Environment Agency

nuclear sector plan

2008 Performance Report

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foreword

Welcome to our third annual report on the environmental performance of the nuclear industry. This highlights where the industry performed well in 2008 and identifies areas for continued improvement.

The sector is still experiencing major changes. Potential sites for new nuclear power stations have been nominated, and we and the Health and Safety Executive (HSE) continue to assess new designs of nuclear power reactors that may be constructed in the UK. Decommissioning and clean-up of existing nuclear sites is progressing, although it is a long term process. We welcome the high-level groups which have been set up to plan this work, including the Nuclear Development Forum and Sellafield Remediation Forum, but they need to take ownership and ensure a co-ordinated approach. Following changes in government policy, new routes are starting to become available to recycle or dispose of low-level radioactive waste. While this is welcome, stimulating and encouraging the supply chain will be key to making these new disposal routes operational. Government and the Nuclear Decommissioning Authority (NDA) are mapping out an approach to dispose of higher-activity radioactive waste in a future geological repository.

We published the first nuclear sector plan in November 2005, and have worked closely with the nuclear industry to update it. A revised version of the nuclear sector plan was published in July 2009. It builds on the successes of the plan to date, and looks ahead to forthcoming challenges such as the need to minimise greenhouse gas emissions and adapt to climate change. It sets out the main environmental issues facing the nuclear industry over the next few years, and the ways in which we can work together to address them. It encourages nuclear operators to continue to be responsible for environmental issues and to improve further their environmental performance beyond the minimum standards of regulation. It also commits us to continue our work to be a "better regulator", focusing on significant issues and streamlining regulation. We are working with government to modernise the radioactive substances legislation, through the Environmental Permitting Programme, and the secondary legislation in RSA Exemption orders. We will report again on progress in relation to the revised nuclear sector plan in 2010. In recognition of the joint effort between ourselves and the nuclear industry, where "we" is used in the body of this document it applies to the Environment Agency and the industry collectively. Logos of organisations participating in this initiative are shown below. We hope you find this report useful.

Tricia Henton / Environment Agency

babcock · Research Sites Restoration Ltd · British Energy · Rolls-Royce · Sellafield Ltd · Westinghouse · Ministry of Defence · NDA · Magnox South · LLW Repository Ltd · AWE · urenco · Magnox North · Studsvik · BAE SYSTEMS · GE Healthcare

summary

This is the third annual report describing the environmental performance of the nuclear sector in England and Wales. It covers 2008 and measures performance against the objectives and performance indicators set out in the first issue of the **nuclear sector plan**, which was published in November 2005. Next year we will report against the revised nuclear sector plan which was published in July 2009.

We developed the sector plan collaboratively. It covers statutory responsibilities and voluntary activities the industry has agreed to carry out. The Environment Agency is very pleased that the industry is supporting the sector plan and that it has agreed to use it to monitor and report on the impact of its activities.

Overall, the nuclear sector continues to make good progress towards meeting the environmental objectives in the nuclear sector plan. Here, we highlight the most significant improvements in performance during 2008 and those areas where progress has been slower.

Use of natural resources continues to fall

➜ The nuclear sector used 13.6 million cubic metres of water and 5.9 million megawatt hours (MWh) of energy in 2008 – seven per cent less water and 15 per cent less energy than in 2007. However, we recognise that water and energy use may increase again in future as decommissioning progresses.

Slow progress in packaging radioactive waste, but good performance in recycling non-radioactive waste

➜ Only two sites, Sellafield and Winfrith, made progress with packaging intermediate-level radioactive waste (ILW) in 2008. Despite a seven per cent increase in the volume of waste packaged, the overall proportion of conditioned and packaged waste stored at nuclear sites fell from 25 per cent in 2007 to 23 per cent this year. Making real progress on packaging this waste remains a major long-term challenge for the industry.

The nuclear sector produced a total of 243,500 tonnes of non-radioactive waste in 2008. Eighty per cent of this waste was reused or recycled, compared to 69 per cent in 2007. Integrated waste strategies were in place at 86 per cent of nuclear sites.

Radioactive discharges to water and air similar to last year

➜ The industry continues to make good progress towards meeting the UK radioactive discharge strategy targets. Liquid alpha discharges increased by seven per cent in 2008 because more fuel was reprocessed at Sellafield, but they are still very low in comparison with historic levels. The treatment of some historic liquid waste was completed at Sellafield, resulting in significant reductions in discharges of beta/gamma-emitting radionuclides and technetium-99 to water. Discharges of tritium to water fell because two power stations were out of service during 2008.

Discharges of alpha-emitting radionuclides and tritium to air fell by five per cent. Beta/gamma discharges to air increased significantly this year because more fuel was reprocessed at Sellafield, but they are still low in comparison to historic levels. The longer-term trend is a continued fall in discharges to both air and water.

Average radiation doses to the general public from all sources in the UK are around 2.7 milliSieverts (mSv) a year, and discharges from the nuclear industry account for less than 0.1 per cent of this. The highest estimated radiation doses to “critical groups” of adults and children living around nuclear sites were 0.027 mSv as a result of discharges to air and 0.23 mSv as a result of discharges to water – well below the public dose limit of 1 mSv a year.

Contribution to reducing greenhouse gases

➜ The nuclear sector released greenhouse gases equivalent to 0.64 million tonnes of carbon dioxide into the environment in 2008 – 16 per cent more than in 2007. The nuclear power stations in England and Wales generated nine per cent of the UK's electricity and offset around 21 million tonnes of carbon dioxide emissions[1].

1 Generating the same amount of electricity using fossil fuels would give rise to about 22 million tonnes of carbon dioxide, so nuclear generation saved over 21 million tonnes.

Nuclear performs well compared with other sectors

The nuclear sector's environmental performance is good compared with that of the other business sectors regulated by the Environment Agency. In 2008, the nuclear sector reused or recycled 80 per cent of its non-radioactive waste – only the food and drink sector and the "other" group of sectors (which includes the construction, paper and pulp, and textile industries) recycled more waste. The nuclear sector had no serious pollution incidents or serious breaches of permits in 2008 – less than any other regulated sector.

Areas for improvement

There are still certain areas where the nuclear sector needs to focus if performance is to continue to improve. In particular these include:

- increasing the efficiency of use of natural resources at some sites, for example through the use of energy auditing and more energy-efficient systems;
- making real progress in packaging and conditioning of intermediate-level radioactive waste in a form suitable for disposal, or for safe and secure storage. We recognise, however, that considerable effort is required to develop plant and processes and obtain approval from the regulators;
- implementing the national low-level waste strategy, to ensure that new routes for recycling or disposing of low-level radioactive waste are available and that best use is made of the limited capacity at the Low-Level Waste Repository (LLWR). The Environment Agency will work with the supply chain to facilitate the use of these new disposal routes for low-level radioactive waste;
- continuing to increase recycling levels for non-radioactive waste at some sites, by sharing best practice within the sector;
- continuing to make good progress in reducing significant radioactive discharges and working towards meeting the UK strategy targets for discharges to water;
- continuing to minimise discharges of greenhouse gases;
- continuing to improve understanding and management of contaminated land on nuclear sites, moving forward into cleaning up the contamination at an appropriate time;
- continuing to develop corporate social responsibility, including involving stakeholders early in key decisions and influencing the environmental performance of suppliers;
- the Environment Agency needs to continue to develop its approach to "better regulation".

Moving forward

We published a revised version of the nuclear sector plan in July 2009. This builds on the successes of the previous version, published in November 2005, and looks ahead to the environmental challenges that face an industry undergoing major change. We will report against the new objectives and improvement goals for the first time next year, using data for 2009.

Feedback

We welcome your views on the content or format of the report. If you have any queries or wish to make any comments, please contact Rona Arkle: **rona.arkle@environment-agency.gov.uk**.

Table – Environmental performance of the nuclear sector, 2008

In overview, we summarise below performance in 2008 and how it has changed over the last few years. More detail about the changes is provided in the main report.

Indicator	Target	2008 performance	Trend	
			Compared to 2007	Since 2005◆
Objective 1: reduce consumption of natural resources				
1.1 Water use (excluding cooling water)	↓	13.6 million m^3 water used	↓ 7%	↓
1.2 Energy use	↓	5.9 million MWh (21,172 TJ) energy used	↓ 15%	↓
Objective 2: minimise and manage solid wastes				
2.1 Proportion of ILW conditioned and packaged by volume	↑	23% of waste on site has been conditioned and packaged	↓ 2%	→
2.2-2.4 Reuse/recycling of non-radioactive waste	↑	80% of non-radioactive waste was recycled	↑ 11%	↑
Objective 3: reduce discharges to air and water				
3.2 Annual liquid alpha discharges	↓	0.16 TBq discharged	↑ 7% [a]	↓
3.3 Annual liquid beta/gamma discharges (excluding tritium)	↓	21 TBq discharged	↓ 34%	↓
3.4 Annual liquid tritium discharges	↓	1,400 TBq discharged	↓ 31%	↓
3.5 Discharges of technetium-99 from reprocessing	↓	2.4 TBq discharged	↓ 51%	↓
3.6a Annual alpha discharges to air	↓	4.6 TBq discharged	↓ 5%	↑
3.6b Annual beta/gamma discharges to air (excluding tritium)	↓	26,000 TBq discharged	↑ 85% [a]	↓
3.6c Annual discharges of tritium to air	↓	450 TBq discharged	↓ 4%	→
3.7 Critical group doses due to radioactive discharges	↓	Up to 0.23 mSv from liquid discharges and 0.027 mSv from gaseous discharges	→ nc	→

Indicator	Target	2008 performance	Trend	
			Compared to 2007	Since 2005◆
3.8 Discharges of nitrates and nitrites to controlled waters	↓	1,016 tonnes discharged	↓ 9%	↓
3.9 Proportion of sites with an integrated waste strategy	100%	86% of sites have an integrated waste strategy	↑ 6%	↑
Objective 4: reduce greenhouse gas emissions				
4.1 Greenhouse gas emissions	↓	0.64 million tonnes CO_2 equivalent released	↑ 16% [b]	→
Objective 5: develop site restoration and biodiversity plans				
5.1 Number of sites "determined" to be affected by chemical contamination	→	One nuclear site is formally "determined" as contaminated under the Part 2A regulations	→ nc	→
5.2 Proportion of sites with management plans for contaminated land	100%	All sites with land affected by radioactive or chemical contamination have some management arrangements in place	→ nc	→
5.3 Proportion of sites with biodiversity action plans (BAPs)	100%	79% of sites have implemented BAPs	↑ 9%	↑
Objective 6: improve transparency, understanding and involvement				
6.1 Percentage of sites holding local stakeholder meetings	100%	All nuclear sites hold some form of regular stakeholder meeting	→ nc	→
6.2 Percentage of operators which publish environmental reports	100%	64% of nuclear operators published an environmental report	↓ 9% [c]	↓
Objective 7: promote product stewardship				
No specific indicators				

Indicator	Target	2008 performance	Trend	
			Compared to 2007	Since 2005◆
Objective 8: work to risk-based regulatory and environmental management systems				
8.1 Number of sites with modern multi-media authorisations	100%	All sites now have multi-media authorisations	↑	↑
8.2 Pollution incidents	0	No serious pollution incidents recorded, but one more low category incident	→ nc	→
8.3 Breaches of permits	0	No serious breaches of permit recorded, but two more low category breaches	→ nc	→
8.4 Enforcement actions and prosecutions taken	0	Two enforcement notices were issued	→ nc	→
8.5 EPR permits issued within target time	100%	60% of permits were issued within four months [d]	↓ 22% [d]	↓
8.6 RSA93 authorisations issued within programme time	100%	40% of authorisations were issued within four months [d]	↓ 55% [d]	↓

◆ when reporting against the nuclear sector plan started
nc no change in performance
a) increase in discharges is because more fuel was reprocessed at Sellafield in 2008
b) increase in greenhouse gas emissions is due to increased production at defence sites
c) the number of operators publishing their own environmental report has not changed, but due to reorganisation there are now more operators in the nuclear sector so the proportion has fallen
d) in previous years, target/programme time was agreed with the operators on a case-by-case basis

contents

Introduction

The nuclear sector

The “nuclear sector” consists of 34 nuclear licensed sites[2] in England and Wales. Other sites (including hospitals and universities) also produce radioactive waste, but not in such significant amounts.

The sector is diverse. It covers a wide range of operations and products that can be broken down into seven sub-sectors. The sub-sectors, companies and sites are listed below, as they reported in 2008.

2 Sites which are licensed by the Nuclear Installations Inspectorate (NII) under the Nuclear Installations Act (1965), or sites that would be licensed if the Act applied to the Ministry of Defence.

Sub-sector	Company	Sites	
Electricity generation	Magnox South Ltd	Berkeley [a] Dungeness A [a] Sizewell A [a]	Bradwell [a] Hinkley Point A [a]
	Magnox North Ltd	Oldbury Wylfa	Trawsfynydd [a]
	British Energy	Dungeness B Heysham 1 Hinkley Point B	Hartlepool Heysham 2 Sizewell B
Fuel reprocessing	Sellafield Ltd	Sellafield [b]	
Fuel fabrication and enrichment	Sellafield Ltd	Capenhurst [a]	
	Urenco (Capenhurst) Ltd	Capenhurst	
	Springfields Fuels Ltd	Springfields	
Research	Sellafield Ltd	Windscale [b]	
	Research Sites Restoration Ltd	Harwell [a]	Winfrith [a]
	Imperial College	Ascot [c]	
Defence	Ministry of Defence (MoD)	BAE Barrow [d] HMNB Devonport [d]	Devonport Royal Dockyard [d] RRMPOL Derby [d]
	Atomic Weapons Establishment (AWE)	Aldermaston	Burghfield
Medical and bioscience research and products	GE Healthcare	Amersham (Grove Centre) Cardiff (Maynard Centre) Harwell (Building 10.23) [c] Harwell (Building 443.26) [c]	
Waste management	LLW Repository Ltd	LLWR near Drigg	
	Studsvik UK Ltd	Lillyhall [e]	

a) Decommissioning sites
b) From April 2008, Windscale reported as part of Sellafield. Windscale is a research site, which used to be operated by UKAEA
c) Small sites with minimal environmental impacts, not reporting under the nuclear sector plan
d) MoD provides a consolidated return for these sites, which support the nuclear submarine programme
e) Nuclear site licence and RSA93 authorisation granted in 2008, but the site did not start operating until July 2009 so is not included in this report

2008 performance

The original nuclear sector plan includes eight environmental objectives. These are:

1 **Reduce the consumption of natural resources.**

2 **Minimise and manage solid waste.**

3 **Reduce discharges to air and water.**

4 **Reduce greenhouse gas emissions.**

5 **Develop site restoration and biodiversity action plans.**

6 **Improve transparency, understanding and involvement between the Environment Agency, industry and other stakeholders.**

7 **Promote product stewardship and wider supply chain benefits.**

8 **Work to risk-based regulatory and environmental management systems.**

Each objective has a number of associated performance indicators.

This report details performance against the indicators in the original nuclear sector plan for 2008. Please refer to the sector plan[3] for more detail on the background and indicators. This report compares nuclear with other sectors where data are available, and compares 2008 with 2007 performance if appropriate. We also consider where the sector needs to improve its environmental performance.

Thirty nuclear licensed sites took part in the 2008 reporting, but Windscale now reports as part of Sellafield. Three small sites do not report under the nuclear sector plan, because they have minimal impacts on the environment, and Studsvik UK's new metals recycling facility had not started operating in 2008.

Significant developments in 2008

Electricity generation

A technical issue with the boiler closure units was identified during routine inspections at Hartlepool power station in late 2007. British Energy took a conservative decision to take Hartlepool and its sister station, Heysham 1 (which has similar design features), out of service until the issue was resolved. As a result, the amount of energy generated by the nuclear sector fell by 26 per cent in 2008. Working closely with the regulators and contractors, British Energy successfully returned the two stations to service in early 2009. A number of the figures for 2008 reported here reflect this period, when these two sites were not generating any electricity.

Medical and bioscience

GE Healthcare announced it will be leaving the radiochemicals manufacturing business, and is managing a phased withdrawal from its Maynard Centre operations in Cardiff through 2009-10.

Waste management

Studsvik UK Ltd constructed a purpose-built metals recycling facility for low-level radioactive waste (LLW) at Lillyhall, in West Cumbria. This is an important development for the nuclear industry, as it offers an alternative to disposal for metallic LLW. The Lillyhall site was granted a nuclear site licence and an authorisation to discharge of radioactive waste in 2008, but did not start operating until July 2009.

3 Available on the Environment Agency website at http://publications.environment-agency.gov.uk/pdf/GEHO1105BJVE-e-e.pdf

Objective 1

Reduce consumption of natural resources

1.1 Water use (excluding cooling water)

Key message

- **Water use in the nuclear sector continues to fall year-on-year.**

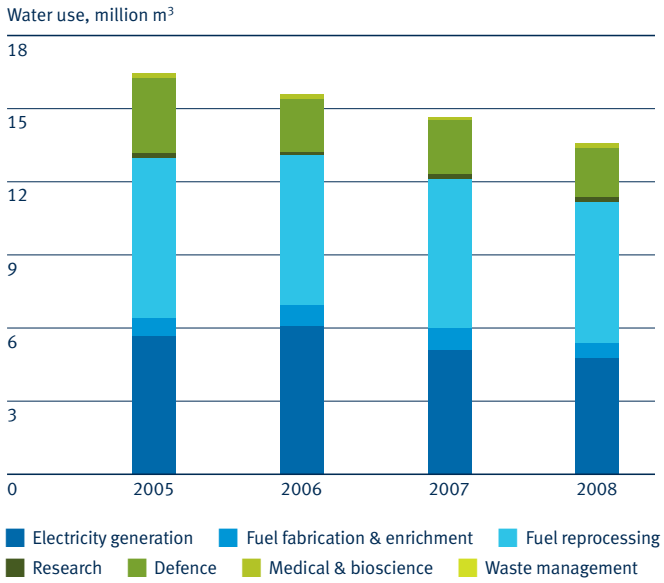
Context

- Some nuclear sites use significant quantities of water in industrial processes, while others use it mainly for "domestic" purposes. In most cases, it is not possible to meter these uses separately.

Nuclear sector performance

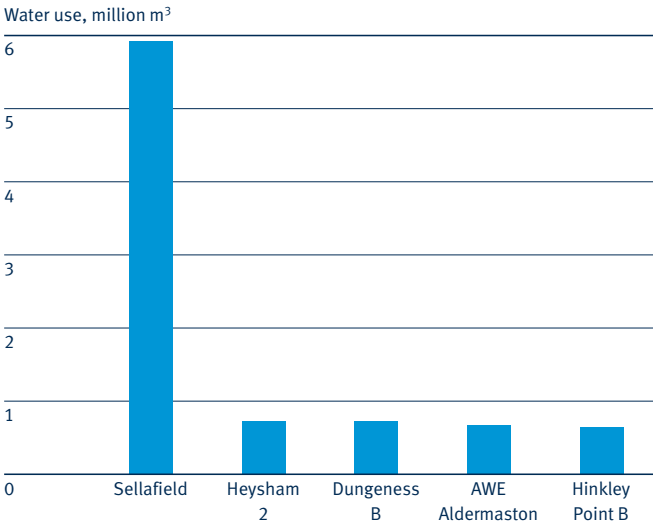
- The nuclear sector used a total of 13.6 million cubic metres of water in 2008 – seven per cent less than in 2007.

Figure 1.1a: **Total water use**



Note: within the electricity generation sub-sector, a substantial increase at Trawsfynydd offset reduced water use at other sites – this was due to a change in the way it reports water use rather than a new use of water (it now includes abstraction as well as mains supply).

Figure 1.1b: **Sites with highest water consumption, 2008**



- Twenty-one sites (72 per cent) used less water in 2008, compared with 2007. The largest reduction (54 per cent) was at Sizewell A, where a leak of clean water from the site reservoir was fixed.
- Eight sites (28 per cent) used more water than in 2007. The largest increase occurred at Sellafield Ltd's Capenhurst site (36 per cent), due to increases in staff numbers and the commissioning of a new plant.

1.2 Energy use

Key message

- **Energy use in the nuclear sector continues to fall year-on-year.**

Context

- Some nuclear sites use significant quantities of energy in industrial processes, while others use it mainly for "domestic" purposes. In most cases, it is not possible to meter these uses separately.

Nuclear sector performance

- The nuclear sector used 21,172 TJ (5.88 TWh) of energy in 2008 – 15 per cent less than in 2007. This was largely due to Hartlepool and Heysham 1 being out of service throughout 2008.
- Twenty-two sites (76 per cent) used less energy in 2008, compared with 2007. Hartlepool and Heysham 1 both used 87 per cent less energy in 2008 because they were out of service. Reductions at other sites were due to the introduction of more energy-efficient systems and/or the reduced operation of cooling water pumps at Dungeness A and Sizewell A now they are no longer generating.
- Seven sites (24 per cent) used more energy in 2008, compared with 2007. At Hinkley Point B, energy use increased by 24 per cent because the site returned to normal operation after being shut down for part of 2007. Urenco's energy use increased by 11 per cent, in line with increased fuel enrichment capacity.
- In 2008, the eight nuclear power stations operating in England and Wales produced a net total of 124,300 TJ (34.5 TWh) of electricity which was fed into the national grid – nine per cent of the total electricity generated in the UK in 2008. This is 26 per cent less than in 2007, because Hartlepool and Heysham 1 power stations were out of service. Dungeness B also shut down for periods during 2008.
- At a site level, the operating power stations continue to use the most energy. This does not change significantly year-on-year because energy is needed to circulate coolant around the reactors, and the design of the cooling circuits is fixed.

Figure 1.2a: **Total energy use**

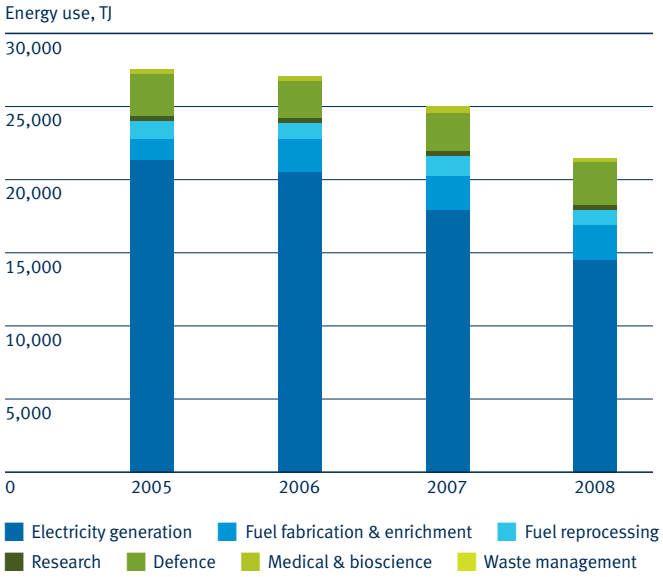
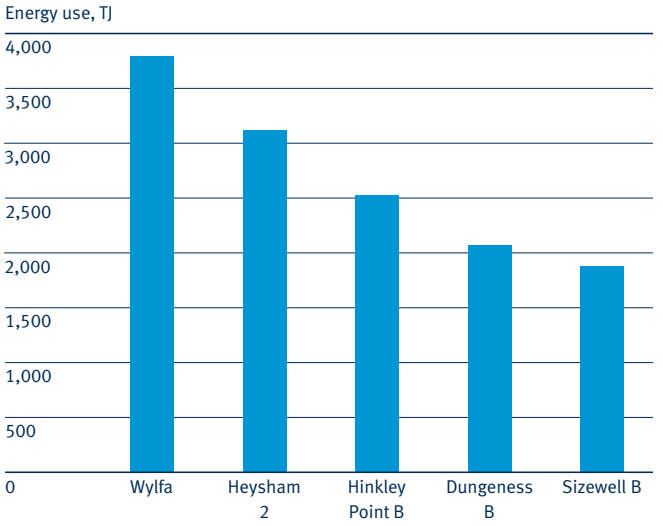


Figure 1.2b: **Sites with highest energy use, 2008**



Objective 2

Minimise and manage solid waste

2.1 The percentage of intermediate-level waste (ILW) at each site that has been conditioned and packaged in a form suitable for disposal

Key message

- **Some sites are continuing to make progress in conditioning and packaging ILW, but the rate of packaging is not keeping pace with the rate at which waste is being produced. The proportion of waste conditioned and packaged fell from 25 per cent in 2007 to 23 per cent this year, as a result of increases in the volume of stored waste.**

Context

- The Environment Agency and the NII are trialling guidance on how operators should develop "radioactive waste management cases" (RWMCs) for intermediate-level waste streams. These cases will draw together existing information on nuclear and environmental safety issues, in particular those relating to long-term storage and disposal.
- Different nuclear sites are at different stages of their lifecycle. Operating sites inevitably have less focus on conditioning and packaging waste for final disposal than decommissioning sites.
- Conditioning and packaging may be intentionally delayed for some waste streams, with the agreement of the NII and the Environment Agency. The Environment Agency considers such practices on a case-by-case basis, and expects this waste to be stored safely and securely.

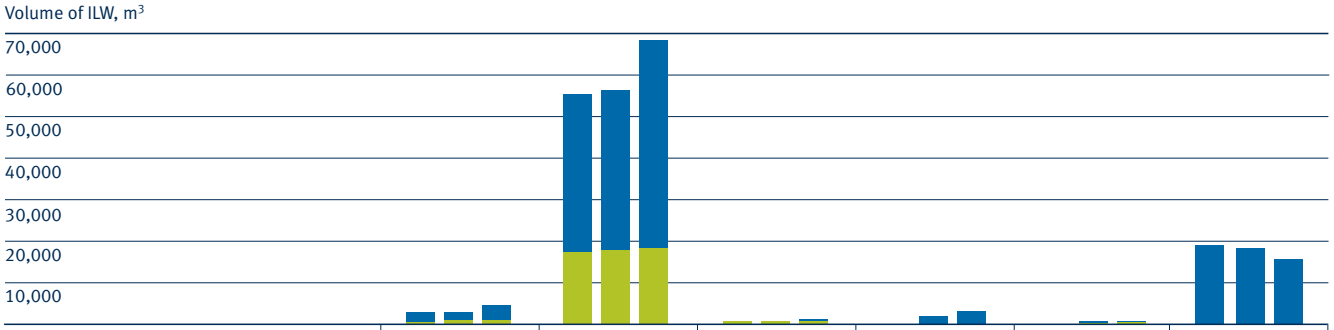
Nuclear sector performance[4]

- On 1 April 2008, the total volume of ILW stored on all nuclear sites[5] in England and Wales was 92,474 m^3. This includes raw waste, and waste which is conditioned and/or packaged. The total volume of stored waste increased by 13 per cent compared to 2007. This is the result of a number of factors, the main one being a change in the basis of reporting[6].

4 For consistency, all volumes are quoted in conditioned state. For wastes which are not yet packaged, assumptions have been made about the conditioning and packing processes. These assumptions may change in the future.
5 This is also referred to as waste 'in stock'
6 The 2007 waste volume was derived from data presented in the 2004 national inventory, whereas the 2008 waste volume is derived from data presented in the 2007 national inventory. Estimates of waste arisings have been revised in the 2007 national inventory to take into account improved characterisation of waste streams, waste assessments that have taken place to support Letters of Compliance, and updated liability estimates for decommissioning

- Between 2007 and 2008, only two nuclear sites (Sellafield and Winfrith) conditioned and packaged ILW in a form expected to be suitable for disposal. The nuclear sector has now conditioned and packaged a total of 20,972 m^3 of ILW, an increase of seven per cent since 2007. However, the proportion of waste conditioned and packaged fell from 25 per cent in 2007 to 23 per cent this year as a result of the increased volume of stored waste.
- As in previous years, waste from fuel reprocessing at Sellafield dominates the picture. Sellafield accounted for 73 per cent of the total volume of ILW stored in England and Wales, and for 90 per cent of the packaged and conditioned volume of ILW. There was also 7,603 m^3 of interim packaged waste at Sellafield. This is waste suitable for long-term storage but not for final disposal.
- Winfrith made substantial progress in 2008, increasing the volume of stored ILW that is conditioned and packaged from 17 per cent in 2007 to 51 per cent in 2008.
- Both the Environment Agency and the industry wish to see more progress in conditioning and packaging waste for final disposal. The industry is continuing to develop innovative approaches to waste packaging – for example, Magnox is considering the potential to use "mini-stores" for decay storage of resins and for final packaging. However, we do not expect the picture to change quickly, as packaging and conditioning ILW involves considerable effort in developing plant and processes and preparing and obtaining approval for safety cases. We also recognise that it may be acceptable to delay packaging in some cases – for example, if wastes are suitable for decay storage or when interim packaging of waste will reduce risks to the environment to an acceptable level.

Figure 2.1: **Progress with conditioning and packaging ILW at individual sites**



	Trawsfynydd	Sellafield	Windscale	Harwell	Winfrith	All other English & Welsh sites
Stored waste awaiting conditioning						
2006	1,879	36,847	173	0	0	19,220
2007	1,631	38,333	174	1,967	467	18,200
2008	3,451	49,029	313	2,987	322	15,400
Conditioned and packaged waste						
2006	861	16,753	645	0	0	0
2007	1,129	17,767	697	43	98	0
2008	1,129	18,771	697	43	332	0

Note: the volume of stored waste at other sites in England and Wales is less than the volume reported last year, because some waste reported in the 2004 inventory as ILW was reclassified as LLW in the 2007 inventory

P2.2 Inert waste (non-radioactive)

P2.3 Non-hazardous waste (non-radioactive)

P2.4 Hazardous waste (non-radioactive)

Key message

- **The nuclear sector recycled 80 per cent of its non-radioactive waste in 2008.**

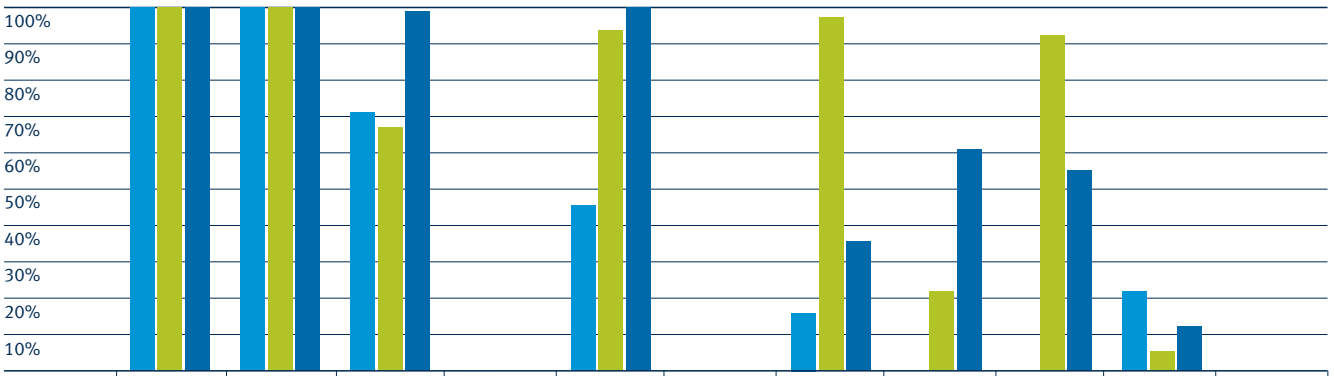
Context

- Operational or decommissioning activities on nuclear sites may generate significant amounts of non-radioactive waste. Most of this waste comes from construction and demolition projects. It is categorised as hazardous, non-hazardous, or inert. Types and quantities change throughout the lifecycle of a nuclear site.
- It may not be possible to recycle all wastes. There may not be any opportunities to recycle (as in the case of asbestos), or the quantities may be too small for recycling to be practicable.

Nuclear sector performance

- The nuclear sector produced a total of 243,500 tonnes of non-radioactive waste in 2008 – broadly similar to the amount it produced in 2007. Seventy-two per cent of the waste was inert, and 22 per cent was non-hazardous.
- The nuclear sector recycled 80 per cent of its non-radioactive waste in 2008, up from 69 per cent in 2007. Recycling of all types of waste increased.
- Recycling rates continue to vary substantially between companies.

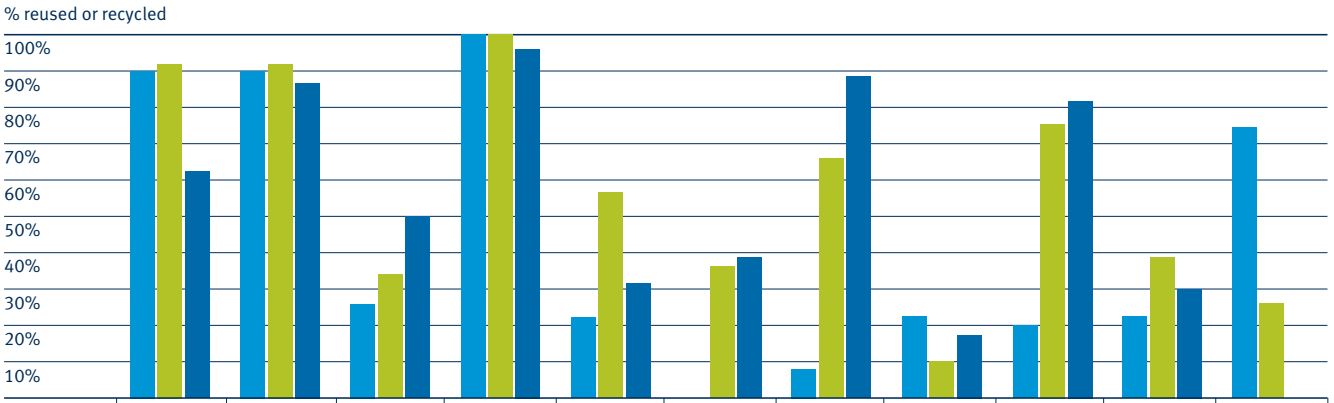
Figure 2.2: **Inert waste reuse/recycling rates by company, 2008**



	Magnox North	Magnox South	British Energy	SFL	Sellafield Ltd	LLWR Ltd	RSRL	MoD	AWE	GEH	Urenco
2006	100%	100%	71%	n/a	46%	n/a	16%	0%	0%	21%	n/a
2007	100%	100%	67%	n/a	94%	n/a	97%	21%	92%	5%	n/a
2008	100%	100%	99%	n/a	100%	n/a	36%	61%	56%	12%	n/a

Note: total for MOD inert waste is based on one site only. SFL, LLWR Ltd and Urenco did not produce any inert non-radioactive waste. Data for 2006 and 2007 for Magnox North and Magnox South is based on data for all eight Magnox sites, and may not be strictly comparable. Changes in performance for Sellafield Ltd and RSRL are partly due to Windscale now reporting as part of Sellafield site.

Figure 2.3: **Non hazardous waste reuse/recycling rates by company, 2008**



	Magnox North	Magnox South	British Energy	SFL	Sellafield Ltd	LLWR Ltd	RSRL	MoD	AWE	GEH	Urenco
2006	90%	90%	25%	100%	21%	0%	8%	22%	20%	23%	74%
2007	91%	91%	34%	100%	56%	36%	66%	10%	75%	39%	25%
2008	62%	87%	50%	96%	32%	39%	88%	17%	82%	30%	0%

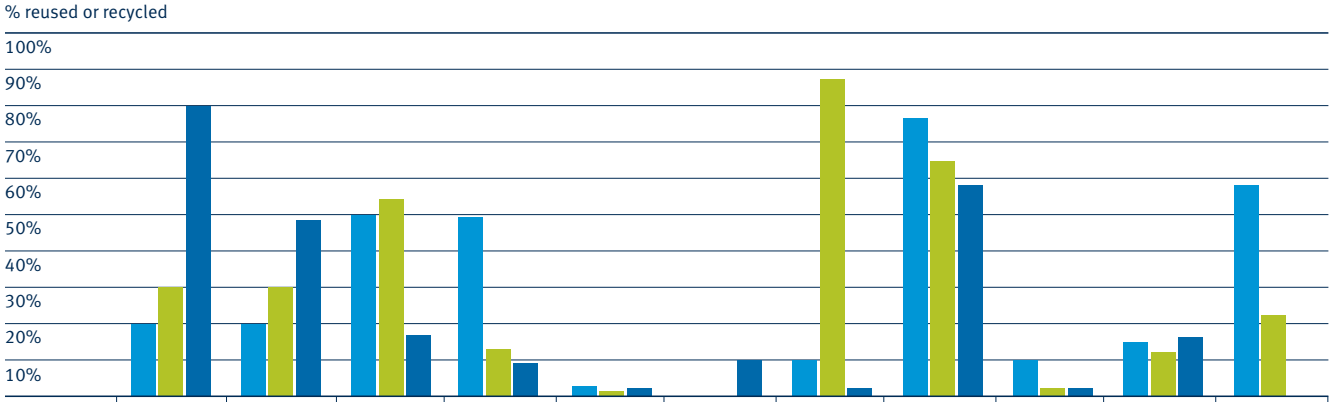
Note: data for 2006 and 2007 for Magnox North and Magnox South is based on data for all eight Magnox sites, and may not be strictly comparable. Changes in performance in 2008 for Sellafield Ltd and RSRL are partly due to Windscale now reporting as part of Sellafield site.

Reuse/recycling rates by type of waste, 2008

Type of waste	% reused or recycled
Inert	96%
Non-hazardous	46%
Hazardous	14%
Total	**80%**

- Four companies recycled over 90 per cent of their inert waste, with Magnox North, Magnox South and Sellafield Ltd recycling all theirs.
- Improvements to waste management arrangements at Hartlepool resulted in a significant increase in the proportion of inert waste recycled at the site (30 per cent in 2007 to 99 per cent in 2008), and for British Energy.
- While RSRL did not recycle any inert waste at Winfrith in 2008, a large amount of inert waste is currently stored on this site pending re-use.
- Six companies reused or recycled at least 50 per cent of their non-radioactive, non-hazardous waste in 2008.
- The two biggest producers of non-hazardous waste, Aldermaston and the MOD, continued to increase the amount of non-hazardous waste they recycled (for example by introducing plasterboard recycling at Aldermaston).
- Due to project work at Heysham 1, British Energy produced more hazardous waste this year than in previous years. A pipework replacement project at Heysham 1 generated large amounts of spoil which was contaminated with historical ash and clinker. Normal British Energy operations generated less hazardous waste than in previous years.
- Magnox South and Magnox North achieved large increases in the proportion of hazardous waste recycled at Bradwell and Oldbury respectively. Projects started at both sites to replace banks of batteries, and oil was removed and recycled from the circulation hall at Bradwell.

Figure 2.4: **Hazardous waste reuse/recycling rates by company, 2008**



	Magnox North	Magnox South	British Energy	SFL	Sellafield Ltd	LLWR Ltd	RSRL	MoD	AWE	GEH	Urenco
2006	20%	20%	50%	49%	3%	0%	10%	76%	10%	15%	58%
2007	30%	30%	54%	13%	1%	0%	87%	64%	3%	12%	22%
2008	80%	48%	17%	9%	2%	10%	2%	58%	3%	16%	0%

Note: total for MOD hazardous waste is based on three sites. Data for 2006 and 2007 for Magnox North and Magnox South is based on data for all eight Magnox sites, and may not be strictly comparable. Changes in performance for Sellafield Ltd and RSRL may be partly due to Windscale now reporting as part of Sellafield site.

Comparison with other sectors

- The nuclear sector reused or recycled 80 per cent of its non-radioactive waste in 2008. This was higher than the recycling rate in any other regulated sector apart from the food and drink sector and the "other" sector.

Sector	% of waste recovered [a]
Other [b]	84%
Food & drink	81%
Nuclear	80%
Mineral products	69%
Metals	63%
Energy	56%
Waste	37%
Chemicals	26%
Water	6%

a) The figure for the nuclear sector also includes re-use of non-radioactive material on site.
b) The "other" sector includes construction, paper and pulp, and textiles industry.
Source: http://www.environment-agency.gov.uk/research/library/data/112176.aspx

Objective 3

Reduce discharges to air and water

3.1 Proportion of best practicable means (BPM) assessments required that have been completed and accepted by the Environment Agency

As stated in previous reports, this indicator is not an effective measure of sector performance and we have removed it from the revised nuclear sector plan.

3.2-3.5 Annual liquid radioactive discharges

Key message

- **Reducing liquid radioactive discharges to meet the current UK discharge strategy targets by 2020 is one of the key environmental challenges facing the nuclear sector. Good progress is being made towards meeting these targets.**

Context

- The UK strategy for radioactive discharges has recently been reviewed, and a new version was published in July 2009[7]. Some of the targets for 2020 have been revised, and new targets have been agreed for 2030. We will report against these challenging new targets in 2010.

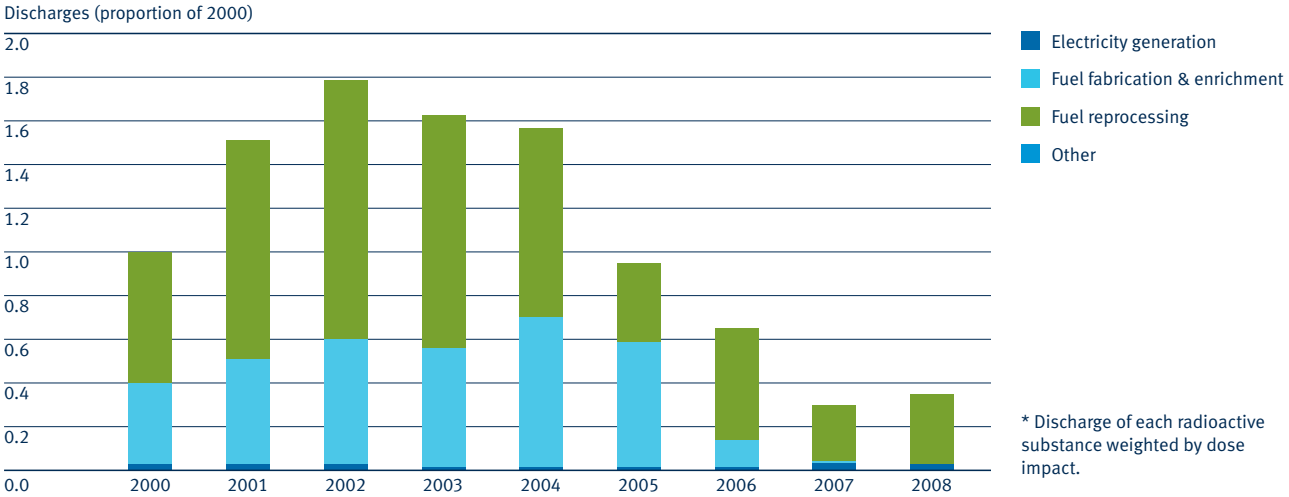
Nuclear sector performance

- Total discharges of alpha activity to water from the nuclear sector increased by seven per cent compared to 2007. Liquid beta/gamma discharges decreased by 34 per cent and discharges of liquid tritium decreased by 31 per cent.
- While they remain low, liquid alpha discharges from the electricity generation sub-sector doubled compared to 2007. This increase was mainly a result of progress in decommissioning of the cooling ponds at Hinkley Point A, and is not unexpected. There was also a small increase in discharges as a result of skip cleaning during decommissioning at Bradwell and a fuel failure in the cooling ponds at Sizewell A in 2007.
- There was a small (eight per cent) increase in liquid alpha discharges from the fuel reprocessing sub-sector, due to increased throughput, but these discharges remained well within the 2020 target. Discharges from fuel reprocessing are around a hundred times lower than they were in the early 1980s.
- Although liquid alpha discharges from the research sub-sector trebled, these discharges were still minor and within the 2020 target.

7 Available from DECC's website at: http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/nuclear/issues/radioactivity/radioactivity.aspx

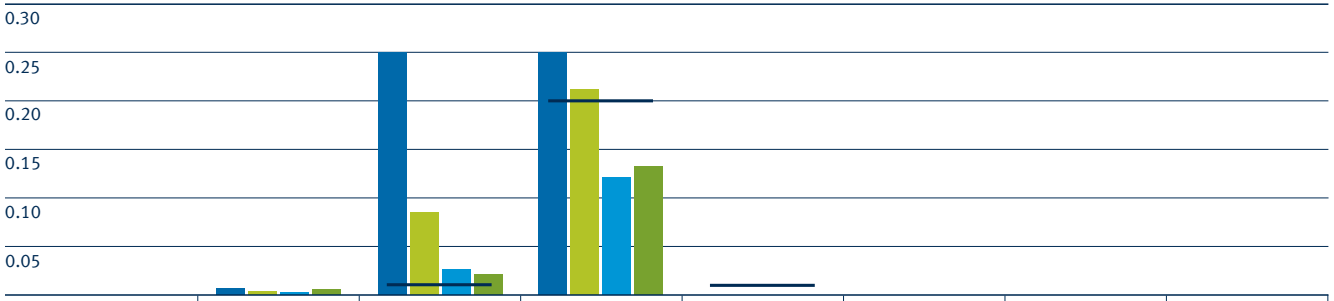
- Minor discharges from the medical/bioscience and waste management sub-sectors reduced this year.
- Liquid beta/gamma (excluding tritium) discharges from all sub-sectors except fuel fabrication/ enrichment and research decreased between 2007 and 2008.
- The increase in liquid beta/gamma discharges within the fuel fabrication/enrichment sub-sector was due to residue processing restarting at Springfields. Sellafield completed its treatment of historic medium-active concentrate in early 2008, and this resulted in a significant decrease in liquid beta/ gamma discharges within the fuel reprocessing sub-sector.
- Liquid beta/gamma discharges from the fuel reprocessing, research and defence sub-sectors were within the 2020 targets.
- Discharges of tritium to water from the electricity generation sub-sector decreased by 56 per cent between 2007 and 2008, mainly because Hartlepool and Heysham 1 were shut down for extended maintenance. Discharges also decreased at Dungeness B because the station was shut down for part of the year. Discharges from this sub-sector were within the 2020 target in 2008, but are likely to increase again in 2009.
- Liquid tritium discharges from the fuel reprocessing sub-sector increased by 24 per cent between 2007 and 2008, partly because more fuel was reprocessed.

Figure 3.2a: **Trends in radioactive discharges to water**



Note: this graph assumes that all discharges are released into the same environment. 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 toxicities 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, so the graph does not have any units. This does not equate to actual impact. The "other" category includes the research, defence, medical and bioscience, and waste management sub-sectors – they are not shown separately because the contribution they make to the total is so small.

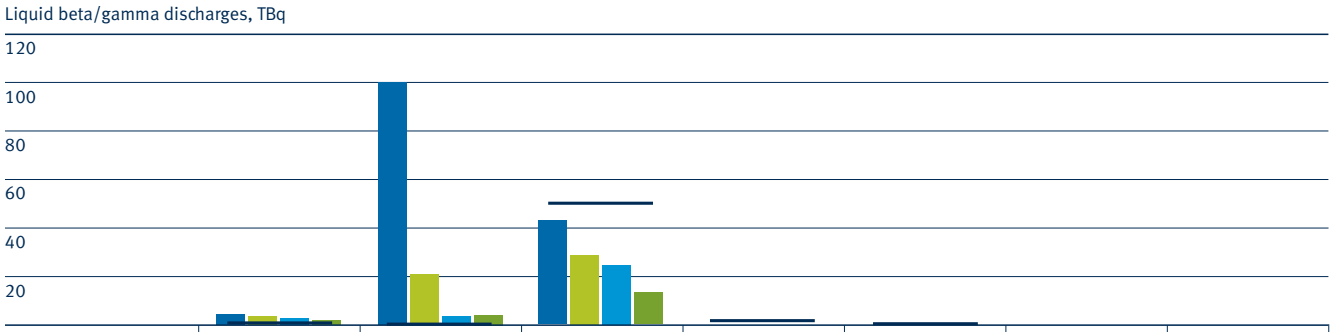
Figure 3.2b: **Annual liquid alpha discharges**



	Electricity generation	Fuel fabrication & enrichment	Fuel reprocessing	Research	Defence	Medical & bioscience	Waste management
2005 discharges	5.9E-03	2.5E-01	2.5E-01	3.0E-04	8.8E-05	1.0E-05	7.4E-04
2006 discharges	1.8E-03	8.4E-02	2.1E-01	1.2E-04	5.8E-05	1.2E-05	4.5E-05
2007 discharges	2.1E-03	2.6E-02	1.2E-01	1.5E-04	8.2E-05	1.3E-05	1.3E-04
2008 discharges	4.4E-03	2.2E-02	1.3E-01	4.3E-04	1.0E-04	9.7E-06	7.1E-05
2020 tagets	n/a	1.0E-02	2.0E-01	8.0E-03	n/a	n/a	n/a

Note: data for the electricity generation sub-sector for 2005-07 has been revised to take into account improved data for Hinkley Point A. There are no targets in the current UK radioactive discharge strategy for liquid alpha discharges from the electricity generation, defence, medical and bioscience or waste management sub-sectors.

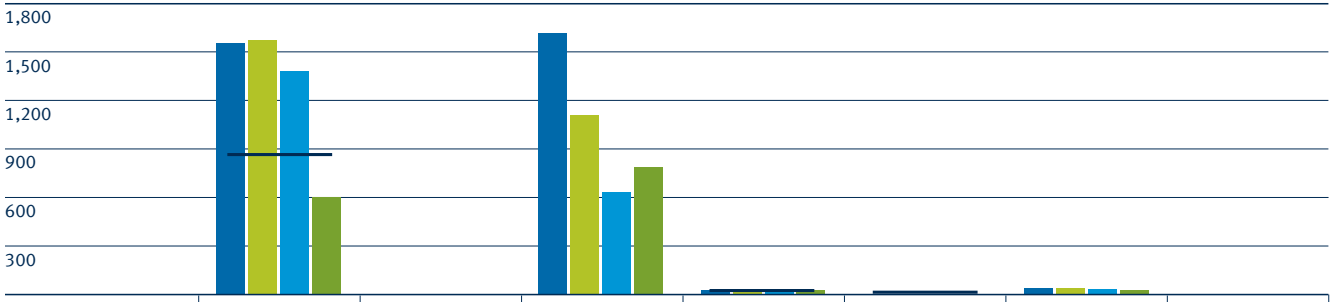
Figure 3.3: **Annual liquid beta/gamma discharges (excluding tritium)**



	Electricity generation	Fuel fabrication & enrichment	Fuel reprocessing	Research	Defence	Medical & bioscience	Waste management
2005 discharges	4.5E+00	1.0E+02	4.3E+01	1.2E-02	1.0E-03	2.8E-01	6.0E-05
2006 discharges	4.0E+00	2.1E+01	2.9E+01	2.8E-02	1.0E-03	2.9E-01	7.1E-04
2007 discharges	3.3E+00	3.0E+00	2.5E+01	3.6E-04	8.7E-04	1.5E-01	1.3E-03
2008 discharges	1.8E+00	4.6E+00	1.4E+01	3.2E-02	8.1E-04	6.7E-02	8.6E-04
2020 tagets	1.5E+00	Virtually zero	5.0E+01	9.0E-01	3.0E-03	n/a	n/a

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

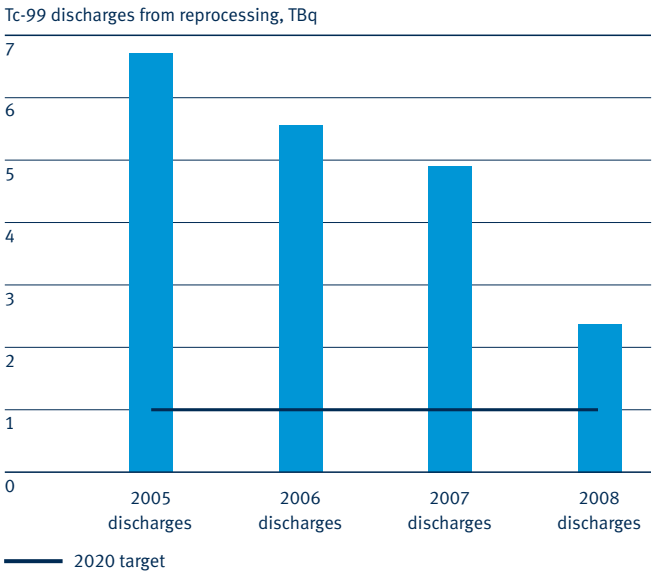
Figure 3.4: **Annual liquid tritium discharges**



	Electricity generation	Fuel fabrication & enrichment	Fuel reprocessing	Research	Defence	Medical & bioscience	Waste management
2005 discharges	1.5E+03	brt	1.6E+03	8.5E+00	2.0E-01	4.0E+01	brt
2006 discharges	1.5E+03	brt	1.1E+03	1.6E+01	1.1E-01	2.5E+01	brt
2007 discharges	1.4E+03	brt	6.3E+02	2.3E+01	1.3E-01	2.8E+01	brt
2008 discharges	6.0E+02	brt	7.8E+02	9.9E+00	1.1E-01	1.4E+01	brt
2020 tagets	8.5E+02	n/a	n/a	2.0E+01	4.0E-01	n/a	n/a

Note: discharges of tritium from sites in the fuel fabrication/enrichment and waste management sub-sectors were below the reporting threshold (brt) from 2005-2008.

Figure 3.5: **Annual technetium-99 discharges from reprocessing**



- Discharges of tritium to water from the research and defence sub-sectors were within the 2020 targets.
- Discharges of technetium-99 to sea halved from 4.9 TBq in 2007 to 2.4 TBq in 2008 as a result of Sellafield completing its treatment of historic medium-active concentrate waste in 2007. This decrease was achieved in spite of an increase in the amount of fuel being reprocessed. Meeting the 2020 target remains challenging but appears increasingly achievable.

3.6 Annual radioactive discharges to air

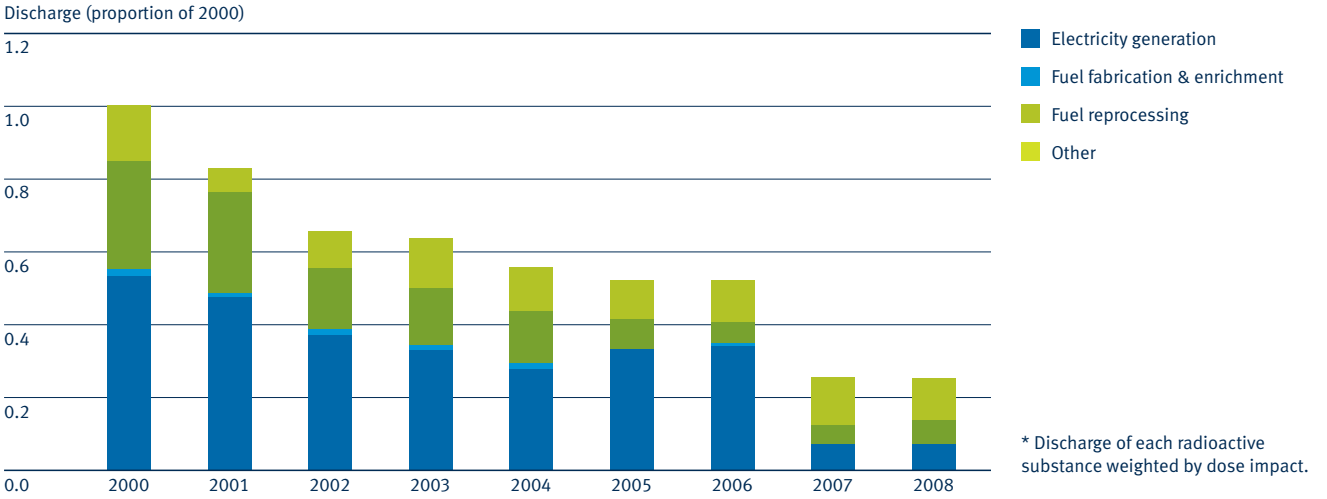
Key message

- **Discharges of alpha-emitting radionuclides and tritium to air fell, but beta/gamma discharges increased in 2008.**

Nuclear sector performance

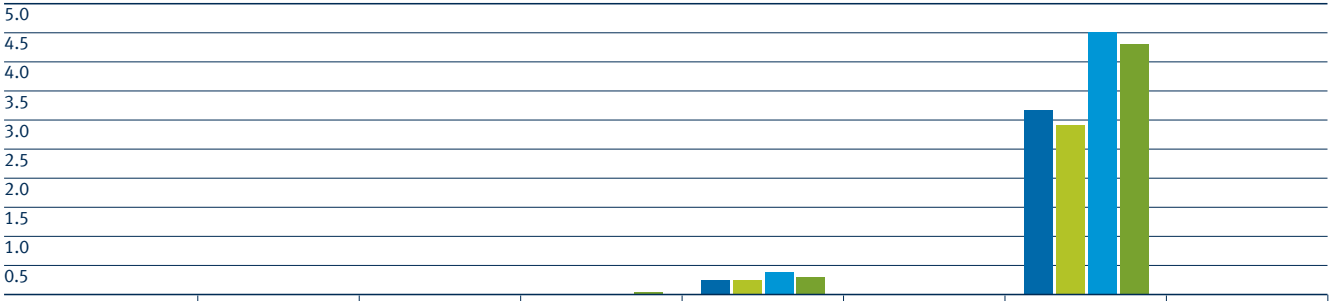
- Discharges of alpha and tritium activity to air decreased by five and four per cent respectively compared to 2007. Gaseous beta/gamma discharges increased by 85 per cent, mainly because discharges from Sellafield increased as more fuel was reprocessed.
- Discharges of alpha-emitting radionuclides to air from the medical/bioscience sub-sector, the main contributor, decreased by five per cent. The increase in discharges from the fuel reprocessing sub-sector is because Windscale now reports as part of Sellafield. Discharges from the research sub-sector decreased by 25 per cent, partly because Windscale now reports with Sellafield although discharges from Harwell fell by 15 per cent.

Figure 3.6a: **Trends in radioactive discharges to air**



Note: this graph assumes that all discharges are released into the same environment. 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 toxicities 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, so the graph does not have any units. This does not equate to actual impact. The "other" category includes the medical and bioscience, defence, research and waste management sub-sectors.

Figure 3.6b: **Gaseous alpha discharges**

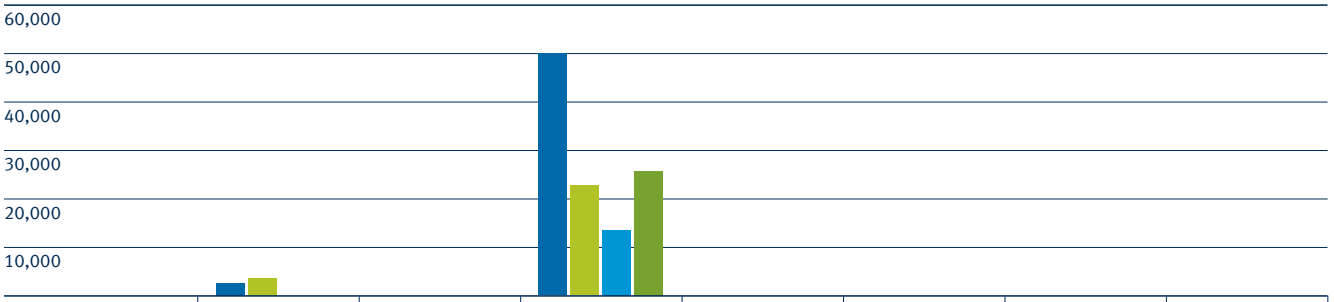


	Electricity generation	Fuel fabrication & enrichment	Fuel reprocessing	Research	Defence	Medical & bioscience	Waste management
2005 discharges	brt	6.7E-04	8.7E-05	2.7E-01	brt	3.2E+00	9.0E-08
2006 discharges	brt	4.3E-04	1.1E-04	2.9E-01	5.9E-08	2.9E+00	brt
2007 discharges	brt	5.2E-04	1.4E-04	4.2E-01	brt	4.5E+00	brt
2008 discharges	brt	5.6E-04	3.2E-02	3.2E-01	brt	4.2E+00	brt

Note: alpha discharges from sites in the electricity generation sub-sector were below the reporting threshold from 2005-2007, as were discharges from the defence sector in 2005 and 2007-08 and from the waste management sub-sector from 2006-2008. Data for the research sub-sector for 2007 have been updated to include discharges from Windscale, which were previously reported as "brt" (below reporting threshold).

- Fuel reprocessing accounted for over 99 per cent of the nuclear sector's discharges of beta/gamma-emitting radionuclides (excluding tritium) to air in 2008. Discharges from Sellafield increased by 86 per cent compared to 2007, primarily as a result of increased fuel reprocessing, although these discharges are still very low compared to historic levels.
- Discharges of tritium to air from all sub-sectors remained stable or decreased in 2008, with the exception of fuel reprocessing. Discharges from Sellafield increased by 69 per cent as a result of increased reprocessing.
- Discharges of tritium to air from GE Healthcare's Maynard Centre accounted for almost 65 per cent of the sector's total. These discharges decreased by 21 per cent compared to 2007, because of year-to-year variation in the radiochemicals produced to meet customer requirements.

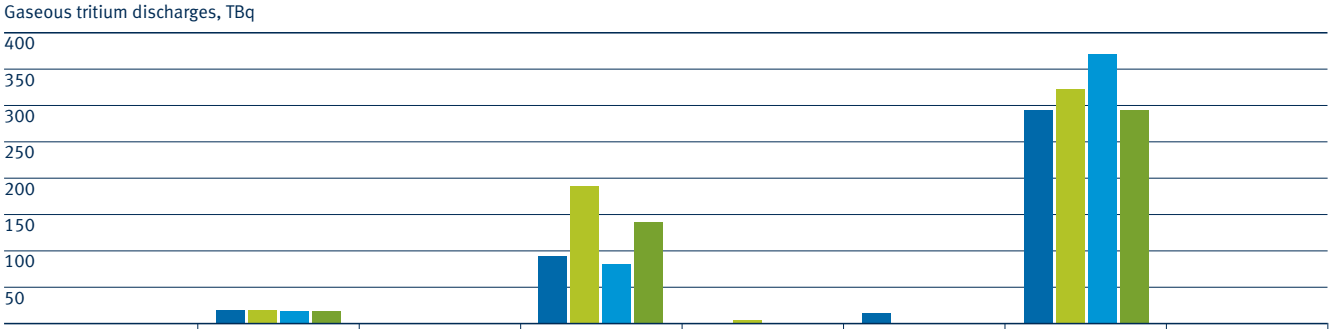
Figure 3.6c: **Gaseous beta/gamma discharges (excluding tritium)**



	Electricity generation	Fuel fabrication & enrichment	Fuel reprocessing	Research	Defence	Medical & bioscience	Waste management
2005 discharges	3.1E+03	brt	5.0E+04	1.8E-03	9.0E-03	1.9E+01	1.6E-07
2006 discharges	3.5E+03	2.4E-06	2.3E+04	1.2E-01	3.1E-02	1.9E+01	brt
2007 discharges	9.9E+01	1.7E-06	1.4E+04	4.0E-03	1.3E-02	2.0E+00	brt
2008 discharges	9.4E+01	1.1E-06	2.6E+04	brt	2.8E-02	1.3E+00	brt

Note: beta/gamma discharges from sites in the fuel fabrication/enrichment sub-sector were below the reporting threshold in 2005. Similarly, discharges from the waste management sub-sector from 2006-2008, and from the research sub-sector in 2008, were below the reporting threshold. Data for the research sub-sector for 2007 have been updated to include discharges from Windscale, which were previously reported as "brt" (below reporting threshold).

Figure 3.6d: **Gaseous tritium discharges**



	Electricity generation	Fuel fabrication & enrichment	Fuel reprocessing	Research	Defence	Medical & bioscience	Waste management
2005 discharges	2.0E+01	brt	9.3E+01	7.0E-01	1.4E+01	2.9E+02	brt
2006 discharges	2.0E+01	brt	1.9E+02	2.6E+00	1.2E+00	3.2E+02	brt
2007 discharges	1.6E+01	brt	8.3E+01	9.2E-01	7.2E-01	3.7E+02	brt
2008 discharges	1.7E+01	brt	1.4E+02	3.2E-01	6.7E-01	2.9E+02	brt

Note: discharges of tritium from sites in the fuel fabrication/enrichment and waste management sub-sectors were below the reporting threshold from 2005-2008.

3.7 Critical group doses due to radioactive discharges

Key message

- **Doses to the most exposed groups of people who live around nuclear sites are well within the dose limit of 1 milliSievert (mSv) for a member of the public, and have remained relatively stable over the last few years. The highest estimated dose in 2008 was 0.23 mSv, as a result of liquid discharges from Sellafield.**

Context

- Average radiation doses to the general public from all sources in the UK are around 2.7 mSv a year. Discharges from the nuclear industry account for less than 0.1 per cent of the average radiation dose.
- Food and the environment near nuclear sites are regularly monitored to find out what levels of radioactivity they contain. The monitoring results are published annually in the Radioactivity in Food and the Environment[9] (RIFE) report. The Environment Agency uses this data, together with information on the habits of people who live near the sites, to assess radiation doses to the public as a result of waste discharges. Changes in doses occur from year to year and are mostly caused by variations in radioactivity concentrations and dose rates. However, in some years doses are affected by changes in people's habits, in particular the food they eat. The assessed doses for those groups that are most exposed to radiation near all nuclear sites in the UK are known as "critical group doses".

Nuclear sector performance

- Doses to the most exposed groups as a result of liquid and gaseous discharges from nuclear sites are generally very small. All remained well within the 1 mSv limit for members of the public in 2008.

Figure 3.7: **Sources of radiation exposure to an average member of the public in the UK[8]**

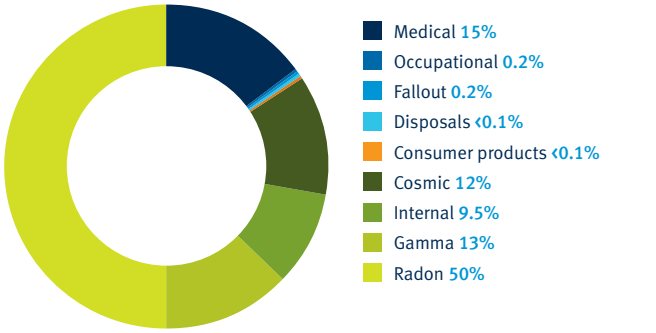


Figure 3.7a: **Highest estimated doses due to liquid discharges**

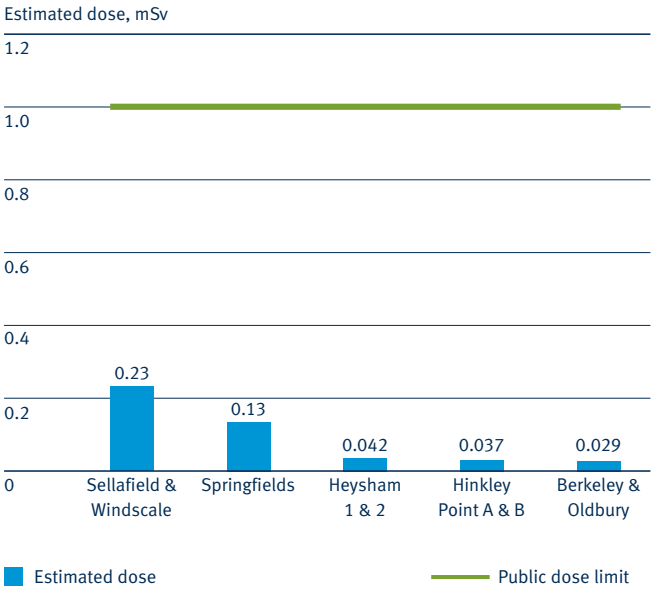
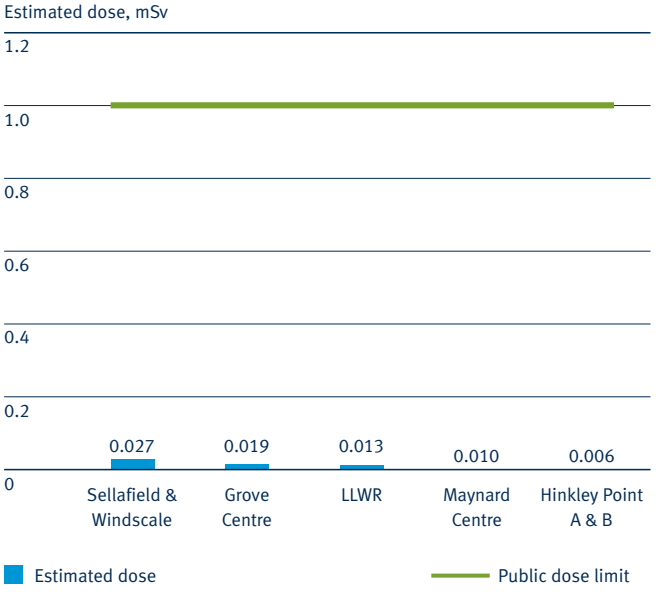


Figure 3.7b: **Highest estimated doses due to gaseous discharges**



Note: the estimated dose to the most exposed group near the Low Level Waste Repository (LLWR) is mainly from other sources of radionuclides in the environment, in particular discharges from Sellafield

8 Based on data from *HPA-RPD-001: Ionising radiation exposure of the UK population, 2005 review*
9 The latest RIFE report can be found at http://www.environment-agency.gov.uk/homeandleisure/110353.aspx

- A group of people in Cumbria that consumed a large quantity of fish and shellfish were estimated to receive the highest dose of radiation due to liquid discharges. Discharges from the Sellafield and Windscale complex were estimated to contribute 0.23 mSv to this dose in 2008. Most of the dose was due to the accumulation of plutonium isotopes and americium-241 in seafood and the environment from historic liquid discharges in the 1960s and 1970s. Other groups as far afield as Heysham, the Ribble Estuary and South Wales also received radiation doses as a result of discharges from Sellafield, but at lower levels than the Sellafield critical group.
- At Springfields, the most exposed group is people who live in houseboats on the Ribble Estuary. The most exposed groups around the power stations at Heysham, Hinkley Point, Berkeley and Oldbury were adults who consume locally-caught fish and seafood, and who are also exposed to external radiation in inter-tidal areas.
- Doses to the most exposed groups as a result of liquid discharges from seven nuclear sites were less than 0.5 per cent of the dose limit for members of the public.
- In 2008, the highest critical group dose from gaseous discharges was under three per cent of the dose limit. Infants living near Sellafield were estimated to receive this dose, mainly as a result of drinking locally-produced milk.
- Doses to the most exposed groups as a result of gaseous discharges from 12 nuclear sites were less than 0.5 per cent of the public dose limit.

3.8 Discharges of nitrates and nitrites to controlled waters

Key message

- **Discharges of nitrate and nitrite to water are continuing to fall year-on-year.**

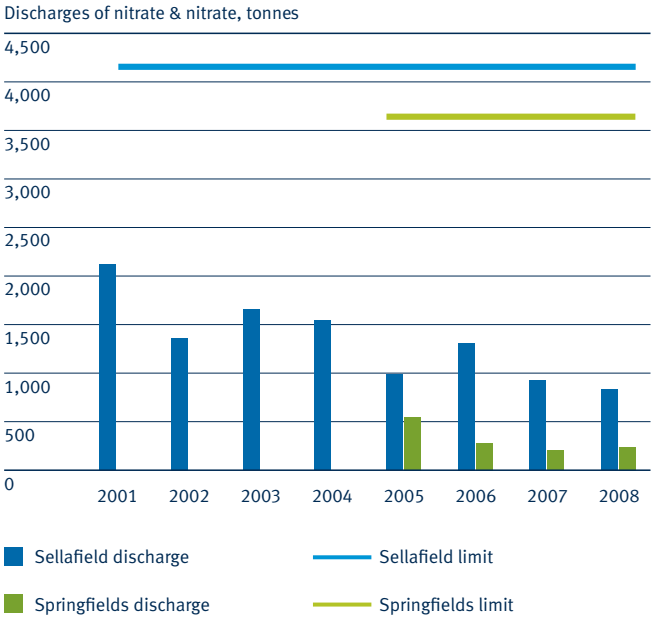
Context

- Nitrate and nitrite are some of the most substantial non-radioactive discharges from the nuclear sector. They are mainly produced when nitric acid is used to dissolve nuclear fuel or uranium-rich residues from fuel manufacturing processes. Discharges of nitrates and nitrites from Sellafield and Springfields are a small percentage of the total quantity of these nutrients discharged to the Irish Sea. However, they have a measurable impact on nutrient levels near the discharge points.

Nuclear sector performance

- The nuclear sector discharged 1,016 tonnes of nitrate and nitrite to water in 2008 – nine per cent less than in 2007, and equivalent to discharges from a wastewater treatment works serving a population of around 200,000.
- Discharges from Sellafield fell by 13 per cent compared to 2007. Discharges from Springfields increased by 13 per cent because processing of uranium residues re-started in 2008.

Figure 3.8: **Nitrate and nitrite (as nitrogen) discharges**



P3.9 Integrated waste strategies (IWS)

Key message

- **Over 85 per cent of nuclear sites now have an integrated waste strategy in place.**

Context

- Since 2005 the NDA has required its site operators to produce integrated waste strategies to support their lifetime plans for decommissioning and clean-up. These cover radioactive and non-radioactive wastes, and outline how waste generation is minimised and how waste will be managed to minimise the impact of its disposal on the environment.
- The Environment Agency is encouraging other (non-NDA) nuclear operators to produce integrated waste strategies.

Nuclear sector performance

- Operators reported that 25 nuclear sites (86 per cent) had an integrated waste strategy in place by the end of 2008. LLWR published its first IWS in 2008. The Environment Agency routinely reviews integrated waste strategies with operators to ensure that they remain fit for purpose.
- Eighteen of the sites with an integrated waste strategy in place had also developed an IWS action plan. Ten sites had discussed their action plans with the Environment Agency. Integrated waste strategy action plans will be or are currently being developed for Urenco Capenhurst, the two GE Healthcare sites and one MoD site.
- The Environment Agency continues to work with the NDA to develop a national integrated waste strategy. Building on the work carried out on individual sites, NDA has reviewed waste management across its estate to capture common themes and interactions. A draft report was published in 2008. The UK Nuclear Industry Low-level Waste (LLW) Strategy was published for consultation in June 2009[10]. It was developed by NDA in conjunction with LLWR and the National LLW Strategy Group, which includes broad representation from waste producers, regulators and local government. The strategy is based on the waste management hierarchy, and aims to make best use of existing assets and new waste management routes. Following public consultation, the strategy will be updated and is expected to be approved in early 2010. NDA is also developing strategies for higher-activity waste and nuclear materials. The Environment Agency is working with the supply chain to facilitate the use of the new disposal routes.
- The Exemption Orders under the Radioactive Substances Act 1993 are currently being reviewed by the Department for Energy and Climate Change (DECC). Consultation on proposals for a future exemption regime has been undertaken in 2009, and a new regime is expected to be implemented in 2010. The revised exemption regime is likely to impact on waste strategies, and a significant response from industry to the consultation may result in the proposals being revised.

P3.10 Environmental concentrations of key radionuclides in various media

As stated in previous reports, this indicator is not an effective measure of sector performance and we have removed it from the revised nuclear sector plan.

10 Further information on the national low level waste strategy can be found at: http://www.nda.gov.uk/news/llw-strategy-consultation.cfm

Objective 4

Reduce greenhouse gas emissions

4.1 Greenhouse gas emissions

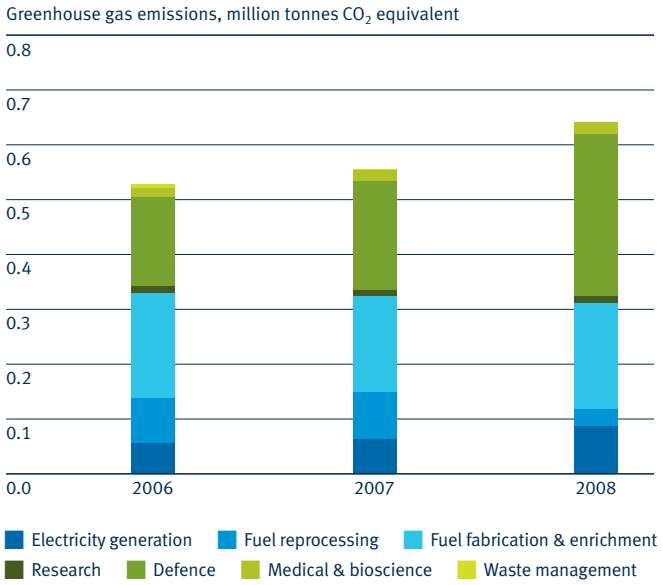
Key message

- **Climate change is one of the Environment Agency's top priorities. Greenhouse gas emissions from the nuclear sector increased by 16 per cent in 2008, in line with increased productivity, but nuclear power generation saved over 21 million tonnes of carbon dioxide emissions[11].**

Nuclear sector performance

- In 2008, the nuclear sector released greenhouse gases equivalent to 0.64 million tonnes of carbon dioxide – 16 per cent more than in 2007. The increase is related to increased production at some defence sites.
- The eight nuclear power stations operating in England and Wales released 0.08 million tonnes of CO_2 and generated nine per cent of the UK's electricity[12]. By comparison, producing this amount of electricity using fossil fuels would release about 22 million tonnes of carbon dioxide[13].

Figure 4.1a: **Trends in greenhouse gas emissions**



Note: data from 2005 have not been included because they were unreliable.

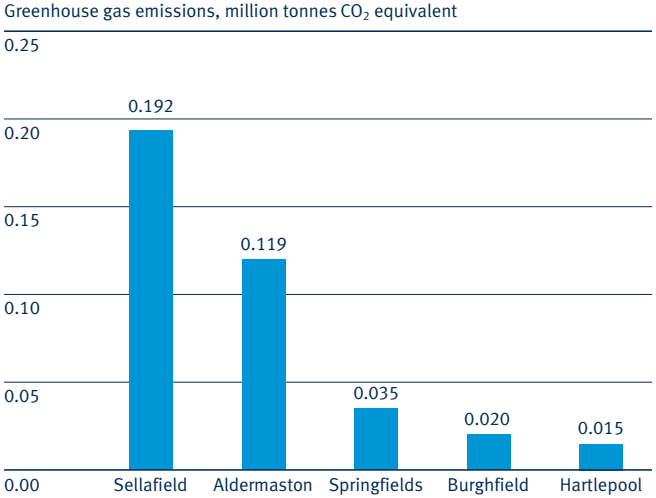
11 If the same amount of electricity had been generated using fossil fuels, around 22 million tonnes of carbon dioxide would have been emitted
12 If the output from Scottish nuclear power stations is included, the total nuclear contribution was 12 per cent
13 The value depends on the energy mix. If all the electricity was produced by coal approximately 31 million tonnes of carbon dioxide would be generated. For gas the equivalent figure is 14 million tonnes.

- Reported emissions from the defence sub-sector increased by over 50 per cent compared to 2007. This mainly related to an increase in maintenance and production activities on the MoD sites[14].

Comparison with other sectors

- Some industrial sectors report to the Environment Agency's pollution inventory on greenhouse gas emissions associated with their activities. Out of all the sectors that report, the energy sector is the major producer of greenhouse gases. In 2008, it produced 203 million tonnes of carbon dioxide (three per cent less than last year[15]). Emissions from the nuclear sector are equivalent to less than 0.5 per cent of the total emissions from the energy sector.

Figure 4.1b: **Five biggest producers of greenhouse gases, 2008**



Note: emissions from Aldermaston and Burghfield may be relatively higher than figures given by some of the other operators because they include emissions from employee commuter mileage, business travel (flights, rail, hire car and claimed mileage) as well as fuel used by vehicles filling up on-site.

14 Data for the MoD sites includes greenhouse gas emissions from activities related to nuclear submarines, but also from other activities on the sites (for example other vessels and land-based activities). The data cannot be separated because some facilities are shared and the energy supplies are not separately metered.

15 In 2007, we reported that the energy sector emitted 186 million tonnes of carbon dioxide equivalent based on information published in *Spotlight on business*. Comparable data is not available for 2008, but DECC's *Energy Trends* report indicates that the energy sector released 209 million tonnes of carbon dioxide equivalent in 2007 and 203 million tonnes in 2008.

Objective 5

Develop site restoration and biodiversity action plans

5.1 Sites "determined" to be affected by chemical contamination, as defined by the Environment Act 1995

Key message

- **Only one nuclear site has an area of land "determined" as contaminated land under the Part 2A regulations.**

Context

- Contaminated land is a potentially significant environmental and waste management issue for the nuclear sector. The scale of this issue differs widely between individual nuclear sites. In many cases, contamination is a legacy from the way sites were previously used.
- For land on nuclear sites, the Contaminated Land Regulations issued under Part 2A of the Environmental Protection Act 1990 only consider chemical contamination.

Nuclear sector performance

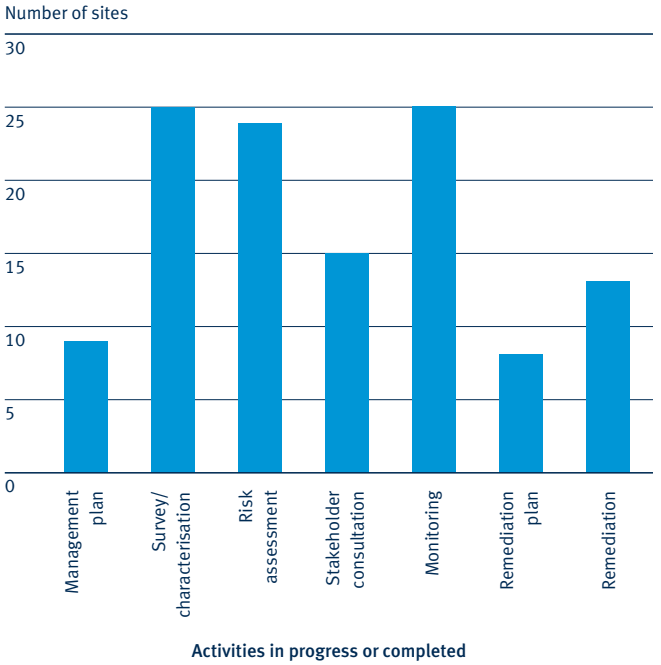
- By 2008, a total of 985 sites had been "determined" as contaminated land in England and Wales.
- Aldermaston is the only nuclear site with an area of land "determined" as contaminated land under the Part 2A regulations, and AWE is working to clean up part of the site which is contaminated by chemical solvents.

5.2 Proportion of sites with management plans for contaminated land developed in consultation with regulators

Key message

- **All nuclear sites with contaminated land have appropriate management arrangements in place.**

Figure 5.2: **Management arrangements in place for contaminated land, 2008**



Context

- Many nuclear site operators are taking action to identify and manage land which is affected by chemical or radioactive contamination at levels below the threshold defined as "contaminated" under the Part 2A Contaminated Land Regulations. This land does not present a risk of significant harm to employees or the public, but managing it is recognised as good stewardship. This will be a long-term process. Sites which are to be fully decommissioned and de-licensed will need to be cleaned up at some point so that they are suitable for the agreed future use.

Nuclear sector performance

- Including Aldermaston, operators considered that 25 nuclear sites (86 per cent) had some areas with radioactive and/or chemical contamination in the soil or groundwater. Four nuclear sites (14 per cent) were not considered to be contaminated by their operators, and therefore do not need a contaminated land management plan.
- Operators on the majority of sites are carrying out or have completed survey and characterisation work to find out the extent of the contamination, and have completed risk assessments. Monitoring is carried out routinely on most sites. Other management arrangements are generally less well developed. Sites may be making progress on more than one stage at the same time, and are likely to continue to review management plans and refine them as more information becomes available.
- The most significant legacy of contaminated land and groundwater is at Sellafield. A two-year characterisation programme started in 2007, and development of a network of shallow and deep boreholes progressed throughout 2008. Information available to date has reaffirmed that the main sources of contamination are within the inner area of the site. A risk assessment model is now expected to be completed in June 2010, and this will inform future decisions on the management of contaminated land and protection of groundwater.
- A new groundwater containment plant was commissioned at Harwell in 2007 to prevent contamination in the groundwater moving further away from the Western Storage Area. The new plant offers a number of safety, environmental and operational improvements over the original one – for example, in 2008 it treated a significantly higher volume of water while using two-thirds less electricity than the original plant would have used.

5.3 Implementing biodiversity action plans at appropriate sites

Key message

- **Almost 80 per cent of nuclear sites have now implemented biodiversity action plans (BAPs).**

Context

- Most nuclear licensed sites are in remote, rural locations, and many cover large areas of land. Several sites have unique habitats, and some are home to rare plants or animals. Most operators recognise it is important to manage their sites for wildlife, and actively promote biodiversity by developing biodiversity action plans (BAPs).

Nuclear sector performance

- By the end of 2008, 23 sites (79 per cent) had implemented BAPs. This is two more than last year as a result of Trawsfynydd and Hinkley Point A implementing their first BAPs.
- One MOD site is currently considering developing and implementing a BAP. Operators considered that the remaining five sites (two GE Healthcare sites, two MOD sites and SL Capenhurst) did not need a BAP since these sites are on land which is of little ecological interest.

Objective 6

Improve transparency, understanding and involvement between the Environment Agency, industry and other interested organisations

6.1 Percentage of sites holding local liaison/site stakeholder group meetings

Key message

- **All nuclear sites hold some form of regular local liaison meeting.**

Context

- The Environment Agency encourages nuclear site operators to work closely with their local stakeholders to help the latter understand what is happening on the sites and how it may affect them, and to give them an opportunity to influence decisions on the site. The nuclear industry needs to understand the concerns of individuals and organisations that are interested in or affected by its operations.

Nuclear sector performance

- All nuclear sites hold some form of regular local liaison meeting, known either as a local liaison committee (LLC) or, at NDA sites, a site stakeholder group (SSG). These groups generally involve members of local authorities and trade unions, interested members of the public and other local organisations.

- All NDA site stakeholder groups are chaired by someone who is independent of the operator. Chairs of the local site stakeholder groups also attend regional and national stakeholder groups, to discuss wider issues and share best practice.
- NDA's National Stakeholder Group provides a forum for the NDA and key stakeholders to discuss issues of national interest. It met twice in 2008, to discuss the themes and topics of the NDA strategy, and the NDA's business plan for 2009-2012. The NDA also held stakeholder meetings or workshops on its supply chain strategy, land sales, interim storage of nuclear waste, options for using or disposing of plutonium, and research and development to support the geological disposal programme.
- The Environment Agency feels there is scope for the industry to improve how it interacts with stakeholders. For example, operators in the sector could learn from each other, or from work done by other business sectors, nationally and internationally. Operators need to make sure that they involve stakeholders early in key decisions so people have an opportunity to have their say, rather than simply being informed of the outcome of any decision-making. This is addressed in the revised nuclear sector plan, and we will report on progress next year.

6.2 Percentage of operators which publish environmental reports

Key message

- **Over 60 per cent of operators in the nuclear sector published their own environmental report in 2008. The nuclear sector plan has also improved reporting on the environmental performance of the nuclear industry.**

Nuclear sector performance

- All nuclear sites regularly submit information about radioactive discharges to the Environment Agency. Some also send information about environmental monitoring. In most cases this information is sent to public registers in the relevant Environment Agency region and to relevant local authorities. Reporting under the nuclear sector plan has continued to improve overall reporting on the nuclear sector's environmental performance.
- Seven of the 11 operators in the nuclear sector published their own environmental report in 2008. Sites continue to report on their environmental performance to site stakeholder groups.

P6.3 Monitoring progress with operators' plans for involving interested organisations – developmental indicator

This indicator is not an effective measure of sector performance and we have removed it from the revised nuclear sector plan.

Objective 7

Promote product stewardship and wider supply chain benefits

P7.1 Number of companies with published policies describing their aims and methods as a purchaser to promote product stewardship practices among their suppliers – developmental indicator

P7.2 Number of companies with published policies describing their aims and methods as a supplier to promote product stewardship practices among their customers – developmental indicator

These indicators are not effective measures of sector performance. We have included an improvement goal in the revised nuclear sector plan on corporate social responsibility. Sustainable procurement is one aspect of corporate social responsibility. The nuclear industry has many suppliers, and has the opportunity to work with them to identify and reduce their impact on the environment.

Objective 8

Work to risk-based regulatory and environmental management systems

8.1 Number and proportion of modern, multi-media RSA93 disposal authorisations issued

Key message

- **All nuclear sites now have modern, multi-media authorisations.**

Context

- The Environment Agency currently issues authorisations under the Radioactive Substances Act 1993 (RSA93) which allow operators to dispose of radioactive waste[16]. These specify discharge limits and conditions that aim to protect people and the environment. Modern authorisations are integrated or multi-media, which means they cover all permitted disposal routes from a nuclear site in a single permit and place management requirements on nuclear operators.

Nuclear sector performance

- One new multi-media authorisation was issued to Urenco Capenhurst in 2008, and by the end of the year all nuclear sites had multi-media authorisations.

16 It is expected that, from April 2010, permits to discharge radioactive substances will be issued under the Environmental Permitting Regulations

8.2 Pollution incidents

8.3 Breaches of permits

Key message

- **No serious pollution incidents or breaches of permit were recorded for the nuclear sector in 2008.**

Context

- An incident is defined as "a specific event which is being brought to the Environment Agency's attention, is within its areas of responsibility and which may have an environmental and/or operational impact."
- The Environment Agency aims to protect the environment by setting permit conditions that prevent or control the risk of polluting the environment and/or causing harm to human health. It defines breaches as non-compliance with permit conditions.
- The Environment Agency classifies both incidents and breaches from Category 1 to Category 4, where Category 1 is the most serious. Incidents are classified based on their actual impact, while breaches are classified on their potential impact. For example, a Category 1 incident has a major impact on the environment, while a Category 2 breach of permit has or could have a significant impact on the environment and a Category 3 incident has a minor impact. A Category 4 breach has no potential to have an effect on the environment.

Nuclear sector performance

- No Category 1 or Category 2 pollution incidents or breaches of permit were recorded for the nuclear sector in the Environment Agency's databases[17] in 2008.
- Twelve minor pollution incidents were recorded for the nuclear sector in 2008, but none had more than a minimal impact on the local environment. Examples of incidents include an overflow from tanks containing groundwater contaminated with trichloroethylene (Category 3) and a release of ozone-depleting substances from a chiller unit (Category 4).
- There were 45 breaches of permits recorded for the nuclear sector in 2008. Examples of breaches include a leak of transformer oil into cooling water, which caused no detectable environmental damage (Category 3) and a failure to apply best practicable means to analyse discharges which resulted in an over-reporting of minor discharges (Category 4).
- Operators track trends in the number of lower-category pollution incidents and breaches to make sure they are aware of any changes in environmental performance. Lessons learned from investigating any events are usually applied at other sites operated by the same company, and operators also learn from events that occur on other nuclear sites.

Comparison with other sectors

- The nuclear sector had fewer serious pollution incidents or serious breaches of permits than any other regulated sector in 2008.

Figure 8.2: **Trends in numbers of pollution incidents in the nuclear sector**

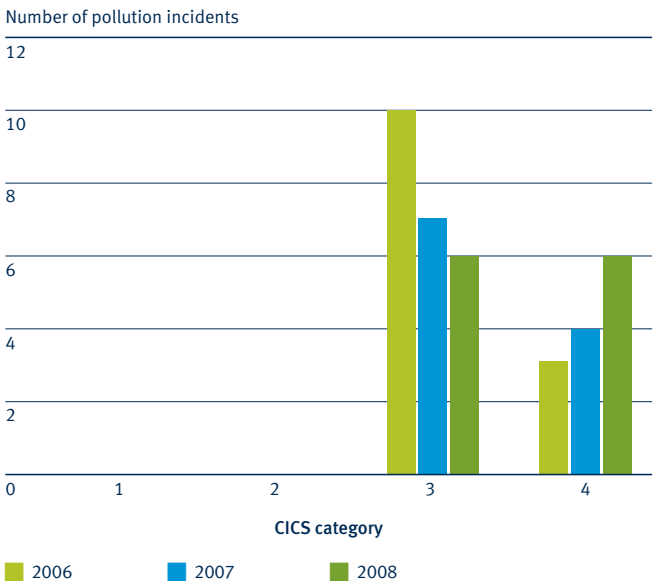
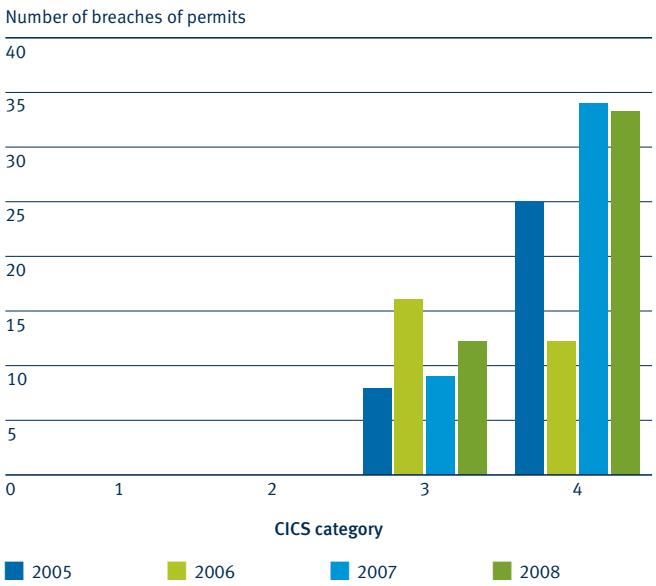


Figure 8.3: **Trends in numbers of breaches of permit in the nuclear sector**



17 Pollution incidents are recorded under the Common Incident Classification Scheme (CICS) in the National Incident Recording System. Breaches of permits are recorded in the Compliance Classification Scheme (CCS) database.

Sector	Number of serious pollution incidents in 2008[a]	Number of serious breaches of permit in 2008[a]	Number of permits[b]	Incidents per permit	Breaches per permit
Nuclear	0	0	34[c]	0	0
Water	61	78	34,000	0.002	0.002
Chemicals	2	14	782	0.003	0.02
Energy	3	2	388	0.01	0.01
Waste	146	852	9,956	0.01	0.09
Metals	7	36	315	0.02	0.11
Mineral products[d]	7	29	85	0.08	0.34
Farming	113	16	874	0.13	0.02
Food and drink	28	32	unknown[b]	–	–
Other[e]	36	391	unknown[b]	–	–

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) Number of permits in each sector is taken from Spotlight on business: 10 years of improving the environment. Last year, the food and drink sector reported as part of the "other" sector last year, and the number of permits in each part of that category is not known.
c) RSA93 permits only. Many nuclear sites also have EPR (PPC) permits, and some also have water abstraction licences and water discharge consents.
d) The "mineral products" sector includes cement and lime industries, glass ceramic and brick manufacturers, but not mineral extraction.
e) The "other" sector includes construction, paper and pulp, textiles, and retail/wholesale.

8.4 Number of companies with enforcement actions and prosecutions

Key message

- **The Environment Agency took enforcement action against nuclear sector companies on two occasions in 2008.**

Context

- The Environment Agency expects operators to comply fully with relevant legislation and with the conditions and limits of any environmental permits. If this does not happen, it will not hesitate to use its enforcement powers to ensure action is taken to protect the environment or to secure compliance with a regulatory system. These powers include issuing enforcement or prohibition notices; suspending or revoking environmental permits, or varying their conditions; and carrying out remedial works directly. Where it believes a criminal offence has been committed, the Environment Agency will also consider issuing a warning, administering a caution, or prosecuting an operator.
- For the purposes of this indicator, we only report the number of enforcement notices issued and the number of prosecutions taken against operators. The intention of an enforcement notice is to bring an operator back to a position where they comply fully with their permit.

Nuclear sector performance

- In 2008, the Environment Agency took enforcement action under the Radioactive Substances Act 1993 against two companies in the nuclear sector:
  - It issued one enforcement notice to Magnox South's Bradwell site in February 2008, following an event when the operator found six drums contaminated with radioactive material in a consignment of waste oil drums being sent off-site. The enforcement notice required the site to improve its management systems, to ensure that this type of event does not happen again.
  - An enforcement notice was issued to Sellafield Limited in September 2008, following the discovery of extensive corrosion at the base of three gas turbine stacks at the Fellside Combined Heat and Power Plant in February 2008. This plant supplies steam to the nuclear licensed site at Sellafield. The enforcement notice required the site to improve their arrangements for inspecting and maintaining the stacks. The corroded stacks have now been replaced.
- The Environment Agency did not conclude any prosecutions against nuclear sector operators in 2008.

8.5 Number (and proportion) of PPC applications and variations determined and issued within target time

8.6 Number (and proportion) of RSA applications and variations determined and issued within programme time

Key message

- **The Environment Agency issued 60 per cent of PPC applications and 40 per cent of RSA applications within four months.**

Context

- The Environment Agency grants permits to operators under the Pollution Prevention and Control Regulations (PPC) – now replaced by the Environmental Permitting Regulations (EPR) – and the Radioactive Substances Act (RSA). It expects that the RSA will be included in the next phase of the EPR, which is expected to come into effect in April 2010.
- The time taken to determine applications depends on the type of permit, for example whether it is a new application or a variation to an existing permission.

Nuclear sector performance

- The Environment Agency determined eight applications for EPR (PPC) permits or variations in 2008. Five of these permits were issued within the "target time" of four months. The average time to determine a PPC permit in 2008 was just over 17 months, but ranged from 11 days for a variation to the Sellafield permit to five years for two new permits for Aldermaston. The latter were delayed awaiting a decision from the Government on national security issues.
- The Environment Agency issued one new RSA93 authorisation and 16 variations[18] to existing RSA93 authorisations in 2008. Seven of these (41 per cent) were completed within four months. On average, it took about 10 months to determine an RSA93 application. Times ranged from about 11 days for a minor variation for Sellafield to 16 months for transfer variations for the Magnox South sites, and just over three years for Urenco's new multi-media authorisation. The latter was due to delays with the European Union Article 37 process.

P8.7 Indicator based on scores from radioactive substance regulation risk assessment methodology – developmental indicator

- The Environment Agency has reviewed its past regulatory effort, and is reasonably confident that its current planning system results in a risk-based approach to nuclear regulation which is broadly comparable to other process industries. However, work is ongoing to improve the robustness and transparency of how it employs its regulatory resources. The revised nuclear sector plan includes goals for the Environment Agency to be a better regulator. In particular, work that the Environment Agency is undertaking with government on modernising environmental permitting, and with HSE on generic design assessments of new nuclear power stations, are examples of how regulation of the sector is being improved.

18 The figure given for number of variations issued in 2008 includes one minor variation for the LLWR site that was approved in December 2007 but was not reported that year

Areas for improvement

Overall, the environmental performance of the sector was good during 2008. However, here we highlight some areas which need to be improved.

1: Reduce the consumption of natural resources

- Most sites continued to increase the efficiency of their use of water and energy in 2008. However, many of these changes were small or due to sites not operating normally. We feel there is still room for improvement at some sites, particularly with regard to the introduction of energy auditing and more energy-efficient systems. Under the revised nuclear sector plan, operators will be expected to develop plans by 2011 to minimise their use of water and energy.

2: Minimise and manage solid waste

- Progress on conditioning and packaging intermediate-level waste (ILW) continued at Sellafield and Winfrith, but overall it is slow. We expect to see continued and sustained progress in this area, including increases in the amounts of ILW conditioned and packaged at other sites and a continued commitment to condition waste for safe and secure storage where appropriate.
- All operators will be expected to support implementation of the national low-level waste strategy. The Environment Agency will work with the supply chain to facilitate the use of new disposal routes. We have included a new indicator in the revised nuclear sector plan to monitor how low-level radioactive waste is managed.
- There was an overall increase in recycling of non-radioactive wastes, but the levels varied substantially between sites depending on their operational status. Some operators need to increase the amount of waste they recycle, in accordance with best practice. Operators have made efforts to improve their data on recycling, and under the revised nuclear sector plan we have asked them to report how waste arising from operational and decommissioning activities is managed.

3: Minimise discharges to air and water

- The sector made good progress in reducing discharges of radioactive waste, helped partly by the completion of treatment of historic medium-active concentrate at Sellafield. The sector must continue to improve in this area to meet all targets in the UK radioactive discharge strategy, including new targets for 2030 in the revised strategy. In the fuel reprocessing sector, the biggest challenge will be to reduce discharges without affecting the UK's ability to reprocess spent fuel.
- There has been continued progress in documenting integrated waste strategies (IWS) at most nuclear sites and a corresponding improvement in waste management practices. The NDA is making progress in developing a national IWS. The Environment Agency will continue to encourage remaining sites to establish IWSs. This will continue to be a target in the revised nuclear sector plan.

4: Minimise greenhouse gas emissions

- Greenhouse gas emissions from the nuclear sector increased in 2008, mainly due to increased production on some of the defence sites. Operators need to continue to reduce emissions where possible. Under the revised nuclear sector plan, operators will be expected to develop optimised plans by 2011 to minimise their greenhouse gas emissions.

Other areas for improvement

- Nuclear operators recognise that managing contaminated land is part of good stewardship. Considerable work has been done to understand more about the nature and extent of contaminated land on many nuclear sites, and to develop management plans to address the risks. This work needs to continue, and move forward into cleaning up the contamination at an appropriate time.
- Operators need to continue to make sure that the Environment Agency, industry and other organisations are involved early enough to influence any key decisions. They also need to assess and influence the environmental performance of their suppliers. This forms part of their corporate social responsibility commitments, and is addressed in the revised nuclear sector plan.
- Operators and the Environment Agency will also need to prepare for reporting under the revised nuclear sector plan next year.

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