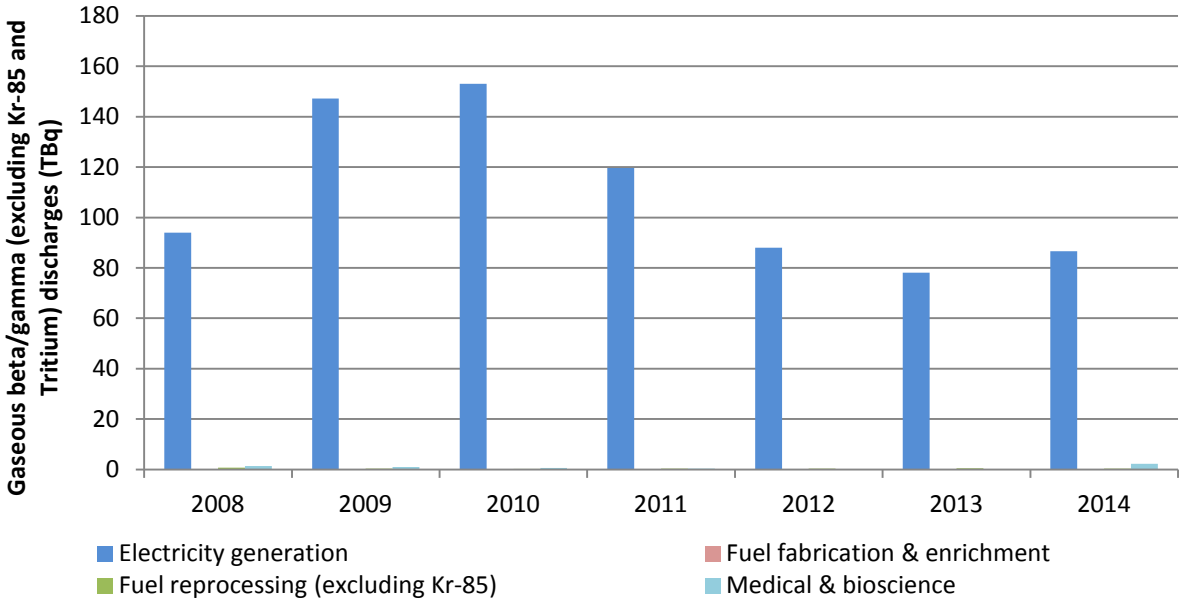
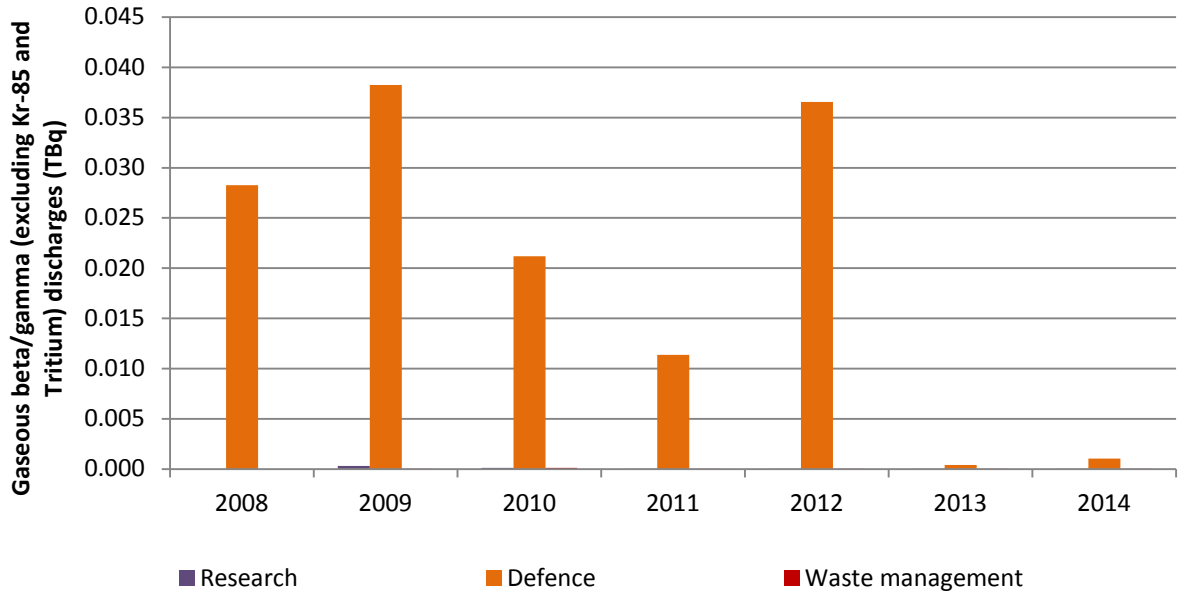


Figure 20: Annual discharges of gaseous beta/gamma radioactivity (excluding tritium and krypton-85) from research, defence and waste management sites

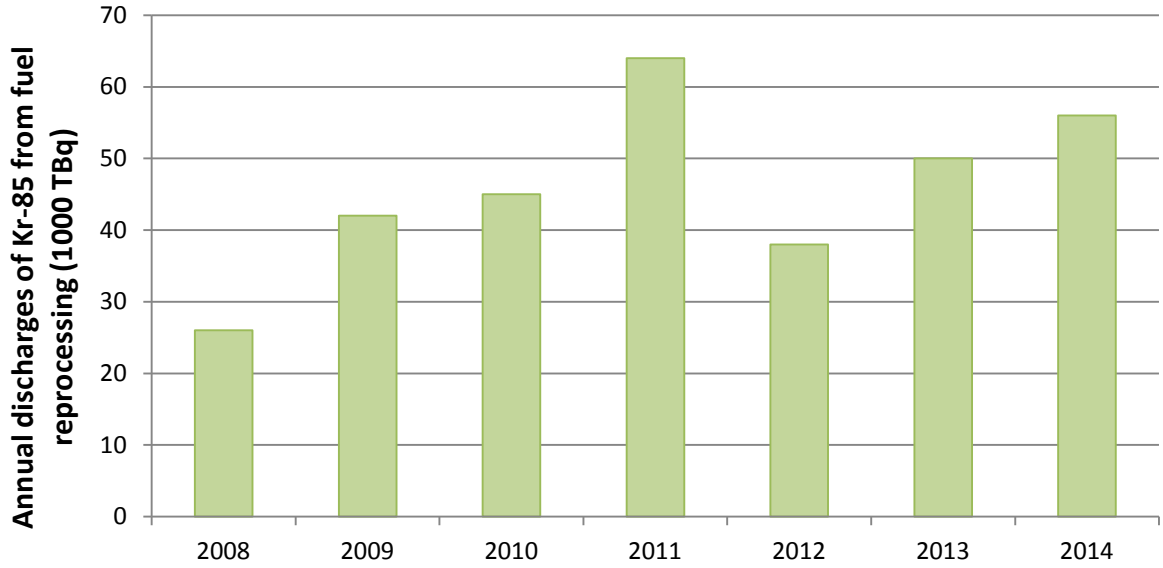


- **Total beta/gamma gaseous discharges, excluding tritium and krypton-85, increased to 89.2 TBq. This 13% increase on 2013 discharges is due to discharges reported by the electricity generation and medical and bioscience sub-sectors.**

- The medical and bioscience sub-sector reported discharges of 2.26 TBq, its highest figure in 8 years, but this only contributes 2.5% to the total discharges in 2014. The electricity generation sub-sector contributes 97% of the total reported discharges.
- The fuel fabrication, reprocessing and waste management sectors all reported reductions in their discharges, with 56%, 33% and 32% reductions from 2013 levels respectively.

Annual discharges of krypton-85

Figure 21: Annual discharges of krypton-85 from Sellafield



- **Discharges of Kr-85 increased 12% in reported discharges from 2013. This is due to an increase in the reprocessing of spent fuel at Sellafield.**

Annual discharges of gaseous tritium

Figure 22: Annual discharges of gaseous tritium from generation, fuel fabrication and enrichment, fuel reprocessing and medical and bioscience sites

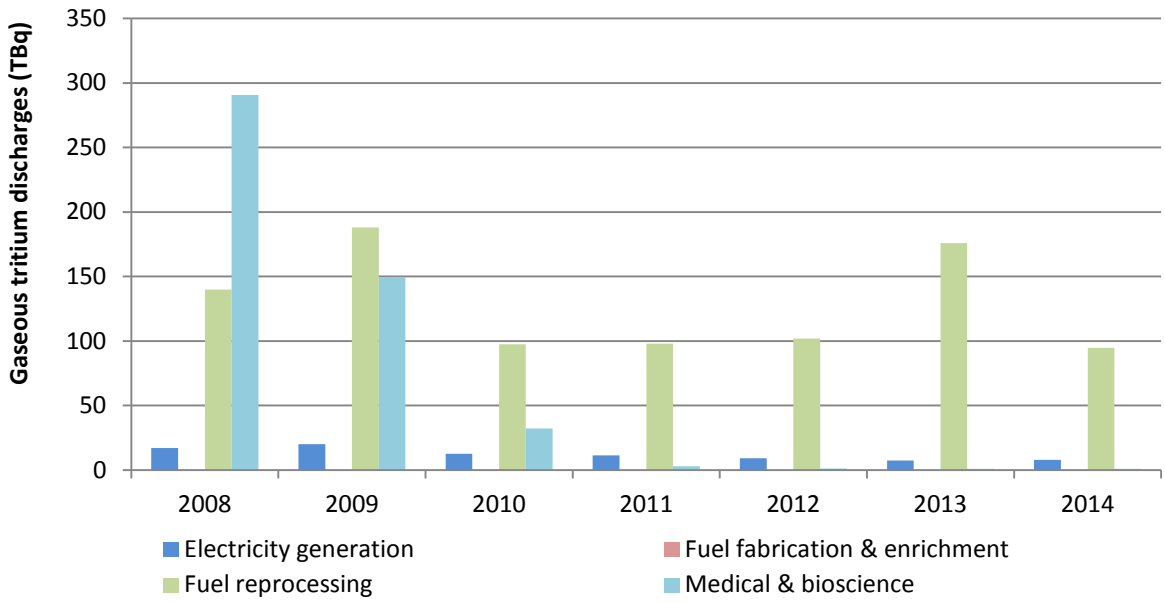
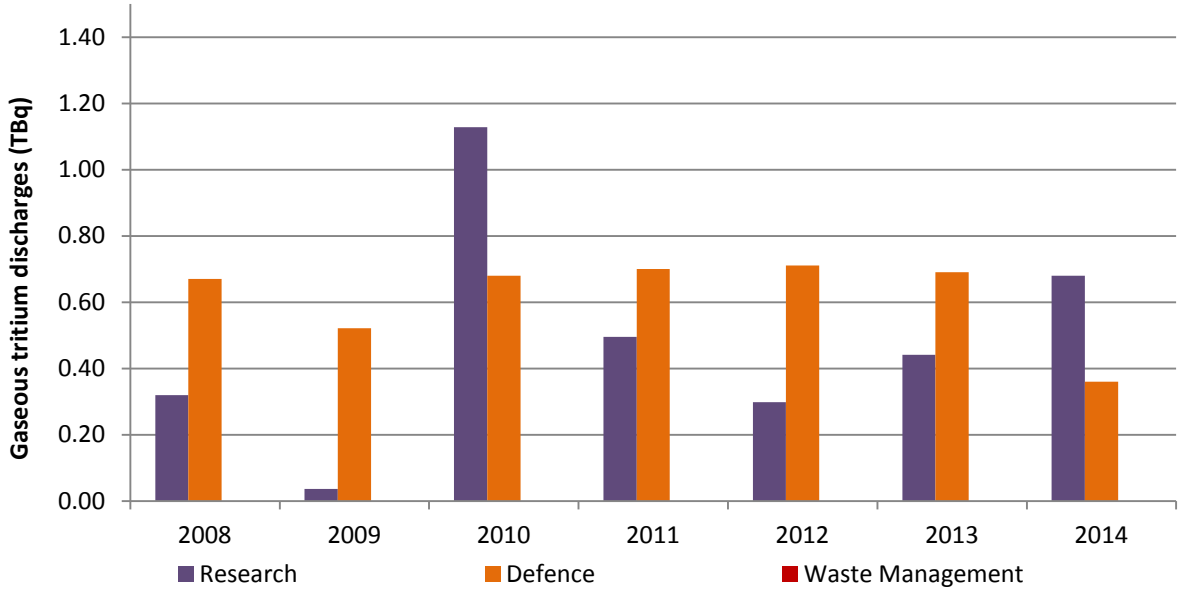


Figure 23: Annual discharges of gaseous tritium from research, defence and waste management sites



- **2014 saw a large decrease in discharges of tritium, down by 43% on 2013. This is due to reductions in discharges in the reprocessing and defence sub-sectors, with both reporting reductions of over 40% since 2013.**
- Fuel reprocessing contributed 90.3% of total discharges in 2014. This sub-sector contributed 94.7 TBq of the industry total of 104 TBq.
- Despite the reduction in total discharges, the majority of sub-sectors reported increases in discharge levels, with the electricity generation, fuel fabrication and research sectors reporting 7%, 53% and 54% increases on 2013. Each of the reported increases was less than a TBq for each subsector.
- Discharges from the medical and bioscience sectors remained the same at 1.09 TBq.

Useful links

Guidance on the scope of and exemptions from the radioactive substances legislation in the UK
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69357/pb13624-rsl-guidance-110914.pdf

Implementing geological disposal - policy paper
https://www.gov.uk/government/publications/implementing-geological-disposal

Integrated Waste Strategy document specification and format
http://www.nda.gov.uk/publication/eng01-specification-for-the-content-and-format-of-a-site-integrated-waste-strategy-document/

Ionising Radiations Regulations 1999
http://www.legislation.gov.uk/uksi/1999/3232/contents/made

Managing Radioactive Waste Safely
https://www.gov.uk/government/publications/managing-radioactive-waste-safely-a-framework-for-implementing-geological-disposal

Natural Resources Wales
English - http://naturalresourceswales.gov.uk/?lang=en / Welsh - http://naturalresourceswales.gov.uk/?lang=cy

Nuclear sector plan performance reports
https://www.gov.uk/government/publications/nuclear-industry-environmental-performance-reports

Nuclear sector plan Issue 3
https://www.gov.uk/government/publications/nuclear-industry-environmental-performance-reports

Radioactivity in Food and the Environment (RIFE) reports
http://www.sepa.org.uk/radioactive_substances/publications/rife_reports.aspx

RGN RSR2: regulation of radioactive substances activities on nuclear licensed sites
https://www.gov.uk/government/publications/rgn-rsr-2-regulation-of-radioactive-substances-activities-on-nuclear-licensed-sites

Ten principles of the UN Global Compact
http://www.unglobalcompact.org/abouttheGc/TheTenprinciples/index.html

UK energy in brief 2014
https://www.gov.uk/government/statistics/uk-energy-in-brief-2014

UK National Low Level Waste Strategy
http://llwrsite.com/national-waste-programme/national-llw-strategy/

UK National Radioactive Waste Inventory
https://www.nda.gov.uk/ukinventory/

UK Nuclear Fission Technology Roadmap Preliminary Report
http://eti.co.uk/downloads/related_documents/Nuclear_Fission_Technology_Roadmap_Feb_2012.pdf

UK Strategy for Radioactive Discharges
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/249884/uk_strategy_for_radioactive_discharges.pdf

Links to participating organisations

http://www.awe.co.uk

http://www.babcockinternational.com

http://www.baesystems.com

http://www.edfenergy.com

http://www3.gehealthcare.co.uk/

http://www.llwrsite.com/

http://www.magnoxsites.co.uk/

http://www.nda.gov.uk

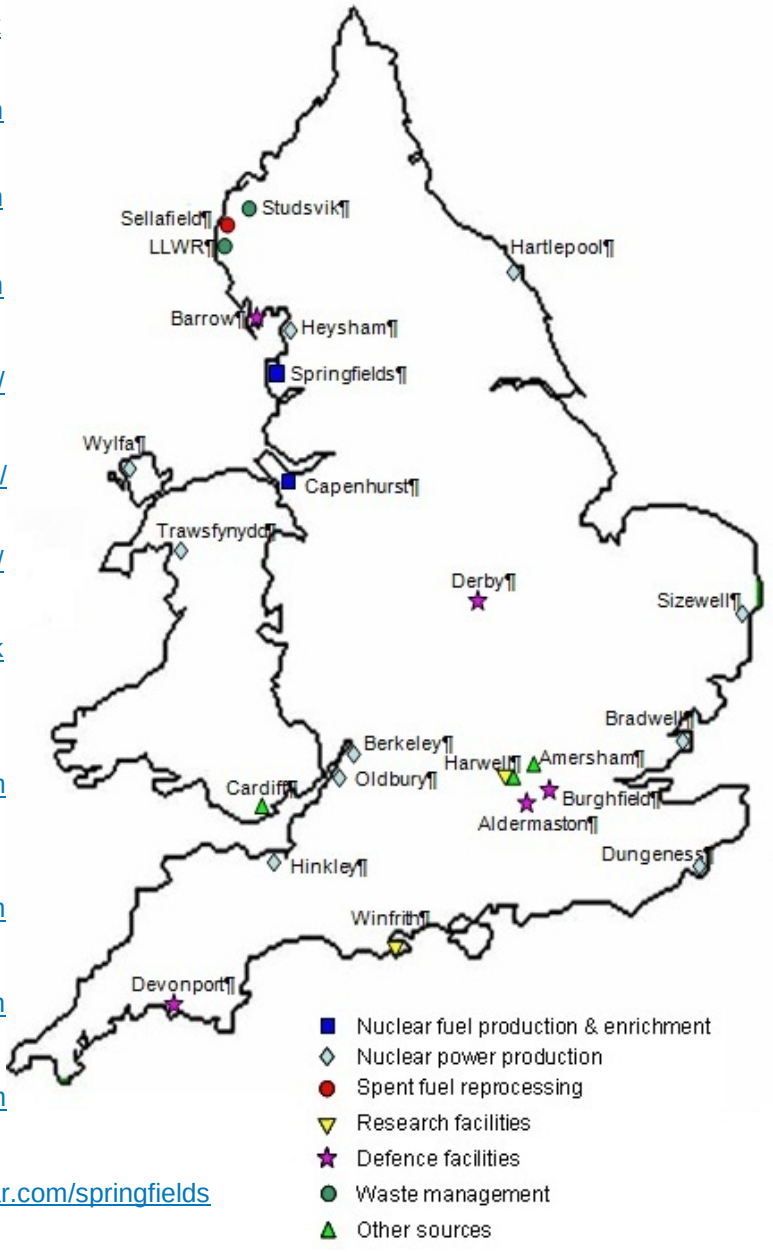
http://www.rolls-royce.com

http://www.sellafieldsites.com

http://www.studsvik.com

http://www.urenco.com

http://www.westinghousenuclear.com/springfields



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