Environment Agency

nuclear sector plan

2011 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 authorities, other agencies, civil society groups and the communities we serve.

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Foreword

This is the seventh annual report on the environmental performance of the nuclear industry in England and Wales. It describes the performance of the industry measured against the objectives and indicators set out in the Nuclear Sector Plan.

The Nuclear Sector Plan sets out environmental challenges facing the nuclear industry over the next few years, and how we can work together to address them. It encourages operators to consider environmental issues and to improve their environmental performance beyond the minimum standards of regulation. It also commits the Environment Agency to continue our work to be a 'better regulator', focusing on significant issues and streamlining regulation as appropriate.

The plan is currently being revised and updated to reflect continuing progress against objectives and new developments in the nuclear industry, particularly in the areas of environmental leadership, legacy waste issues and sharing best practice. We are delighted that the industry continues to support the use, and further development of, the Nuclear Sector Plan. We want the industry to use it as a basis for regular dialogue between operators and to encourage greater sharing of lessons learned and innovative thinking that will support further improvements in environmental performance.

This report was written in 2012, based on 2011 data supplied by operators. The industry took action in 2011 in response to the accident at the Fukushima nuclear power plant in Japan, which was caused by a large earthquake and tsunami. Operators of all licensed nuclear sites in the UK carried out safety investigations at their sites. These are commonly referred to as the 'stress tests'. The tests were introduced throughout the European Community following the Fukushima accident. They involved reassessing safety margins for each site in the light of extreme natural events. The process identified enhancements that will strengthen resilience further and will provide a positive contribution to the nuclear industry in the UK.

The industry has continued to perform and progress well against the Nuclear Sector Plan objectives in 2011, while at the same time maintaining good relationships and sharing best practice.

Logos of organisations participating in this initiative are shown below.

Ed Mitchell - Environment Agency

Summary

This report describes the environmental performance of the nuclear industry in England and Wales. It measures performance against the objectives and performance indicators set out in Issue 2 of the Nuclear Sector Plan, published in July 2009. The data are provided by the operators of the sites or are taken from national inventories. The operators as a group judge their performance against the objectives. Overall, the environmental performance of the industry during 2011 was good, with improvements made in a number of areas. In this summary we highlight how the industry performed against its eight main environmental objectives during the year, and since 2005 when we started reporting. The 'traffic light' indicates the status of each objective as follows:


Poor performance


Areas where performance is adequate


Good performance


Positive trend in performance since 2005


Negative trend in performance since 2005

Minimise the amount of natural resources used		
Although energy generation and fuel reprocessing increased in 2011, there was no substantial change in energy and water use. In 2011 the industry used just under seven million megawatt hours of electricity (two per cent more than in 2010) and just over 13 million cubic meters of water (almost the same as in 2010). Energy use has fluctuated since 2005 and water use has seen a decline.		
Recognise the impact of climate change		
In 2011 the nuclear industry in England and Wales generated nearly 49 TWh of electricity, which, if produced by fossil fuels, would have released around 30 million tonnes of CO_2. Compared to 2010, greenhouse gas emissions (measured as CO_2 equivalent) from the nuclear industry as a whole increased by 23 per cent. This was due to decreased operating efficiency of a large combined heat and power plant, and changes to the way in which the emissions were calculated. However some sites substantially decreased their CO_2 emissions in 2011.		
Minimise discharges to air and water		
Discharges to air and water remain low, with several sub-sectors of the nuclear industry already achieving their 2020 targets in the UK Discharge Strategy. Some emissions increased in 2011 (discharges of beta/gamma, tritium and technetium-99 activity to water and alpha and beta/gamma activity to air). Some emissions decreased (discharges of alpha activity to water and emissions of tritium to air). The increases are mostly due to an increase in fuel reprocessing in 2011. Overall discharges generally remain low in comparison to 2005 levels.		
Minimise and manage solid waste		
During 2011 the industry avoided sending 87 per cent of its Low Level Waste (LLW) to the national repository compared to 78 per cent in 2010. Operators continue to recycle a very high percentage of their inert and non-hazardous wastes. Progress in the retrieval, conditioning and packaging of 'legacy waste' and other Intermediate Level Waste (ILW) is slow (it has remained below 25 per cent since 2005). New facilities are currently being built at Sellafield to facilitate processing of intermediate level wastes.		
Demonstrate sound environmental management and leadership		
Nuclear operators continue to maintain robust environmental management arrangements at their sites.		

Manage land quality and biodiversity		
The number of sites with land quality management plans has increased since 2010. Biodiversity plans are being implemented at most nuclear sites, with a number of operators achieving biodiversity benchmarks.		
Improve or maintain a very high level of regulatory compliance		
The nuclear industry continues to maintain a high standard of regulatory compliance, with far fewer incidents than other regulated sectors. The total number of incidents and breaches increased in 2011, but the majority of these issues had no environmental impact and the remainder had only minor environmental impact. There were no incidents or breaches with major or significant environmental impact.		
Achieve better regulation		
The Environment Agency continues to make good progress against each of its improvement goals. In 2011 we drafted Site Environment Reviews for all nuclear sites to increase transparency in how we regulate. We introduced a series of themed audits at nuclear sites, beginning with a focus on asset care and maintenance. Together with the Office for Nuclear Regulation and the Scottish Environment Protection Agency (SEPA) we published our joint guidance to industry on 'The Management of Higher Activity Radioactive Waste on Nuclear Licensed Sites'. We also made progress on MCERTS standards for monitoring of liquid effluent flow and radioanalysis of waters. Feedback to operators within two months of notification of an event has increased to 70 per cent.		

Contents

Introduction

This report presents the latest information on environmental performance for the nuclear industry in England and Wales. It describes the progress made by the Environment Agency and the nuclear industry towards meeting the eight objectives set out in issue 2 of the Nuclear Sector Plan, published in 2009:

1. Minimise the amount of natural resources used.
2. Recognise the impact of climate change.
3. Minimise discharges to air and water.
4. Minimise and manage solid waste.
5. Demonstrate sound environmental management and leadership.
6. Manage land quality and biodiversity.
7. Improve or maintain a very high level of regulatory compliance.
8. Achieve better regulation.

The data are either provided by the operators of the sites or taken from national inventories. Operators, as a group, judge their performance against the objectives.

Environmental performance of the nuclear industry

The nuclear industry is diverse. It includes a wide range of activities including electricity generation, decommissioning and clean-up of redundant facilities, waste management, research and development, and defence.

With our support and encouragement, the industry has committed to, and successfully delivered, improvements in its overall environmental performance, while continuing to make significant achievements and contributions to the UK economy.

Highlights in the industry's environmental performance in 2011 include:

- The industry now uses 20 per cent less water than in 2005 when reporting first began.
- Overall sites sent less low level radioactive waste to the national repository through recycling, or using alternative disposal routes. In addition, sites recycled 99 per cent of inert wastes and 85 percent of non-hazardous wastes.
- Overall, emissions to air and water remain low and on track to meet targets, despite some increases in 2011.
- Electricity generated by nuclear power in England and Wales saved approximately 30 million tonnes of CO_2 (equivalent - based on the amount of CO_2 that would have been produced had the same amount of energy been generated using fossil fuels). This is a significant contribution towards helping the UK meet its climate change targets.
- The nuclear industry continues to deliver a high standard of regulatory compliance with far fewer incidents than in other regulated sectors.

Areas for improvement

While the overall environmental performance of the nuclear industry remains good, work still needs to be done in two key areas:

- Developing optimised plans which focus on reducing greenhouse gas emissions.

- Progressing the retrieval, conditioning and packaging of Intermediate Level Waste (ILW).

Greater progress is needed in conditioning and packaging of 'legacy' and other intermediate level wastes. This is recognised by the industry as a key area for improvement and it is working with the regulators to achieve this.

More information

In the following chapters we describe the environmental performance of the nuclear industry as a whole against the eight Nuclear Sector Plan objectives. Information on the performance of individual companies can be found by following the links to their websites provided at the end of this report.

Significant challenges ahead

Processing and packaging higher activity wastes, including ILW, remains a significant challenge to the industry. Sites are starting to tackle some of the more difficult-to-treat ILW, which presents a significant engineering challenge to the industry. Research into methods and technologies to treat various types of ILW is ongoing.

The ability of the nuclear industry to increase the rate of packaging and conditioning of ILW is constrained partly by the uncertainty regarding a final disposal facility for higher activity wastes in the UK. While there are currently no criteria for final disposal of exact types and specifications of packaged higher activity waste, a disposability assessment process exists whereby the Nuclear Decommissioning Authority can issue a Letter of Compliance for higher activity wastes (including ILW) that are packaged into a passive, disposable form.

At present, the UK Government is in the process of developing a Geological Disposal Facility (GDF) as the preferred method of dealing with the disposal of higher activity radioactive wastes. The following actions have been completed:

- The Department of Energy and Climate Change (DECC) has issued an indicative timeline for establishing a GDF.
- The Nuclear Decommissioning Authority (NDA), the organisation tasked with implementing the GDF, has been asked by DECC to look at options to accelerate this timescale.
- A framework for the identification and assessment of potential candidate sites has been produced by DECC. The Framework contains the agreed criteria and a high-level description of the desk-based site identification and assessment process for England.

In addition, the industry will need to work out the best way for its sites to apply the new waste exemption regulations introduced in 2011. Government guidance on radioactive waste exemptions was produced in September 2011 and operators in the nuclear sector are developing plans to implement them.

Feedback

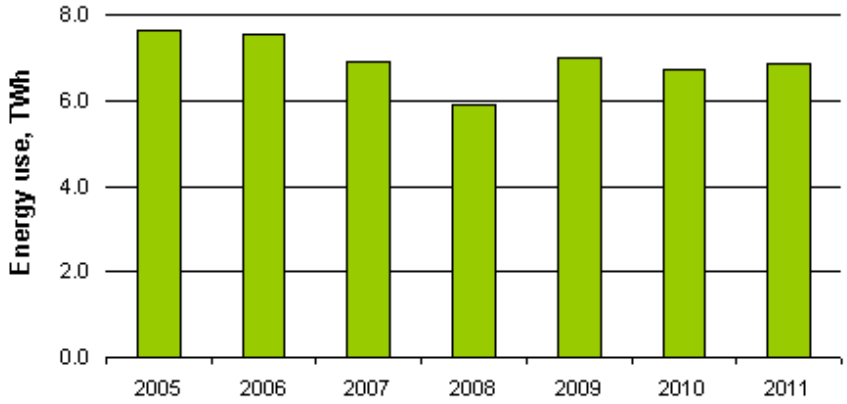
We welcome your views on the content and/or format of the report. If you have any queries or comments, please contact nrgnorth@environment-agency.gov.uk.

Minimise the amount of natural resources used

Energy use

The UK nuclear industry is a net generator of energy, generating approximately 69 terawatt hours (TWh) of electricity nationally in 2011 (including Scotland) and only using nine per cent of this[1]. The nuclear industry in England and Wales uses 10 per cent less energy now than in 2005 when reporting began.

Total energy use



The amount of energy the industry uses depends upon the activities taking place at each of the sites, the amount of electricity produced at power stations, throughputs of other plant and simple things like the weather. In 2011 the UK nuclear industry generated 11 per cent more electricity than in 2010. This was due to increased availability of generating plant in 2011 after extensive maintenance outages in 2010[1]. Raw energy use in the industry in England and Wales has fluctuated slightly in recent years, but did not increase significantly in 2011, despite increased power generation.

Operators are continually reviewing their energy use and seeking to reduce it. The industry has developed a range of initiatives, including energy efficiency and reduction plans, more energy efficient lighting and heating and reviews to identify and improve inefficient equipment and processes. At Sizewell A, the operator achieved a 17 per cent reduction in energy use in 2011, partly by replacing purge air compressors with more efficient models and taking redundant plant out of service. These measures will continue to provide energy savings in the future. At Berkeley, the operator achieved a 32 per cent reduction in energy use in 2011 due to rationalisation works in two key ventilation plants and a staff awareness campaign on energy efficiency.

Energy-Use Reduction Measures at Sellafield

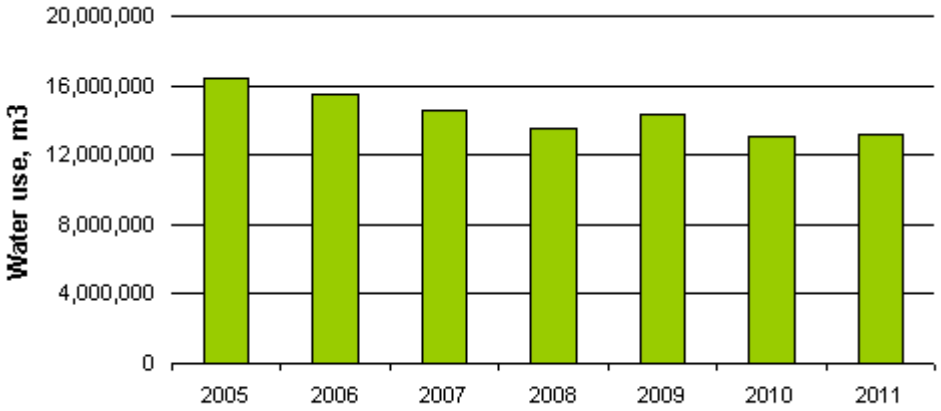
Internal charging for electricity was introduced at Sellafield during the 2011/12 financial year. This initiative, together with periodic reporting of electricity consumption and cost to senior managers, will help to drive down consumption. Annual energy reviews are produced and distributed at Director level to facilitate awareness of consumption and cost across Sellafield. It is anticipated that direct charging for other utilities will follow. A programme of energy reviews has also been carried out, and improvement opportunities identified, including optimising drying settings in the site laundry, replacing lighting and motors with energy efficient equivalents upon failure and improving maintenance to ensure optimum efficiency of equipment.

[1] DECC UK Electricity Statistics, Quarterly Tables: 'Energy Trends' data for 2011 (including data for Scotland) http://www.decc.gov.uk/en/content/cms/statistics/energy_stats/source/electricity/electricity.aspx

Water use

The nuclear industry has reduced its water use by approximately 20 per cent since 2005. However the decline in water use has levelled off in recent years. Some sites use water in their production and safety-related processes and equipment. This means that for these sites, the scope for reducing water use is limited to the small proportion of water that is used in non-production or operational facilities such as offices.

Total water use



Most sites have water-use reduction plans and many have introduced their own water-saving initiatives. Several sites have carried out substantial leak detection and repair programmes in 2011. Many have also installed continuous water-use monitoring systems which are used to help with early identification of leaks. Water monitoring and leak detection work is at the top of the leak management hierarchy, which aims primarily to avoid leaks through prevention at source. Leak management is a crucial way that sites can reduce unnecessary water loss.

Dungeness B in Kent is avoiding non-essential water use and implementing water-saving initiatives such as a leak management plan in order to reduce water use, which is especially important in view of continuing long-term drought issues in the South East.

At Bradwell, the operator implemented a leak detection and repair prioritisation system which resulted in a 33 per cent water saving in 2011. The work included replacing a leaky potable water system and installing a smaller demineralisation plant.

Waterless Urinals at Aldermaston and Burghfield

The AWE Energy Management and Intervention Programme includes targets for reducing water consumption. In 2011 the company took the step of installing waterless urinals at its Aldermaston and Burghfield sites. The capital cost of this project was £75,000. However it should pay back in less than four years as the measure should give a financial saving of £20,000 per annum through water use reduction. In total, 200 urinals were replaced.

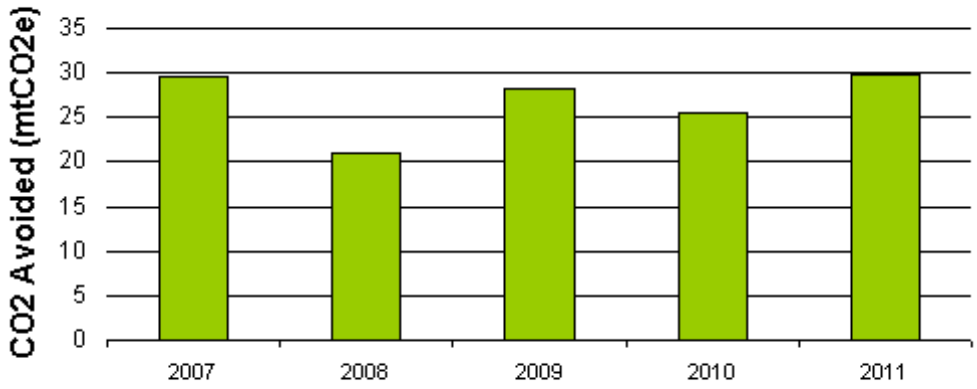
Recognise the impact of climate change

As with other industries, the nuclear industry contributes to climate change and is also susceptible to its impacts.

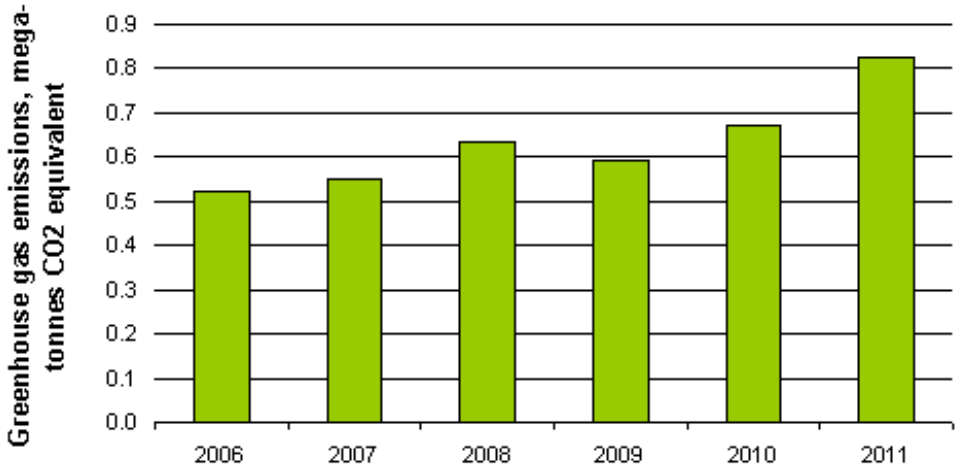
Reducing the impact of climate change

The nuclear industry provides electricity to the UK grid. In 2011 the industry generated 19 per cent of the UK's electricity[1] (including data for Scotland). Nuclear power generation contributes significantly less carbon dioxide (CO_2) to the atmosphere than electricity generated using fossil fuels. In England and Wales, the amount of electricity generated in nuclear power stations was approximately 48.5 TWh. If the same amount of energy had been produced in fossil fuel power stations, approximately 30 million tonnes of CO_2 (equivalent), would have been produced. This is a significant saving, equivalent to approximately a quarter of the UK's emissions of CO_2 from transport in 2011[2] and is presented below as CO_2 avoided.

Carbon dioxide avoided



Total greenhouse gas emissions



The greenhouse gas emission chart shows that there has been an increase in emissions in 2011 from the nuclear industry. This is due partly to the methods sites

[2] http://www.decc.gov.uk/en/content/cms/statistics/climate_stats/gg_emissions/uk_emissions/uk_emissions.aspx

use to calculate greenhouse gas emissions. For the two sites contributing the largest proportion of greenhouse gas emissions, this has resulted in an increase in the figures reported in 2011.

Sellafield contributes the greatest proportion of greenhouse gas emissions for the nuclear sector. In 2011 its combined heat and power plant experienced some technical difficulties which meant that the plant was running at a low efficiency and produced more greenhouse gases than usual.

The second largest contributor to greenhouse gas emissions (URENCO) used a different calculation method in 2011, which resulted in an increase in emissions from previous years. As sites use more sophisticated assessment methods we expect the reported figure to become more inclusive, resulting in a perceived increase in emissions.

However, some sites have managed to reduce their greenhouse gas emissions significantly in 2011. For example, Berkeley power station in Gloucestershire reduced its greenhouse gas emissions by 29 per cent in 2011 by reducing energy use in key ventilation plant. This is a significant achievement. The site also added CO_2 from business mileage as a Key Performance Indicator (KPI). AWE's Aldermaston and Burghfield sites also report on their carbon footprint as a company KPI.

Most nuclear sites have plans in place to target and reduce CO_2 emissions. The industry recognises that this is important and is continuing to work to improve its performance in this area.

In many sub-sectors of the nuclear industry, the majority of greenhouse gas emissions result from energy required to power major plant to support energy generation and other key activities. Only a small amount (less than one per cent in some cases) is associated with minor plant, lighting and heating. At Wylfa power station for example, the greatest fuel use, and therefore most greenhouse gas emissions, are associated with testing and maintenance of the site's safety-related plant.

Cutting Carbon Emissions at Studsvik

As part of Studsvik's continued Carbon Reduction Programme, the focus for action in 2011 was on managing carbon by reducing unnecessary travel. To do this, video conference facilities were installed at key sites and were trialled during 2011 for meetings between colleagues in the UK and Sweden. Studsvik's head office is in Sweden and a return flight from Manchester to Stockholm produces approximately 500 kg of CO_2 per traveller (based on a return journey distance of 1760 miles and using the www.transportdirect.info journey emissions compare tool). Following the successful trial, this is to be rolled out to further UK sites in 2012.

Adapting to climate change

The nuclear industry is constantly reviewing how best to manage its own operations in order to adapt to the impacts of climate change. This includes planning how to respond to a wide variety of natural events such as flooding, coastal erosion, drought, storms, extreme temperatures and high winds. Climate change has the potential to affect the operation of a power plant in a number of ways; for example, delivery of essential goods could be interrupted by weather events such as floods, or water availability might be affected by drought.

In 2011, several sites started to put plans in place aimed at minimising the impacts of weather, climate, and natural hazards on their sites. At the Rolls Royce site in Derby, existing buildings are being adapted to improve their resilience to potential flooding, and flood defence measures will be included in the design of any new buildings. Springfields Fuels Ltd in the north west has implemented a programme of 'winterisation' in response to extended cold periods in the winters of 2009/10 and 2010/11. As a result, plant and processes have been improved to ensure safe operation in cold temperatures and snow.

In 2011, operators of all licensed nuclear sites in the UK also carried out a number of safety investigations at their sites, commonly referred to as the 'stress tests'. The tests were introduced throughout the European Community following the 2011 accident at the Fukushima nuclear power station in Japan, which was caused by a large earthquake and tsunami.

The tests involved a targeted reassessment of safety margins for each site in light of extreme natural events. Completing the assessments was a large task for the operators in a relatively short timescale. The process identified enhancements that will strengthen resilience further and will provide a positive contribution to nuclear safety in the UK.

Minimise discharges to air and water

Radioactive discharges to air and water are permitted by the Environment Agency. Permits require operators to implement 'Best Available Techniques' (BAT) to minimise any releases of radioactivity to the environment. A fuller description of radioactivity and the discharges from the nuclear industry can be found in the UK Strategy for Radioactive Discharges. All discharges of radioactivity to air and water in 2011 were below the levels permitted.

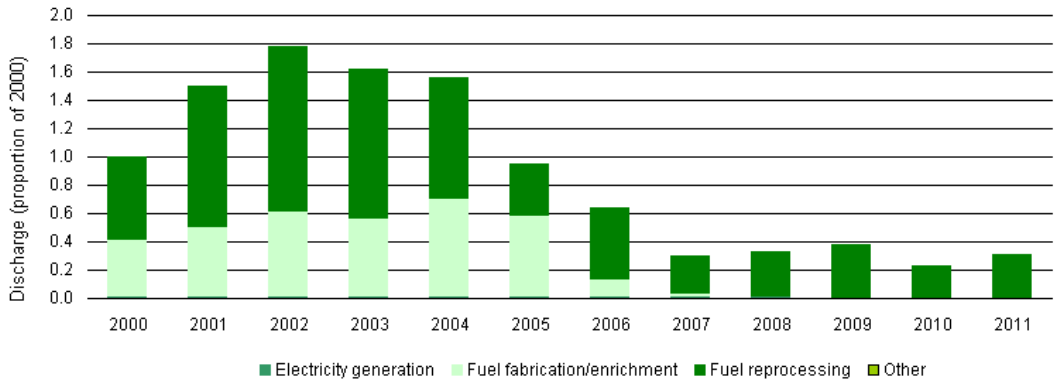
Nuclear Fuel Reprocessing

The nuclear fuel reprocessing sub-sector contributes a large proportion of the UK emissions of radioactivity to air and water. In 2011 some discharges to air and water from this sub-sector increased in comparison to 2010; however overall discharges remain low in comparison to historic levels. The short-term increases seen in 2011 are due to a combination of factors, including an increase in the amounts of fuel reprocessed at Sellafield in 2011, the types of fuel being processed, hazard reduction programmes and decommissioning activities. In order to reach the 2020 discharge targets (as described in the UK Strategy for Radioactive Discharges), many technical approaches are being considered by the nuclear industry with the ultimate aim of transferring or transforming used fuel into a safer state and reducing emissions in the long-term.

Discharges to water

Radioactive discharges to water remain low and on target to meet the commitments set out in the UK Strategy for Radioactive Discharges. This specifies targets to be achieved by 2020. One of the aims of the UK Strategy is to progressively and substantially reduce liquid radioactive discharges. Radioactive discharges from the nuclear industry are in line with, or reducing faster than, the strategy's projections.

Trends in radioactive discharges to water



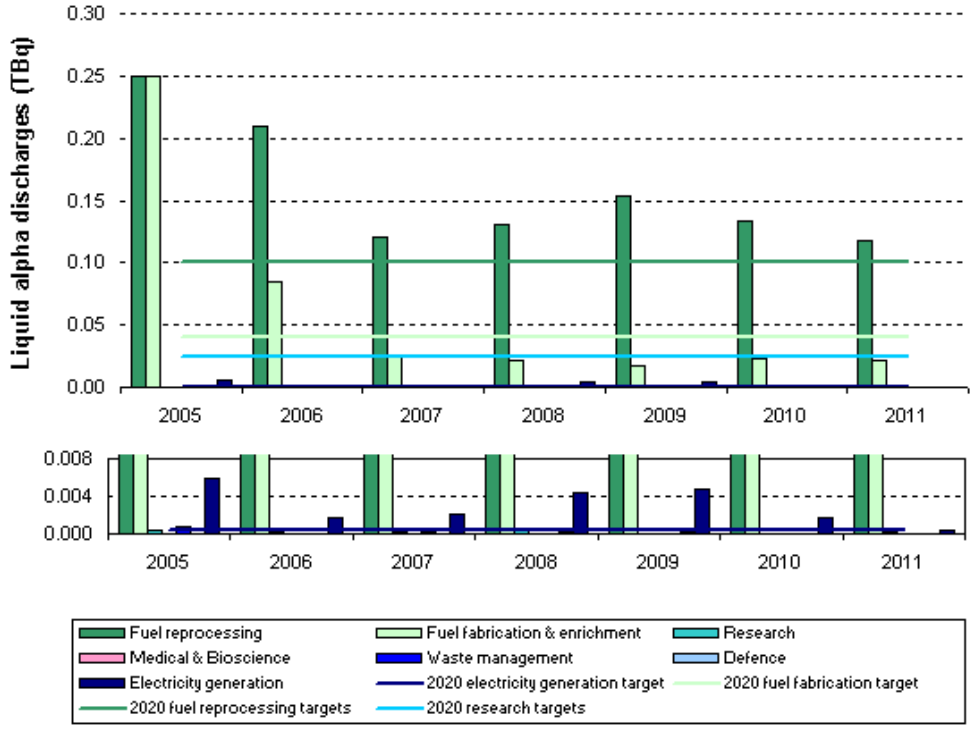
*Discharge of each radioactive substance weighted by dose impact

Notes:
i) the total discharge of each radionuclide from each sub-sector is multiplied by a specific 'dose per unit release' factor which takes into account the different health effects of different radionuclides and the likely concentration in the environment. The total is then compared to the 2000 total to show the trend in this indicator over time. The graph is therefore comparative and does not have any units.
ii) the 'other' category includes the medical and bioscience, defence, research and waste management sub-sectors.
iii) discharges from the 'electricity generation' and 'other' sub-sectors are too low to be seen on the graph.

Since 2007, discharges of radioactivity to water have consistently been less than half the amounts discharged in the year 2000. Discharges to water are dominated by the fuel reprocessing sub-sector. Discharges increased in 2011, due to the complex nature of reprocessing and the abatement processes on the Sellafield site, which mean that fluctuations will be visible on a year-on-year basis. A simple numerical link between the total quantity of fuel to be reprocessed and discharges cannot always be

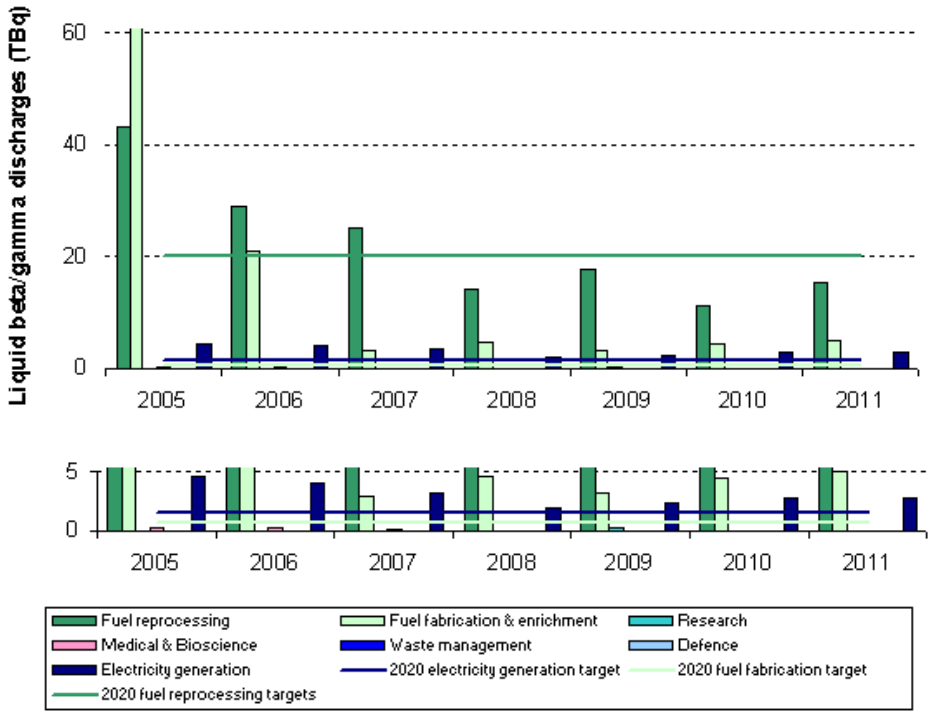
made and more sophisticated analysis is required, although most of the discharges result from reprocessing. Many factors need to be taken into account when examining discharges associated with fuel reprocessing, for example: burn-up, cooling periods, blending requirements, abatement plant performance and non-routine delay stored waste treatment. In addition, there are discharges from hazard reduction and decommissioning activities that are not linked to reprocessing rates. It is in the interest of the UK and the environment that fuel reprocessing continues, in order to reduce the long-term hazard posed by large amounts of stored nuclear fuel.

Annual liquid alpha discharges



Liquid alpha discharges have decreased since 2010. Overall there has been a large decrease in liquid alpha discharges since 2005, with discharges in most sub-sectors now being less than half of the 2005 level with some already below the 2020 targets.

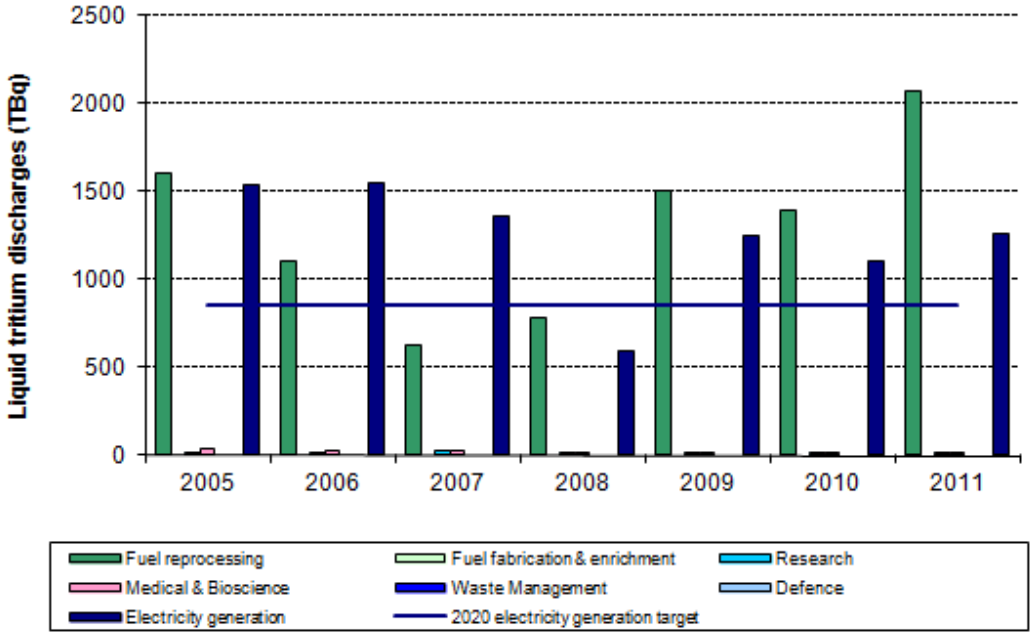
Annual liquid beta/gamma discharges (excluding tritium)



Note:
There are no targets in the UK radioactive discharge strategy for liquid beta/gamma discharges from the research, medical and bioscience or waste management sub-sectors.

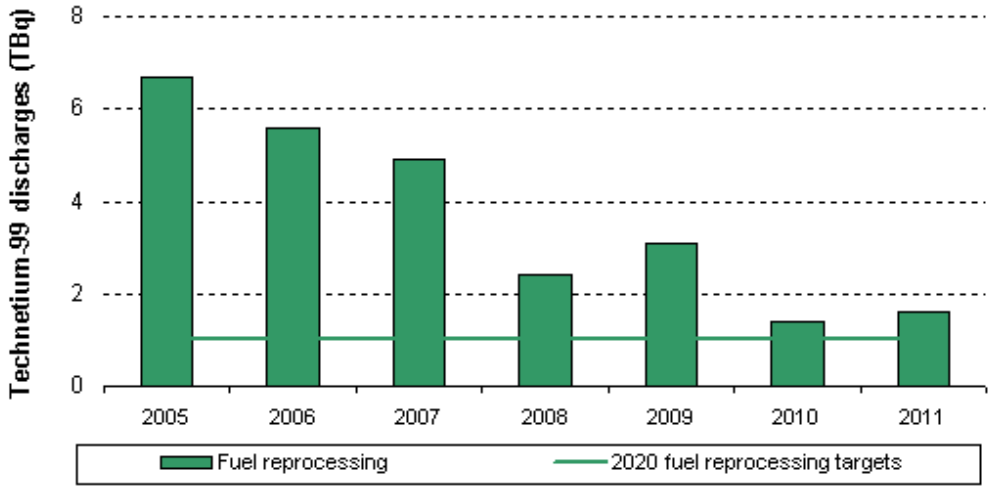
Liquid beta/gamma discharges have increased slightly since 2010 in the fuel reprocessing, electricity generation and fuel fabrication and enrichment sub-sectors. This is a result of particular activities on sites such as processing some technically complicated residues in the fuel fabrication and enrichment sub-sector and increased fuel reprocessing at Sellafield (fuel reprocessing sub-sector). It is projected that the target for the fuel fabrication sub-sector will be achieved by 2020 once the Natural Residues Processing Plant at Springfields closes down in 2015/16. The 2020 target for the defence sub-sector is 0.002 TBq/yr, and the discharges measured for this sub-sector show it has already been achieved. It should be noted that the 2020 targets for the electricity generation sub-sector do not take account of current extended lifetimes of some power stations or potential new nuclear power stations.

Annual liquid tritium discharges



Liquid tritium discharges continue to fluctuate. The increase in discharges from the fuel reprocessing sub-sector in 2011 was due to the increase in reprocessing rates in 2011 in comparison with those in 2010, as well as the annual fluctuations that can be expected due to the range of reprocessing, decommissioning and hazard reduction activities being carried out. In 2011, discharges from the research and electricity generation sub-sectors also increased, the latter due to increased electricity production. Conversely, the medical and bioscience and waste management sub-sectors, saw large decreases in liquid tritium discharges in 2011 compared to 2010. The decrease from the medical and bioscience sub-sector was due to radiochemical production ceasing at GE Healthcare's Maynard Centre and the start of decommissioning of redundant facilities. It should be noted that the 2020 targets for the electricity generation sub-sector do not take account of current extended lifetimes of some power stations or potential new nuclear power stations.

Annual technetium-99 discharges to water from reprocessing



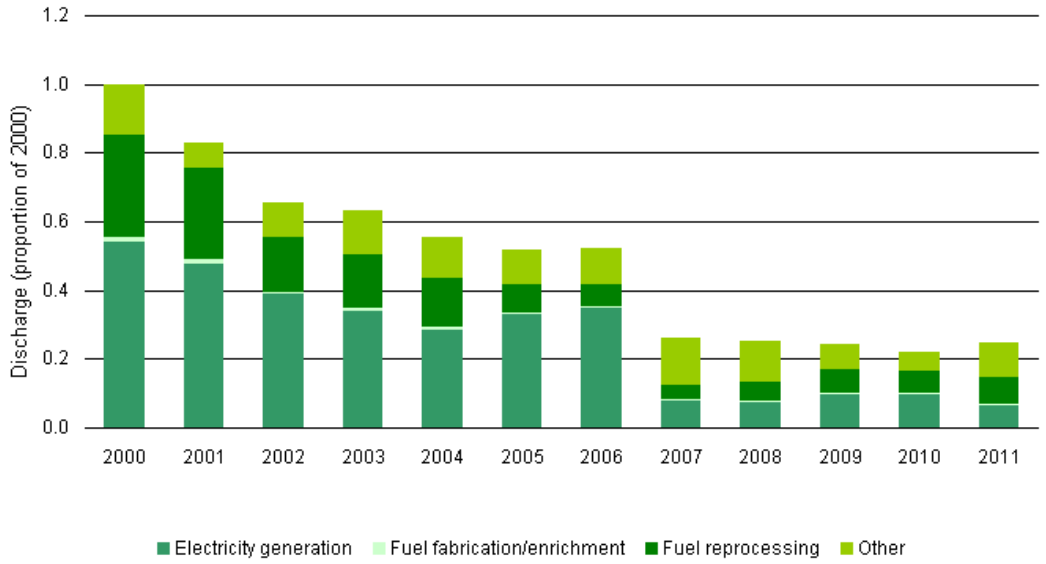
Note: The UK radioactive discharge strategy has technetium targets solely for the fuel reprocessing sub-sector

Technetium-99 discharges in 2011 were slightly higher than in 2010. Again, this is due to the increase in reprocessing rates in 2011 in comparison with those in 2010, and annual fluctuations that can be expected due to the range of reprocessing, decommissioning and hazard reduction activities being carried out. There has been a large decrease in technetium-99 discharges to water from the fuel reprocessing sector since 2005.

Discharges to air

The total radioactive discharges to air from the nuclear industry remained low in 2011. The overall trend since 2000 has been a significant reduction, with a levelling off since 2007.

Total assessed radioactive discharges to air

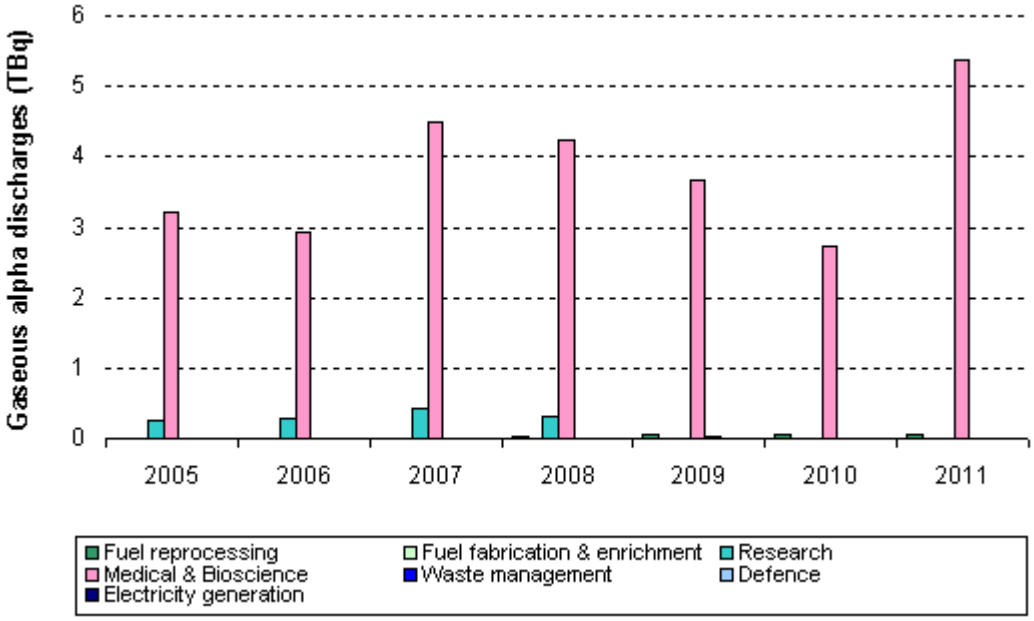


*Discharge of each radioactive substance weighted by dose impact

Notes:
i) The total discharge of each radionuclide from each sub-sector is multiplied by a specific 'dose per unit release' factor which takes into account the different health effects of different radionuclides and the likely concentration in the environment. The total is then compared to the 2000 total to show the trend in this indicator over time. The graph is therefore comparative and does not have any units. ii) the 'other' category includes the medical and bioscience, defence, research and waste management sub-sectors.

Discharges to air from the electricity generation and fuel fabrication and enrichment sub-sectors decreased in 2011, while discharges to air from the fuel reprocessing and other sub-sectors increased. The increases were due to a range of factors, including an increase in fuel reprocessing and an increase in Radon discharges from GE Healthcare's Grove Centre in the 'other' sub-sector.

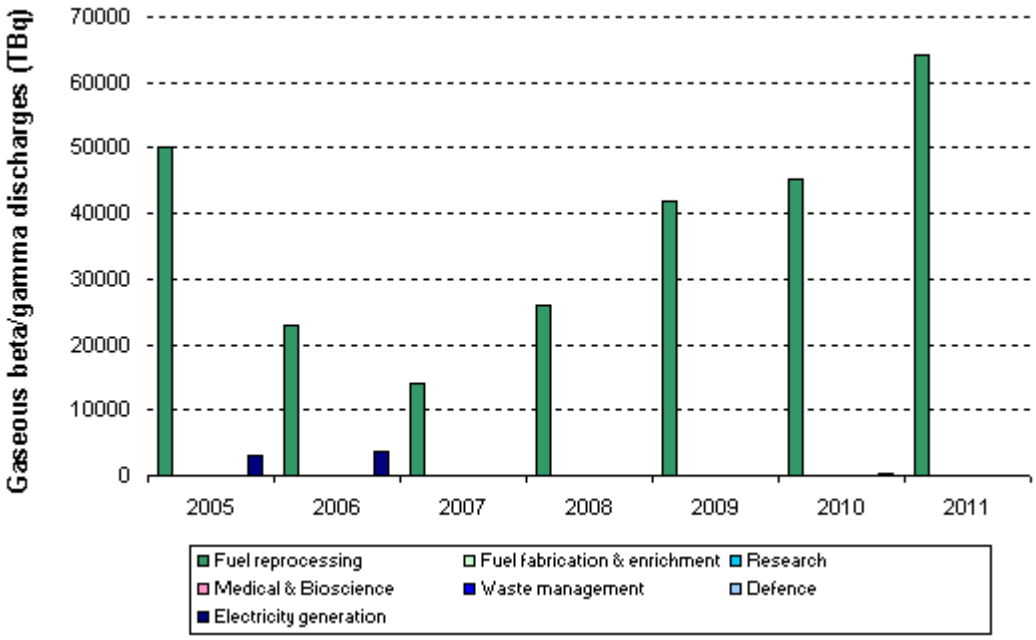
Annual alpha discharges to air



Note: gaseous alpha discharge data reported in 2009 for the fuel reprocessing and fuel fabrication sub-sectors were incorrect. Correct data are reported in the graph above.

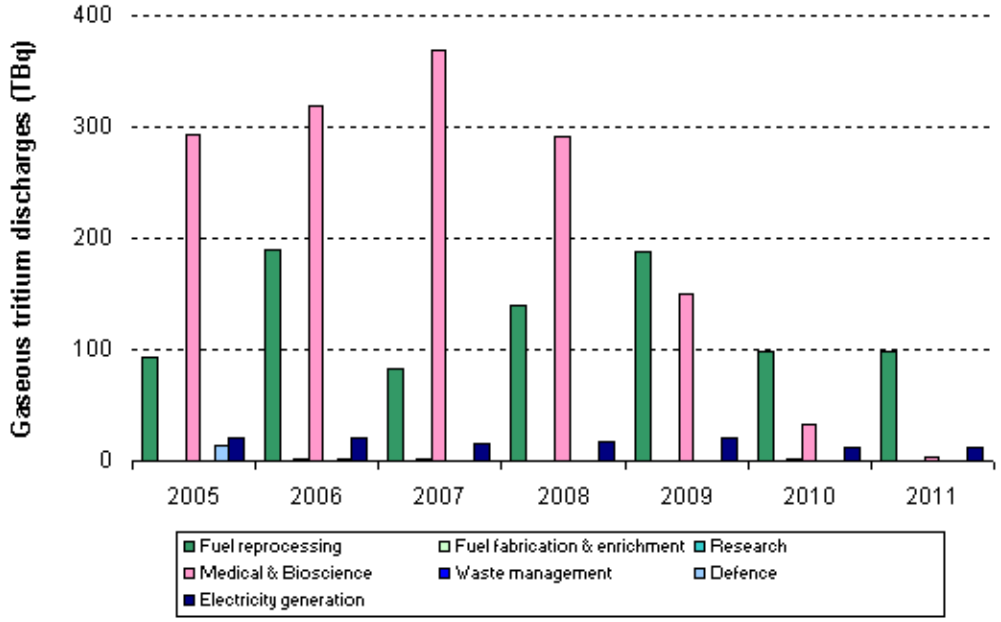
Gaseous alpha discharges continue to be dominated by those from the medical and bioscience sub-sector. The predominant discharge is Radon-222 from a redundant radium source production line at GE Healthcare's Grove Centre. The increase in emissions in 2011 was due to two isolated discharge events in June and July and subsequently radon discharges have reduced. The emissions remained below the limits set in the Environmental Permit. Following investigation, the precise reason for the increased emissions could not be identified. The radium strategy for the site has been produced and this facility is currently programmed for decommissioning in 2015.

Annual beta/gamma discharges to air (excluding tritium)



The gaseous beta/gamma discharges continue to be dominated by those from the fuel reprocessing sub-sector. Discharges increased in 2011 compared to 2010. This was due to the increase in reprocessing rates in 2011 in comparison with those in 2010 and the annual fluctuations that can be expected due to the range of reprocessing, decommissioning and hazard reduction activities being carried out.

Annual tritium discharges to air



Gaseous tritium discharges were lower in 2011 than they were in 2010. The most striking feature in the trends of gaseous tritium discharges since 2005 is the decrease in discharges from the medical and bioscience sub-sector. This was due to radiochemical production ceasing at GE Healthcare's Maynard Centre and the start of decommissioning of redundant facilities (as for liquid tritium discharges).

Radiation doses due to radioactive discharges

Radiation doses to the most exposed members of the public due to discharges from nuclear sites in England and Wales are well within the EU and UK legal limit of 1 mSv per year (Ionising Radiations Regulations, 1999)

Radiation doses are determined primarily by monitoring the concentration of radionuclides in food and the environment around nuclear sites. The results are published annually in the Radioactivity in Food and the Environment (RIFE) report. The Environment Agency uses this data, together with information on the habits of people in the vicinity of the nuclear sites (such as how much of those foods people are likely to eat or how much time people spend in particular locations), to assess radiation doses affecting people as a result of discharges.

Radiation doses change from year to year and are mostly caused by variations in the form and concentrations of radioactivity. However, doses are also affected by changes in people's habits, for example in the food they eat. The 'total dose' assessment method makes use of information on habits around the nuclear sites and, as well as the dose from discharges, also includes the dose from exposure to direct radiation by being near to the site. Members of the public most exposed to radiation near all nuclear sites in the UK are known as the 'representative person'.

Considering doses from discharges alone, during 2011 the representative persons who received the largest doses from liquid discharges were those at Sellafield. Doses from liquid discharges are due to the effects of current and past liquid discharges in seafood and the environment. However, the doses reported in the table below exclude the effects of enhanced concentrations due to the legacy of discharges of naturally occurring radionuclides from a phosphate processing works near Whitehaven. If these doses are included, the highest dose in 2011 from liquid discharges is 0.26 mSv at Sellafield and Whitehaven. The largest doses to the representative persons from gaseous discharges in 2011 were those near Amersham.

Highest doses to representative persons in England and Wales due to current and past discharges[3]

	2009	2010	2011
Liquid discharges (mSv)[a]	**0.20**	**0.18**	**0.15**
Gaseous discharges (mSv)[b]	**0.029**	**0.022**	**0.022**

[a] largest doses as a result of liquid discharges were at Sellafield from fish and shellfish consumption and external intertidal areas (*excluding* naturally occurring radionuclides)

[b] largest doses as a result of gaseous discharges were from terrestrial foods, external dose and inhalation dose at Sellafield in 2009 and 2010; and at Amersham in 2011.

The assessments of total dose reported in RIFE 17 (including the doses both from discharges and from direct radiation from proximity to a nuclear site) show that the highest dose in 2011 in England and Wales was to local adult inhabitants near Amersham (0.22 mSv). The majority of this dose is due to direct radiation. Total dose near Amersham has decreased slightly since 2004. The most marked decreases in total dose since 2004 are on the Cumbrian coast (Sellafield, Whitehaven and Drigg); at Berkeley and Oldbury; at Cardiff; at Dungeness and at Sizewell.

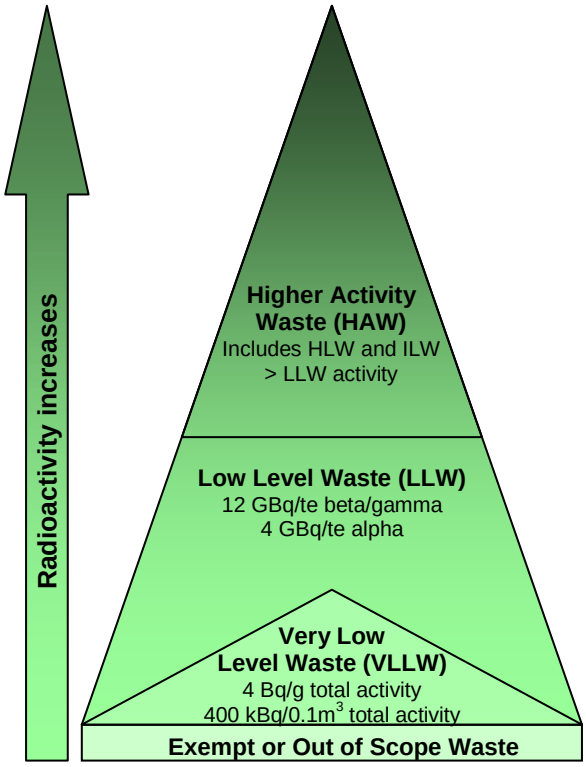
[3] RIFE 15, 16 & 17 - Radioactivity in Food and the Environment, 2009, 2010 and 2011 respectively (Table 1.4)

Minimise and manage solid waste

The nuclear industry generates a range of solid wastes, both radioactive and non-radioactive, as a result of activities at its sites. Operators are required to minimise the production of all wastes. Most of the waste is non-radioactive and comes from construction and demolition projects. Radioactive wastes are disposed of in accordance with permits granted by the Environment Agency.

Radioactive wastes

Solid radioactive waste is divided into four main categories (HLW, ILW, LLW and VLLW) according to the amount of radioactivity it contains and the heat it produces. Intermediate level waste (ILW) and high level waste (HLW) are often referred to together as Higher Activity Waste (HAW) (see diagram). HLW is not included in the scope of the Nuclear Sector Plan. Further details on types of radioactive waste in the UK can be found in the UK National Radioactive Waste Inventory (the summary document provides a useful introduction). A description of the Government's programme to find and implement a solution to the management of higher activity waste can be found at 'Managing Radioactive Waste Safely'.



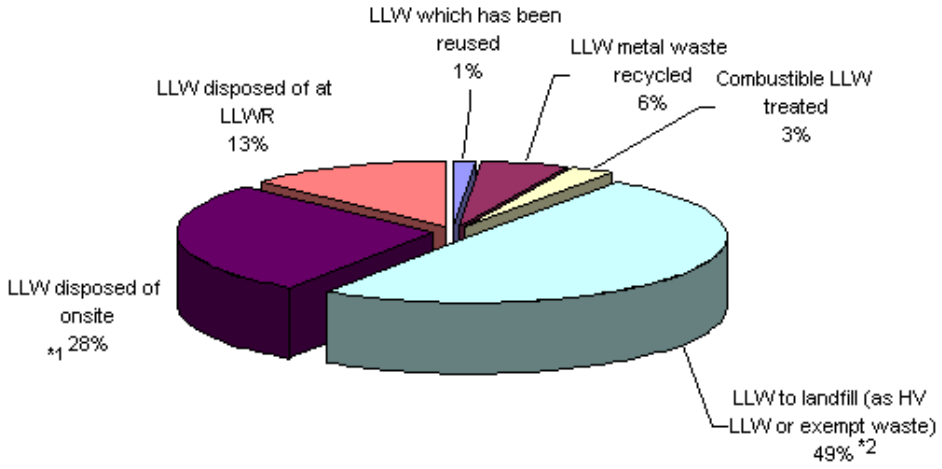
In 2007, a more flexible framework for the disposal of low-level radioactive waste was introduced by the Government. It allows for the disposal of some categories of LLW and VLLW to permitted landfill sites. Since 2010 this process has been regulated under the Environmental Permitting Regulations 2010 in England and Wales. These regulations specify that the landfill site operator must hold an Environmental Permit issued by the Environment Agency in order to accept LLW. The use of landfills for LLW and VLLW will extend the lifetime of the national Low-Level Waste Repository.

Most operators have an Integrated Waste Strategy, which provides an overall plan for dealing with all types of wastes produced on site. At present the majority of sites have these strategies in place and some are still developing them. Operators are continuing to update their strategies to address individual waste streams and how the waste management hierarchy is being employed to deal with them.

URENCO Capenhurst Waste Minimisation and Recycling

Techniques for waste management, including minimisation, are described in the URENCO Integrated Waste Strategy (IWS). Implementation of the techniques described in the IWS saved 90,000 tonnes of concrete rubble from being disposed of as LLW in 2011. This was achieved by thorough, rigorous monitoring and sampling of the areas in question, followed by removal of any contamination found. The material was then crushed and re-used on site. URENCO continues to promote re-use and recycling at Capenhurst by incentivising contracts to encourage waste minimisation and recycling by contractors.

Management of Low Level Waste in 2011



*1disposal at the Calder Landfill Segregated Area (Sellafield)

*2High volume - very low level waste that can be disposed of to specified land fill sites

The Low Level Waste Repository (LLWR) near Drigg is a national asset with limited capacity for the total anticipated volumes of LLW. The nuclear industry is being encouraged to reduce the amount of waste it sends for disposal at the LLWR by implementing the waste hierarchy (reduce, reuse, recycle) and by using other disposal routes. In 2011 the nuclear industry avoided sending 87 per cent of its low level waste to the LLWR (based on figures provided by operators) by recycling, using incinerators for certain wastes or using permitted landfill sites. This is an increase on the 78 per cent which was avoided in 2010.

	2009	2010*	2011
Volume of LLW consigned to LLWR for disposal (m^3)	**6255**	**6304**	**4995**

* the figure for 2010 reported in the 2010 Nuclear Sector Plan was incorrect, the correct figure is reported here

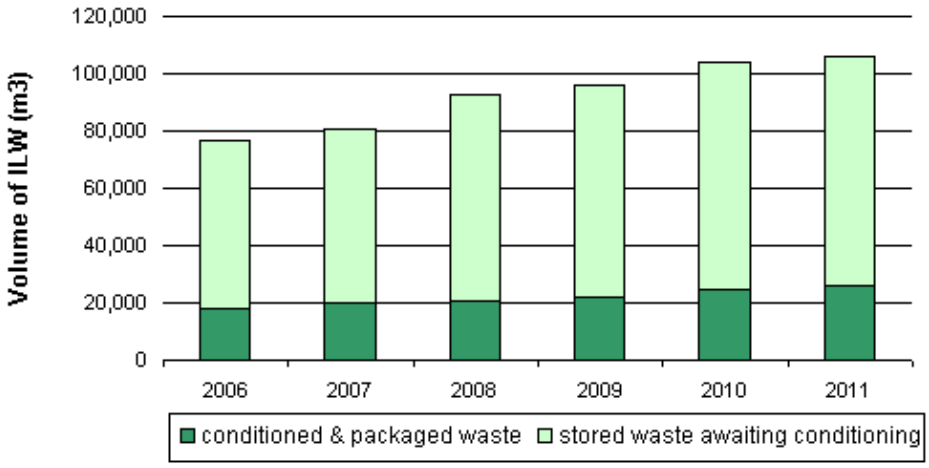
Super-compaction

Many nuclear sites use a technique known as 'super-compaction' to reduce the volume of waste that is sent for disposal. The technique is often used for LLW that is being sent to the Low Level Waste Repository (LLWR). Super-compaction can reduce waste to approximately 20-25 per cent of its original volume. For example, at Studsvik in 2011, two skips filled with secondary waste (plastic, polythene, rubber, wood, rope and other miscellaneous items) were super-compacted prior to disposal at LLWR, reducing the approximate volume of waste from 17 m^3 to 4 m^3.

Intermediate Level Waste (ILW)

Management of ILW is an area of waste management that still needs improving. Progress has been made during 2011 in the conditioning and packaging of 'legacy ILW' within the nuclear industry. These are wastes that are not yet in a final form which can be safely disposed.

Total volume of raw and conditioned/packaged ILW [4]



Generation of ILW is increasing as sites undergo decommissioning and other activities. Since 2006 the proportion of the total volume of ILW that has been conditioned and packaged in England and Wales has remained under 25 per cent. The industry is looking at ways to improve this performance. For example, in 2011 Sellafield Ltd. progressed new infrastructure projects needed to continue the conditioning and packaging of ILW.

The ability to progress to final disposal of ILW is constrained by the availability of a national Geological Disposal Facility (GDF), which is a major project currently in the planning stages. The nature of the disposal facility for higher activity wastes will determine the specific requirements for packaging of the wastes that will be sent there. Currently a disposability assessment process exists whereby the Nuclear Decommissioning Authority can issue a Letter of Compliance for higher activity wastes that are packaged into a passive, disposable form.

Some sites have ILW that is not destined for final disposal in a deep geological facility and this waste may have different conditioning and packaging requirements. The nature of ILW means that significant work is usually needed before waste is moved. Sites are also starting to tackle some of the more difficult-to-treat ILW, which presents a significant engineering challenge to the industry. Research into methods and technologies to treat various types of ILW is ongoing; for example in 2011 good progress was made with the design and manufacture of equipment to retrieve ILW sludge and resins. Commissioning of new facilities for ILW storage at Hunterston progressed in 2011.

Magnox Berkeley ILW Trials

In 2011, a small amount of ILW (mainly Fuel Element Debris) was retrieved from the Active Waste Vaults at Magnox's Berkeley site. The waste was successfully transferred from the old legacy facility into safer, modern, interim storage. This exercise was carried out as part of a feasibility study into the type of container that may be used for the storage and eventual disposal of this type of waste. Further work to design and build retrieval equipment, along with relevant assaying and conditioning facilities is planned for 2012.

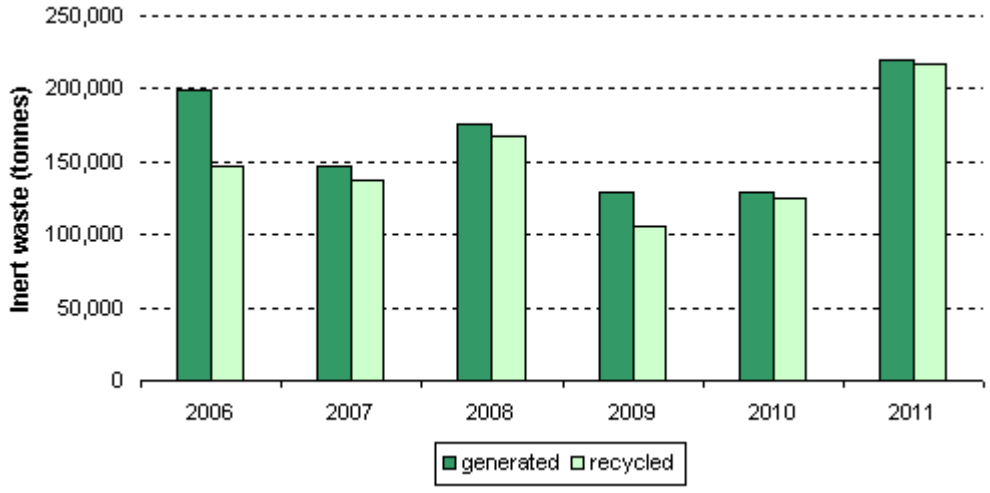
[4] Data is provided by the NDA and is based on the 2010 UK Radioactive Waste Inventory and waste package numbers at 1 April 2011 (provided by Site License Companies).

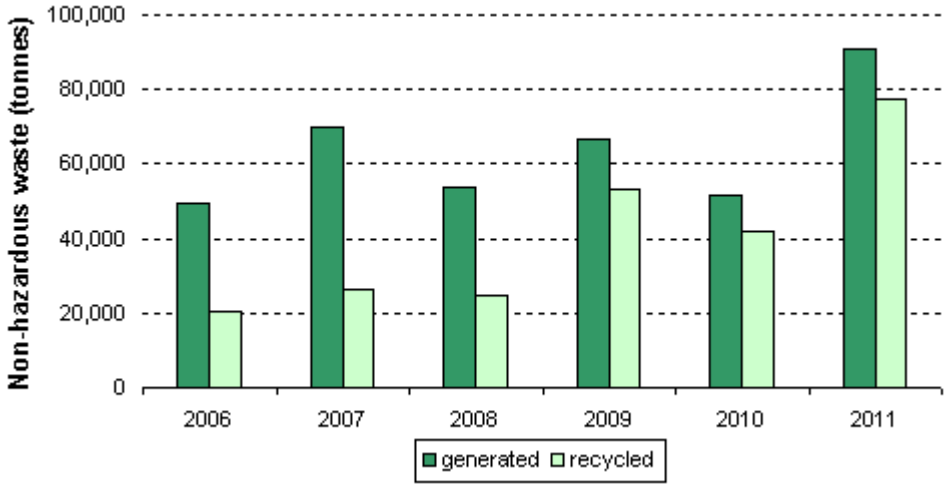
Non-radioactive wastes

The bulk of the waste generated by the nuclear industry is non-radioactive. Non-radioactive waste is divided into three categories according to its hazardous nature and other characteristics; hazardous waste, inert waste and non-hazardous waste.

Hazardous waste is waste which is harmful to human health or the environment and so is disposed of by specific technical treatment or to specialist landfill. Examples include asbestos, solvents, oil and pesticides. Inert waste is waste that has no hazardous properties and which does not undergo any significant physical, chemical or biological transformations. Sand is an example. Non-hazardous waste is waste that, while it doesn't have any hazardous properties, is not inert and could cause problems if not dealt with properly due to the fact that it may biodegrade. Examples of non-hazardous waste include paper, cardboard and plastic.

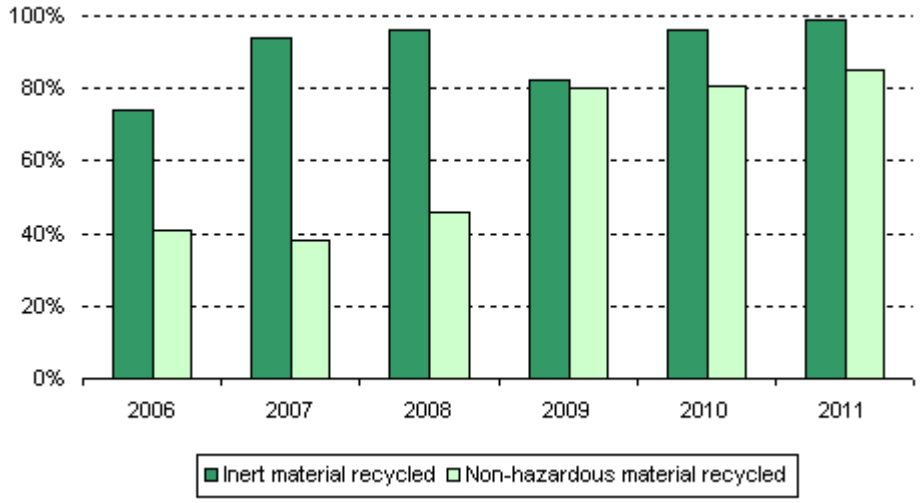
Amounts of non-hazardous and inert waste generated and recycled





In 2011 the amount of inert and non-hazardous waste generated at nuclear sites increased. The amount of waste produced is dependent upon the activities occurring on site and several sites; for example Sellafield, Capenhurst, Bradwell and Dungeness A began significant demolition and building projects in 2011, which produced large amounts of waste. Despite this increase, recycling rates also increased to 99 per cent for inert waste and 85 per cent for non-hazardous waste as sites improved the way they manage wastes in routine work and in large projects.

Percentage of inert and non-hazardous material recycled



The nuclear industry has a very high rate of recycling for inert and non-hazardous wastes (99 per cent and 85 per cent respectively). In England in 2009, 52 per cent of waste generated by the entire commercial and industrial sector was recycled or reused[5]; therefore the nuclear industry is doing well in comparison to other industrial sectors. Across the industry the majority of the inert waste created is reused either on or off the site of origin. For example, at Capenhurst, inert waste is to be used as engineering infill for future building projects on site. Sites are continuing to apply the waste hierarchy, segregating wastes carefully to allow recycling to take place.

Magnox Sizewell A – waste hierarchy in practice

Sizewell A manages hazardous and non-hazardous waste following the waste hierarchy. First, where possible, waste is minimised. For example, the site uses the Company Asset Disposal process to see if unwanted items could be used elsewhere. Where re-use is not practical, the site has provided segregated bins for metal, plastic, compostable items, paper/cardboard and glass waste in all offices, workshops and mess rooms to help recycling. Project waste is assessed through the use of Project Waste Management Plans (PWMPs), which identify how waste can be minimised. The PWMPs also identify how any remaining waste can be segregated and sent for recycling. Segregating waste has allowed the site to maintain its impressive recycling rate of over 90 per cent.

[5] http://www.defra.gov.uk/statistics/environment/waste/wrfg03-indcom/

Demonstrate sound environmental management and leadership

Industry operators remain committed to working together and sharing their views and experience on good environmental performance. They are continuing to make good progress towards the goals set out in the Nuclear Sector Plan. Most operators have an environmental management system that has been independently certified to an international standard (ISO 14001), while others have chosen alternative arrangements to equivalent standards.

Where relevant, operators are continuing to work towards their corporate social responsibility (CSR) policy targets. These cover socioeconomic commitments, sustainability, supplier partnerships, working with external stakeholders and social and community projects. The majority of operators have a specific CSR policy for their sites; others incorporate CSR into their sustainability policy. Several operators also have socio-economic development plans or policies and sustainable procurement policies.

Site operators are encouraged to involve local stakeholders. The Nuclear Decommissioning Authority (NDA) has developed guidance on what it expects from Site Stakeholder Groups (SSGs) and what support the SSGs can expect in return. Operators have stakeholder plans and well established local liaison groups which meet regularly to discuss relevant local issues.

Manage land quality and biodiversity

Site operators have made progress in identifying land affected by chemical or radioactive contamination. Most contaminated land on nuclear sites is from historical activities. Some sites have no contaminated land, while others have legacy contamination issues to manage. All sites are committed to avoiding any future land contamination. Where appropriate, sites have developed Land Quality Management Plans, which may involve monitoring programmes, mitigation and clean-up activities. The Environment Agency, Scottish Environment Protection Agency (SEPA) and the Office for Nuclear Regulation (ONR) are working with the industry to develop these plans.

Most nuclear sites have biodiversity action plans (BAPs) to manage or enhance the flora and fauna present on site or on surrounding land. As well as working on their own sites, many operators work in the local area to encourage biodiversity. The Winfrith site has Sites of Special Scientific Interest (SSSIs) within its boundary. These areas are managed by RSRL (Research Sites Restoration Limited) as part of their Heathland Management Plan, (which supplements their BAP) in consultation with Natural England. GE Healthcare's Maynard and Grove Centres have developed sustainable ground maintenance plans to encourage native plants and plants that require little watering, in order to reduce water use.

Berkeley ecologist working with local primary school

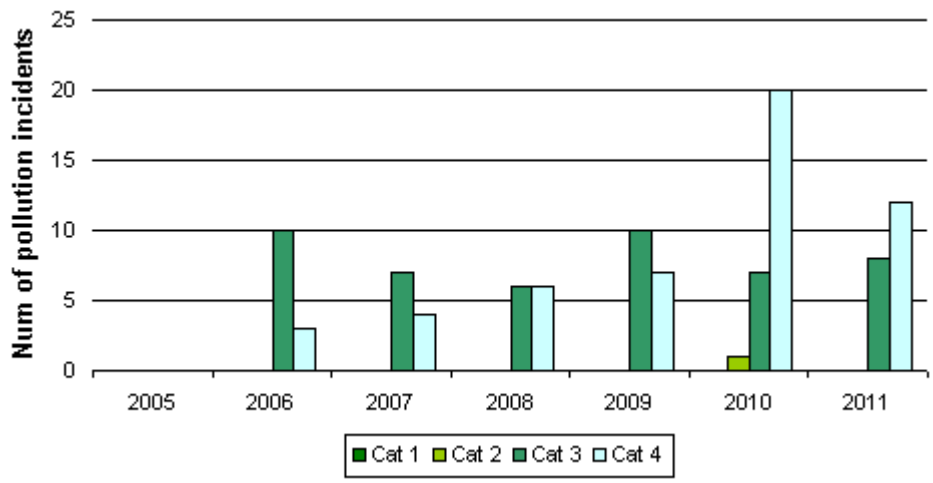
Magnox's Berkeley site worked with the local primary school in 2011 to clean up the school pond and improve the path to the pond from the school. The company ecologist provided specialist advice and helped the pupils to study the flora and fauna of the pond.

Improve or maintain 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. We work closely with the industry and other nuclear regulators (particularly the Office for Nuclear Regulation) to ensure compliance and support improvements in performance. Non-compliances are rare and when they do happen, both the Environment Agency and the industry are committed to responding promptly to understand how these occurred and how any future recurrence can be avoided.

All but one of the incidents at nuclear sites in the past seven years have had either no impact, or only minor impacts, on the environment (as categorised in the Environment Agency's Common Incident Classification Scheme (CICS)). The one exception is the mis-consignment of radioactive waste from Sellafield to the Lillyhall landfill site. The waste was assigned a Category 2 CICS score (potential or significant impact) on the basis that: it was a loss of control of radioactive waste, limited countermeasures were employed (removal of the radioactive waste and return to the Sellafield site) and it was a significant breach of Sellafield Ltd's environmental permit. We are considering our enforcement response for this incident. The incident occurred in 2010, but was not reported in the 2010 Nuclear Sector Plan Environmental Performance Report as it had not been classified when that report was published. None of the incidents at nuclear sites in the past seven years have had major impacts on the environment (as categorised in the CICS).

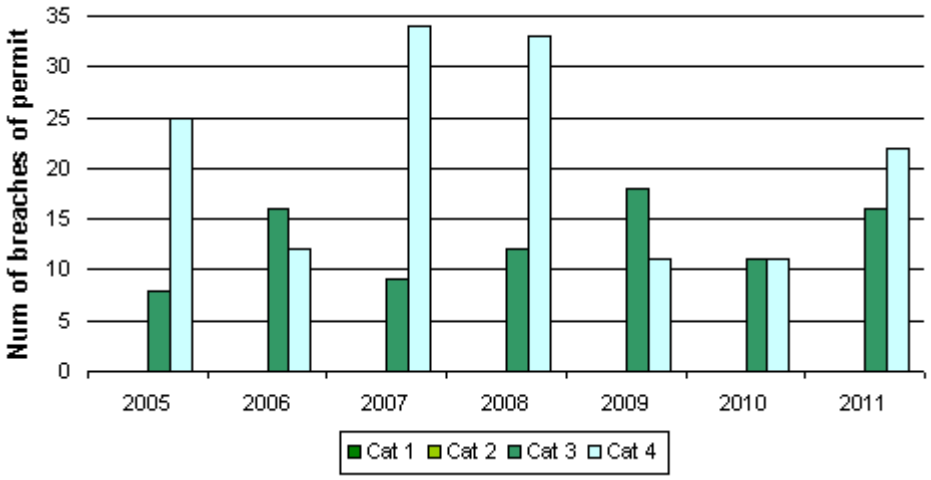
Number of pollution incidents



Note: The Environment Agency classifies incidents (in the CICS scheme) from Category 1 to Category 4, where Category 1 is the most serious. Incidents are classified based on their actual or potential impact. For example, a Category 1 incident has a major impact on the environment, while a Category 4 incident has no environmental impact. No incidents were recorded in 2005.

The number of Category 4 incidents (which have no environmental impact) decreased in 2011 in comparison to 2010. These types of incidents may include a minor deviation from the authorised activity or a discharge being made from an incorrect discharge point. The number of Category 3 incidents increased from seven in 2010 to nine in 2011. Category 3 incidents have the potential to cause a minor environmental impact requiring no, or very limited, intervention, for example a discharge within the limits of the authorisation but from an unauthorised route.

Number of breaches of permit



Note: The Environment Agency classifies breaches (in the CCS scheme) from Category 1 to Category 4, where Category 1 is the most serious. Breaches are classified on their potential impact. For example, a Category 1 breach of permit has or could have a major impact on the environment. A Category 4 breach has no potential to have an effect on the environment.

We also monitor breaches of permit conditions using a 1 – 4 scale (the Compliance Classification Scheme (CCS)), with Category 1 being the most serious. There were no Category 1 or 2 breaches in 2011. The number of Category 3 and 4 breaches increased in 2011. Category 3 breaches are activities that could cause minor harm or pollution of the environment such as failure of monitoring equipment. Category 4 breaches are those that have no environmental impact (or no potential for environmental impact), such as a minor failure in record keeping.

Comparison with other industries

The nuclear industry had fewer serious pollution incidents or serious breaches of permits than most other regulated industry sectors in 2011.

Sector	Number of serious pollution incidents in 2011[a]	Number of serious breaches of permit in 2011[a]	Number of permits[b] 2011
Nuclear	0	0	38
Water	120	81	35,500
Chemicals	11	11	536
Energy	3	0	408
Waste[b]	140	646	11134
Metals	3	9	206
Mineral products[c]	0	0	56
Farming	82	2	1102
Food and drink	6	13	366
Other[d]	7	0	124

(a) 'Serious' pollution incidents are those classified as Category 1 or Category 2 in the Environment Agency's Common Incident Classification Scheme (CICS). 'Serious' breaches of permits are those classified as Category 1 or Category 2 in the Environment Agency's Compliance Classification Scheme (CCS).
(b) Waste management include operations with waste management licences and installations with PPC permits
(c) The 'mineral products' sector includes cement and lime industries, glass ceramic and brick manufacturers, but not mineral extraction.
(d) The 'other' sector includes construction, textiles, and retail/wholesale.

During 2011 we issued a formal caution to Devonport and a formal caution and a civil penalty to Sellafield Ltd.

Achieve better regulation

The Environment Agency has made good progress against each of its improvement goals:

- We are providing Site Environment Reviews for all nuclear sites to increase transparency in how we regulate. These provide an overview of the environmental issues at each site. They cover both radioactive and non-radioactive issues, summarise short and medium-term objectives for the site and provide regulatory plans for the coming financial year. The key purpose of these documents is to collate evidence and information to support our strategic objectives and to help us carry out and demonstrate risk-based regulation.

- During 2011 we worked towards implementing our Medium Term Action Plan (MTAP) which sets out our priorities for risk-based regulation of radioactive substances in the nuclear industry. In 2011, progress against the MTAP included: publishing an Interim Statement of Design Acceptability for the two potential new nuclear reactor designs in the UK; producing draft technical assessment guidance on decommissioning in conjunction with the Office for Nuclear Regulation (ONR); initiating a series of themed audits at nuclear sites, beginning with a focus on asset care and maintenance; taking steps to ensure that we have a resilient workforce of nuclear specialists and publishing joint guidance to industry on 'The Management of Higher Activity Radioactive Waste on Nuclear Licensed Sites' with ONR and the Scottish Environment Protection Agency(SEPA).

- For monitoring of liquid effluent flow, our aim in 2011 was for each site operator to either complete MCERTS certification and obtain a site conformity certificate, or to obtain a temporary or permanent dispensation not to complete MCERTS (by written agreement with their regulator). The majority of site operators have now agreed to complete the MCERTS process and are in the process of obtaining site conformity certificates.

- In 2011, we finalised a standard for radioanalysis of waters. This work will be published in 2012. We propose that the requirements in the MCERTS standard for radioanalysis of waters will be imposed on all new nuclear power stations from the start. For existing sites we propose that if the site adopts the MCERTS scheme we will reduce its independent monitoring of waste water discharges. However, if the site chooses not to adopt the MCERTS scheme, we will continue to check its waste waters using its contractor. Our contractor will be adopting the MCERTS scheme for analysis of water discharges.

- We aim to provide feedback to operators on incidents and breaches within two months of being notified of an event. Events are subject to detailed investigation by both the operators themselves and the Environment Agency as regulator. These investigations commonly take longer than the two month deadline. In 70 per cent of cases last year we provided feedback to sites within the two month period, or agreed with the site that the feedback would take longer than two months due to continuing investigations. This is an increase on the 54 per cent reported for 2010. We focus our efforts on ensuring incidents are investigated fully and that any appropriate improvements are put in place to avoid a recurrence.

Conclusions

Overall, the nuclear industry's environmental performance in 2011 has been good. The industry has continued to perform and progress well against most of the Sector Plan objectives, while at the same time maintaining good relationships and sharing best practice.

In 2011, as in previous years, the industry continued to maintain a high standard of regulatory compliance, but is committed to achieving further improvements in environmental performance that go beyond just compliance. The Environment Agency, by working with the nuclear industry, remains committed to supporting the industry in achieving these high levels of performance.

While discharges increased in 2011, this reflects the processes being carried out on sites. In particular, an increase in fuel reprocessing in comparison to 2010, and annual fluctuations due to the range of operational, decommissioning and hazard-reduction activities being carried out throughout the industry.

Despite an overall increase, emissions decreased in some sub-sectors. Gaseous tritium discharges were lower in 2011 than they were in 2010. This was mainly due to the end of radiochemical production at GE Healthcare's Maynard Centre and the start of decommissioning of redundant facilities.

In 2011 the nuclear industry avoided sending 87 per cent of its low level waste to the LLWR by recycling or using other disposal routes compared to 78 per cent in 2010. This is a significant achievement, which is helping to ensure that the limited capacity of the national repository is being protected for waste that *does* require the protection it offers.

There are aspects of environmental performance that need improvement or continued work and the nuclear industry, the Environment Agency and the other regulators are working to address these areas. They include:

- Maintaining awareness of resource use and striving for further resource efficiency.
- Maintaining low discharges to air and water.
- Better understanding and minimisation of greenhouse gas emissions.
- Increasing the amount of Intermediate Level Waste conditioned and packaged.

Conditioning and packaging of legacy wastes and other higher activity wastes continues to remain the nuclear industry's main environmental challenge. Work is underway to increase the rate of progress and we will continue to work together to monitor this.

Glossary

Geological Disposal Facility
Engineered repository located deep underground to hold high active waste namely spent nuclear fuel. The repository is designed to isolate and contain wastes for long term periods.

Integrated Waste Strategy
An Integrated Waste Strategy is a strategy which describes:

- how a site optimises its approach to waste management in an integrated way
- the waste streams and discharges expected from current and future operations
- actions required to improve the site's approach to waste management.

The waste includes all radioactive and non-radioactive wastes (including those in solid, liquid or gaseous form) arising from the site's past, present and future operations, and any other waste transferred from other sites for management or disposal.

Land quality management plans
Plans for the control, monitoring and remediation of radioactive and non-radioactive contamination in the ground or groundwater at a site.

Low Level Waste Repository
The UK's national low level radioactive waste facility, located close to the West Cumbrian coastline in the north-west of England.

Monitoring Certification Scheme (MCERTS)
MCERTS is a scheme established by the Environment Agency. It provides a framework that businesses can use to demonstrate that their emission monitoring arrangements meet the quality requirements of their permits. A range of schemes exist, including for air monitoring, soil analysis, water monitoring and for environmental data management software.

Radioactive waste inventory
The radioactive waste inventory is a public record of information on radioactive waste present in the UK. It describes the sources, quantities and properties of radioactive waste that exist at a particular point in time. The latest available inventory relates to that waste which existed at 1 April 2010 and that was forecast to arise in the future.

Waste hierarchy
The waste hierarchy is a useful framework which sets out the order in which options for waste management should be considered, based on environmental impact. The framework is based on trying to avoid the creation of waste in the first instance, if this is not possible then working down the hierarchy try to minimise, re-use/recycle as much of the waste as possible. The last resort is to dispose of the waste to landfill.

Links to participating organisations

http://www.awe.co.uk

http://www.babcock.co.uk

http://www.baesystems.com

http://www.edfenergy.com

http://www.gehealthcare.com/uken

http://www.llwrsite.com/llw-strategy

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

http://www.nda.gov.uk

http://www.research-sites.com

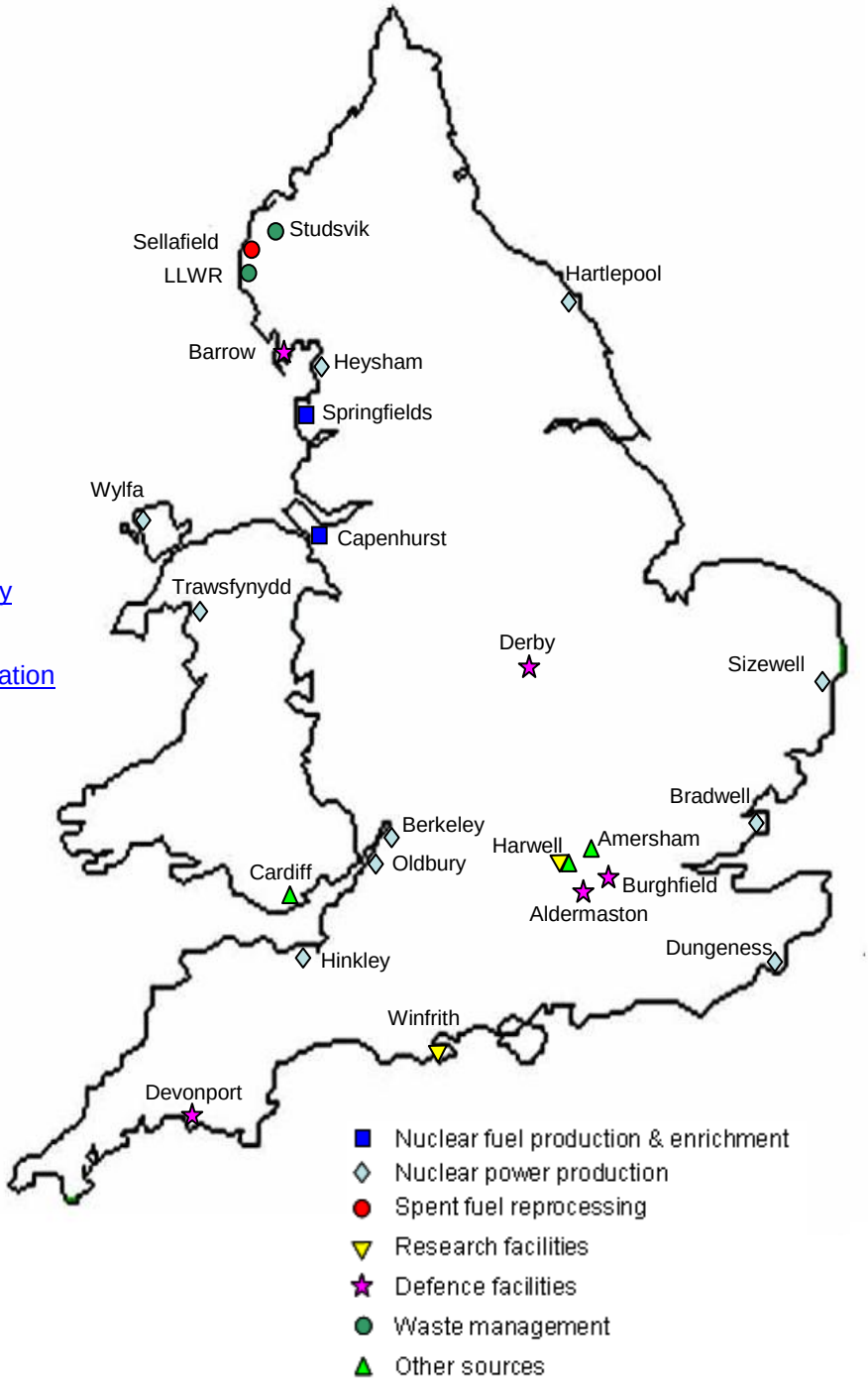
http://www.rolls-royce.com

http://www.sellafieldsites.com

http://www.studsvik.com

http://www.urenco.com

http://www.springfieldsfuels.com



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