EDF Energy Nuclear Generation:

Our journey towards **ZERO HARM**

Summary of our nuclear safety and waste policies and management systems

EDF ENERGY

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1. About EDF Energy

EDF Energy is one of the UK's largest energy companies and its largest producer of low-carbon electricity. A wholly-owned subsidiary of the EDF Group, one of Europe's largest energy groups, we generate around 20% of the UK's electricity and employ around 15,000 people. We supply electricity and gas to around 5.5 million residential and business customers, making us the biggest supplier of electricity by volume.

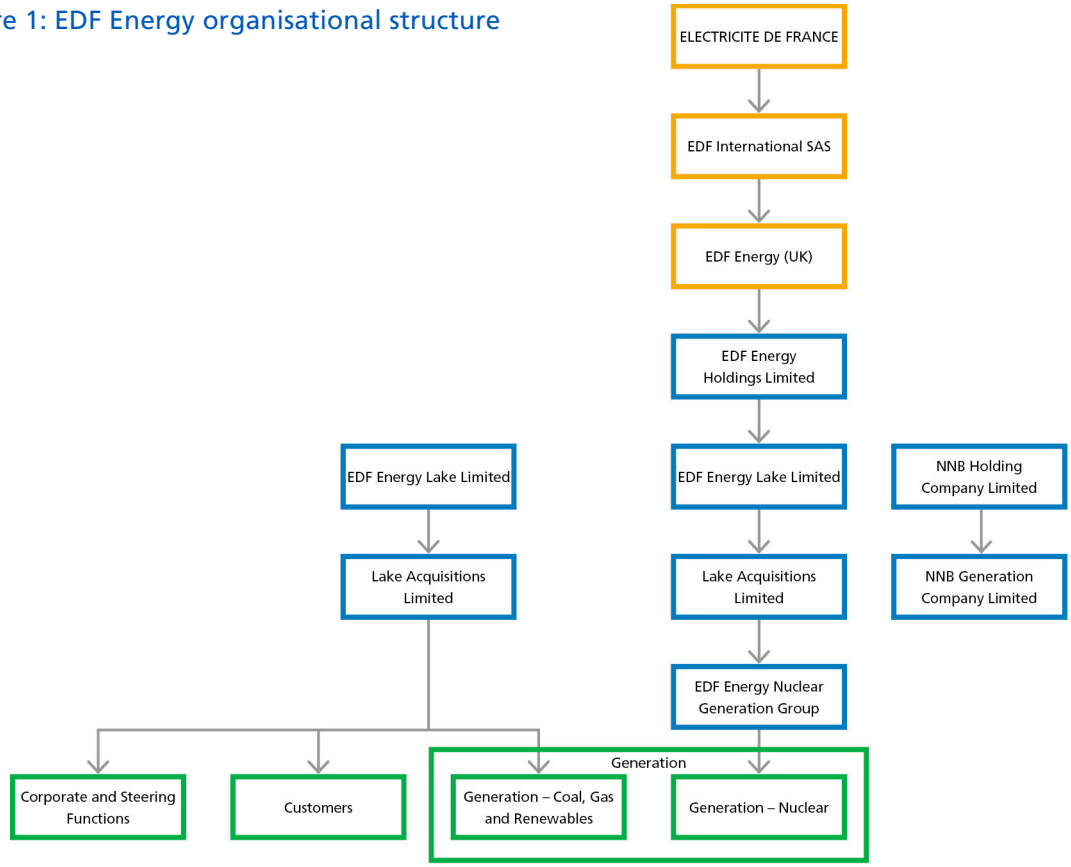
The company is organised into three business units and Corporate and Steering Functions:

- the Generation business which is responsible for the safe reliable operation of eight nuclear power stations (15 reactors, 9,600 MWe[1]), two coal power stations (8 units, 4,000 MWe), one gas power station (3 units, 1,300 MWe), gas storage facilities and renewable energy sources (~500 MWe) in the UK with a total installed capacity of circa 16 GWe[1];
- the Customers business which includes residential and business customers, energy services, smart metering and optimisation; and
- Nuclear New Build (NNB) which is tasked with the delivery of the new generation of nuclear plants in line with EDF Group's global programme of producing safe, affordable, reliable, low-carbon production of electricity in the UK.

1.1 Organisational structure

EDF Energy holds 80% of Lake Acquisitions Limited (the other 20% is held by Centrica) which owns the eight nuclear power stations (15 reactors under commercial operation) of former British Energy. The acquisition process was completed in 2009.

Figure 1: EDF Energy organisational structure



[1] Megawatts (MW) / Gigawatts (GW) electrical (e) output from the reactors rather than thermal output from the reactor

1.2 EDF Energy's company ambitions

EDF Energy's mission is focussed on putting sustainable and responsible business at the heart of what the company does.

Our mission: "Driving progress for people – a successful and responsible long-term energy business, trusted by customers and powering a thriving society and a healthy environment."

This makes sustainable and responsible business core to the way we act today and how we plan for the future.

To deliver our mission, we have established six company ambitions. These 'Better Energy Ambitions' build on our progress so far to embed the themes of sustainability in our business operations, planning and behaviours. They are our framework for sustainability:

- To achieve Zero Harm to people.
- To be the best and most trusted for customers.
- To power society without costing the Earth.
- To deliver safe, secure and responsible nuclear electricity.
- To achieve strong financial and ethical performance.
- To empower our people to be a force for good.

1.3 About EDF Energy Nuclear Generation

The locations of EDF Energy Generation's (NG) eight nuclear power stations are shown below.

Figure 2: EDF Energy Generation's Nuclear Power

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Figure 3: About the EDF Energy Generation (NG) fleet

Station	Reactor Type*	Date commissioned	Scheduled closure date**	NET capacity in Megawatts (MWe)
Hunterston B	2 AGRs	1976	2023	960
Hinkley Point B	2 AGRs	1976	2023	944
Hartlepool	2 AGRs	1983	2019	1,180
Heysham 1	2 AGRs	1983	2019	1,155
Dungeness B	2 AGRs	1983	2028	1,044
Heysham 2	2 AGRs	1988	2023	1,222
Torness	2 AGRs	1988	2023	1,185
Sizewell B	1 PWR	1995	2035	1,198

Capacities are stated net of all power consumed for the stations' own use, including power imported from the National Grid. Capacities are subject to review each year end. The capacities quoted reflect expectations for the reference energy generation from the units from 1 January 2015. In particular, Hinkley Point B and Hunterston B have been adjusted to reflect planned operation at approximately 75% load due to boiler temperature restrictions.

* Advanced Gas-cooled Reactor, Pressurised Water Reactor.

** One of EDF Energy's business imperatives is to extend the lifetime of its nuclear power stations where it is technically and economically viable to do so safely.

1.4 Scope of disclosures

As a part of our commitment to openness and transparency, we are providing information about the governance of nuclear safety and waste in the **nuclear** part of **EDF Energy's Generation business** only (hereafter referred to as NG). Unless specified, this information **does not** apply to EDF Energy Generation's Coal, Gas or Renewables plant, or to NNB given the current stage of development of the project.

The policies described here are provided as a guide to the operating practices of the nuclear part of EDF Energy Generation's operations in the UK. EDF Energy is part of EDF Group, which also has nuclear operations in France and the United States. Each country has its own regulatory regimes and, consequently, specific nuclear policies have been developed in each country. Nevertheless, each nuclear operator within EDF Group exercises the same commitment to nuclear safety and waste management.

In 2012, EDF Group created an overarching policy and accompanying management system for nuclear safety and nuclear waste. Policies at a country-level are consistent with, and may exceed, the EDF Group policy.

EDF Group's disclosures aligned to this document can be found at: "Nuclear safety: our overriding priority 2015"

2. Nuclear safety policy and implementation

2.1 EDF Group's nuclear safety policy

EDF Group has a nuclear safety policy which confirms:

"At EDF Group, we all share the same vision that nuclear safety is the overriding priority in the sustainable use of nuclear energy, recognising that nuclear energy also needs to be efficient, affordable and environmentally friendly. It is an indispensable prerequisite when providing energy to humanity."

Nuclear Generation Limited (NGL) complies with the attached EDF Group Nuclear Safety Policy through a combination of the NGL Nuclear Safety Policy and the supporting NGL Management System. A copy of the EDF Group Nuclear safety Policy is available in Appendix 1.

2.2 EDF Energy's nuclear safety policy

Nuclear safety is our overriding priority. Every one of us has a direct or indirect impact on nuclear safety and it must be at the forefront of what we do. Additionally we must ensure that radiological, environmental, industrial and fire safety are adequately controlled in support of our ambition to achieve a zero harm safety record.

2.2.1 Policy Statement

This policy represents our corporate commitment to nuclear safety and is implemented via our management processes. It requires the commitment of all leaders to support and demonstrate the values outlined in this policy and the commitment of all individuals to maintain positive control of nuclear safety via our deliberate, considered actions.

In operating our nuclear facilities, we have no greater responsibility than to protect the public, the environment and ourselves from the potentially adverse effects of our technology. We are responsible for the safe operation of these facilities. Our obligation, as a nuclear operator, is to protect the people of this country and the population worldwide by maintaining nuclear safety at all times. We take that obligation very seriously throughout the organisation. The importance of maintaining nuclear safety cannot be overstated and this policy requires that everyone is aware of their obligations. Fission products, decay heat and vast amounts of stored nuclear energy can have an adverse impact on our wider society if released in an uncontrolled manner.

Our primary focus is to ensure nuclear safety through positive control of reactivity, core cooling and containment (referred to as 3Cs) of the contents of the core and all by-products of nuclear power plant operations whether in reactor, during movement, disposal or storage. We are committed to keeping the overall balance of risks As Low As Reasonably Practicable (ALARP).

We have adopted the following definition of Nuclear Safety Culture:

"That assembly of characteristics and attitudes in organisations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance." (From the International Atomic Energy Agency – IAEA - Safety Series No75-INSAG-4 "Safety Culture").

This means that, in working together, we should all recognise our individual and collective impact on nuclear safety such that we all do the right thing at all times, that is:

"Nuclear Professionals, doing the right things."

2.2.2 Policy Standards

Safe nuclear operation is achieved by:

Nuclear Safety Culture

A positive nuclear safety culture that is continually fostered within the organisation, characterised by communications founded upon openness, mutual trust and shared values. This includes fostering a safety conscious work environment in which we all openly report and pursue safety issues or concerns without experiencing a negative reaction. In addition to normal processes - for example raising concerns through supervisors and the Corrective Action Programme (CAP – which is explained in section 4.2.3.2) - we also have a confidential reporting line for any outstanding safety concerns (Safecall).

Plant

Plant that is well designed, operated and maintained within established safety cases to ensure they operate at a tolerable risk.

Process

Processes that are robust and focused on prevention of events, problem identification and resolution.

People

People who are well trained, follow procedures, demonstrate a questioning attitude, uphold the highest standards and coach each other to improve those standards.

Learning Organisation

A learning organisation that strives for excellence by continuous improvement.

Underpinning Principles

This policy is also supported by the adoption of the following ten traits (from the World Association of Nuclear Operators - WANO and the Institute of Nuclear Power Operations - INPO).

Figure 4: Ten traits of a healthy nuclear safety culture

Personal Accountability:
all individuals take personal responsibility for safety.

Questioning Attitude:
individuals avoid complacency and continuously challenge existing conditions and activities in order to identify discrepancies that might result in error or inappropriate action.

Effective Safety Communication:
communications maintain a focus on safety.

Leadership Safety Values and Actions:
leaders demonstrate a commitment to safety in their decisions and behaviours.

Decision Making:
decisions that support or affect nuclear safety are systematic, rigorous, and thorough.

Respectful Work Environment:
trust and respect permeate the organisation.

Continuous Learning:
opportunities to learn about ways to ensure safety are sought out and implemented.

Problem Identification and Resolution:
issues potentially impacting safety are promptly identified, fully evaluated, and promptly addressed and corrected commensurate with their significance.

Environment for Raising Concerns:
a safety conscious work environment is maintained where personnel feel free to raise safety concerns without fear of retaliation, intimidation, harassment, or discrimination.

Work Processes:
the process of planning and controlling work activities is implemented so that safety is maintained.

Periodic Assessment

The health of our nuclear safety performance and culture will be periodically assessed to ensure that the objectives of this policy and the ten traits above are being achieved.

Relationship with EDF Group Nuclear Safety Policy

NGL complies with the EDF Group Nuclear Safety Policy through a combination of the NGL Nuclear Safety Policy and the supporting NGL Management System.

2.2.3 Additional precautions

In discharging our legal and moral duty to reduce the risks arising from our operations to a level that is ALARP, we design and operate our plant in accordance with these principles:

a) All reasonably practicable steps will be taken to ensure safe plant operation and to prevent accidents and risks to health at work.
b) All reasonably practicable steps will be taken to minimise the consequences of any accident including radiological consequences.
c) No person will receive doses of ionising radiation in excess of statutory dose limits as a result of normal operation.
d) The exposure of any person to radiation and the collective effective dose to staff and the general public will be kept as low as is reasonably practicable.
e) All activities which may affect safety, including those undertaken by contractors, will be carried out by, and under the control of, suitably qualified and experienced persons within an effective management system.

2.3 Nuclear safety management systems

2.3.1 Governance

The Group Board, EDF Energy Nuclear Generation Group Limited, is responsible for the management monitoring of EDF Energy Nuclear Generation Limited (the Licensee Board), the business unit which holds the Nuclear Site Licence. Several representatives of NG (senior executives from the Nuclear Generation and Engineering Divisions) are members of the Group board. Inside NG, Nuclear Safety Committees are constituted in compliance with the Nuclear Site Licences. These Committees are consulted regularly for their consideration and advice on matters of nuclear safety.

Performance on nuclear safety, radiological protection and operations is reported monthly to the Safety and Oversight, and the Operations Performance Delivery Teams (key governance bodies within NG) and to the Generation Executive Team and the Licensee Board. In addition, quarterly reports on the safety state of the plant and processes through use of results, analysis, insights and oversight are presented to the Licensee Board and the EDF Energy Nuclear Generation Group Limited Board.

The Inspector General for Nuclear Safety and Radiation Protection who reports to the Chief Executive Officer of EDF Group and to the Nuclear Safety Council provides high level oversight of nuclear activities across EDF Group, including NG.

WANO Peer Reviews are held at each of NG's power plants every four years with an interim follow-up visit to review progress. The Company therefore typically receives two or three peer reviews per year with a similar number of follow-up visits. Corporate peer reviews are also held periodically.

Each peer review has two primary outputs:

- A report which identifies areas for improvements (AFIs) which describe gaps between current performance and excellence. These are supported by factual evidence and an analysis of the causes which underlie performance gaps.
- Since 2010, a separate report which reviews station progress in addressing WANO significant operating experience reports recommendations.

During follow up visits, WANO assesses progress made by plants in addressing AFIs identified during the previous Peer Review.

In conjunction with WANO, INPO and the International Atomic Energy Agency, EDF Energy also provides support to, and is supported by, technical support missions, self assessments, operating experience feedback, benchmarking, workshops and seminars, performance indicators and secondments.

2.3.2 Implementation

NG operates in accordance with a single unified management system that integrates safety, health, environmental, security, quality and economic objectives. The management system defines the responsibilities of key post holders, the line management organisation and the main interfaces between the company and other organisations.

The management system draws on best practice, as defined within the IAEA Safety Requirements No. GS-R-3, The Management System for Facilities and Activities, together with BS EN ISO9001, Quality Management System - Requirements, BS EN ISO14001, Environmental Management Systems – Requirements With Guidance For Use, BS OHSAS18001, Occupational Health And Safety Management Systems - Requirements and BS ISO ISO55001, Asset Management. Management System – Requirements. It has also been designed to ensure that the requirements of our nuclear site licences are fulfilled.

The management system supports the achievement of the two general aims of a management system, as stated by the International Nuclear Safety Group in 'Management of Operational Safety in Nuclear Power Plants', INSAG-13:

- To improve the safety performance of the organisation through the planning, control and supervision of safety related activities in normal, transient and emergency situations.
- To foster and support a strong safety culture through the development and reinforcement of good safety attitudes, values and behaviour in individuals and teams so as to allow them to carry out their tasks safely.

The structure of the system is summarised in figure 5, which shows how our company vision and associated strategic objectives are implemented through a defined organisational structure and 36 interlocking processes. For each process there is an identified champion in the business who owns the process definition and documentation and is charged with its continuous improvement. The whole system is underpinned by the values, standards and expectations that should inform and permeate all activities throughout the company.

Based on the standards, the processes include all the elements necessary to manage and control nuclear power stations safely and efficiently. Alongside the processes for specific technical activities there are processes for securing sufficient suitably qualified and experienced personnel (known as 'SQEP') including training, for implementing and monitoring governance procedures, for ensuring adherence to regulations, for securing independent assessment of our activities, for

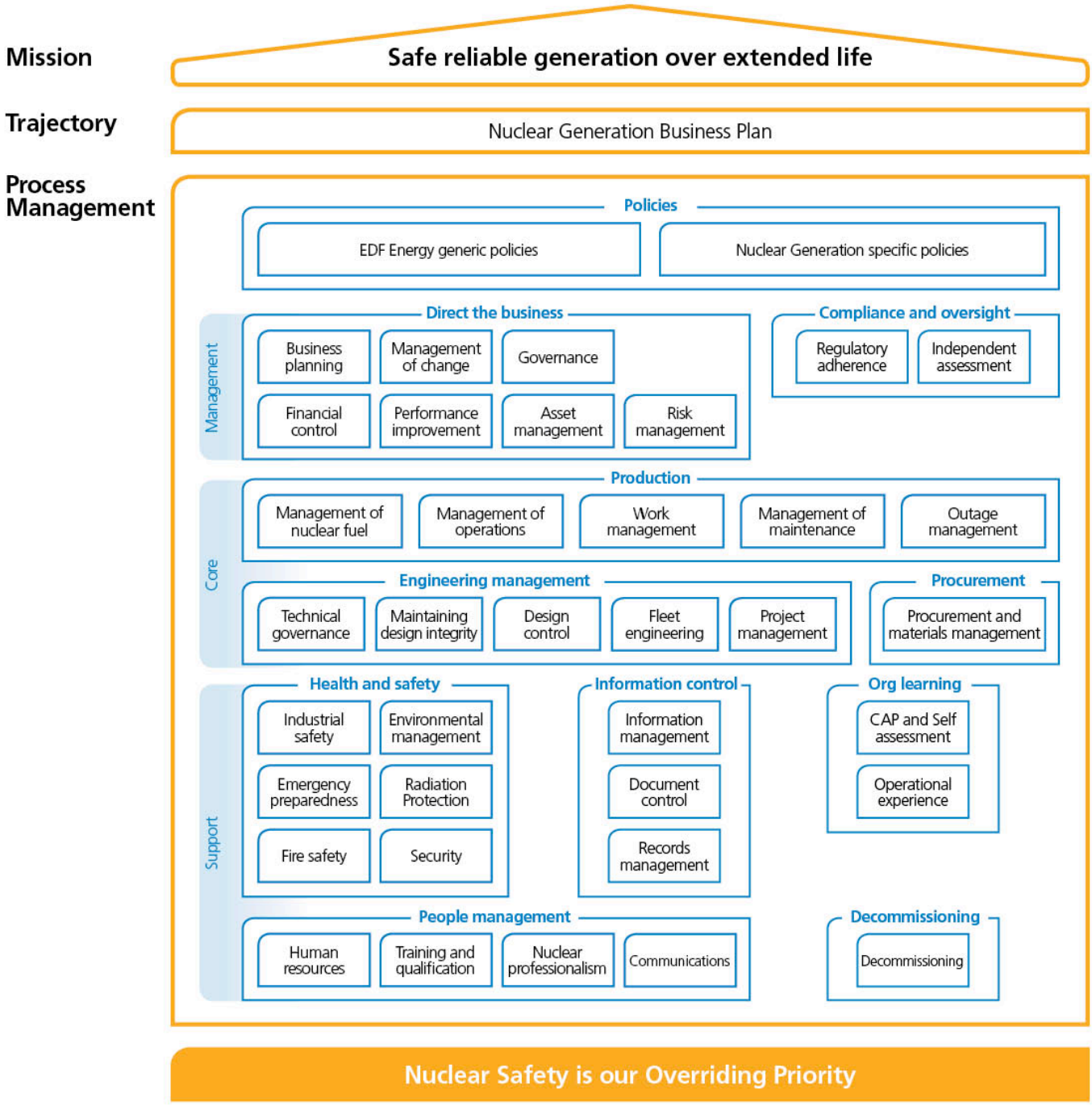
investigating departures from expected plant and personnel behaviour and preventing their recurrence CAP and for driving improvement in all aspects of performance.

As you would expect for a high-hazard industry there is a particular emphasis on oversight to monitor performance and conformity to both our internal standards and external regulations. We operate a multi-layer model with increasingly independent oversight being exercised through:

- management accountability - the exercise of leadership;
- in-process oversight through peer checking and self assessment;
- functional oversight – review and audit by company experts;
- independent internal oversight from our Safety and Regulation Division who report to the Board independently of the operating arm of the company;
- external oversight from our Nuclear Safety Committees with their external members, from peer evaluations by teams from other utilities, from standards accreditation bodies and from the Office for Nuclear Regulation (ONR).

Station workers conducting a routine plant check.

Figure 5: Nuclear Generation Limited Management System



3. Incidents and events

Our plant is designed to be operated without significant impact on the health and safety of its operating staff or of the public living around the stations.

3.1 Policy

The most harmful consequences arising from nuclear facilities originate from the loss of control over a nuclear reactor core cooling, the nuclear chain reaction, or uncontrolled radioactive discharges, which constitute the three key safety functions that are secured and verified on a permanent basis.

We rarely have any significant incidents or events. If one were to occur, EDF Group and NG aim to reduce the likelihood of such losses of control to the lowest possible level and take all necessary measures in order to:

- prevent the occurrence of failures or abnormal conditions that could lead to such a loss of control;
- prevent the escalation of any such failures or abnormal conditions that do occur and mitigate their external consequences;
- prevent the loss of confinement or the discharge of radioactive substances outside the facilities.

3.2 Management system

In line with this fundamental IAEA principle and with local regulations, EDF Group and NG have all put in place local processes to detect[2] and prevent such failures/events[3] of any origin (human or technical), in order to mitigate them and leverage experience feedback to prevent their reoccurrence.

All NG (corporate, station and contractor) personnel shall:

- Identify conditions that have or could have an undesirable effect on performance of equipment, programmes or organisations.
- Ensure necessary immediate actions are implemented to place the plant/situation in a safe and stable condition.
- Report the condition to a supervisor or the control room, as appropriate, including immediate corrective actions taken.
- Promptly initiate a Condition Report.
- Provide sufficient information so that the condition can be properly evaluated for operability, reportability (in accordance with Nuclear Site Licence Condition 7, incidents on the site), significance and disposition.

Symptom-based emergency response guidelines and accident management guidance is available to control any accident, and mitigate the consequences in the unlikely event of failure of any of the required engineered protective features.

In accordance with Nuclear Site Licence Condition 11 (Emergency Arrangements), the Emergency Preparedness Programme includes arrangements for working with other emergency services and government bodies to provide countermeasure advice and to take action to protect the public and environment as a consequence of any significant radioactive material from any of our power stations.

As our plant is designed to be operated without significant impact on the health and safety and environment of the local community and of people working at our power stations, it is subject to an extensive routine programme of inspection, maintenance and testing. Its behaviour in normal operation and a wide range of abnormal circumstances have been analysed (the 'Nuclear Safety Case') to show that the station will either be able to continue operating safely or be brought to a safe shutdown condition. The resulting limits on the allowed operating parameters (such as temperature and pressure) and the availability of backup systems are incorporated into operating instructions which control all aspects of operation and direct the action to be taken if these limits are approached. Staff are rigorously trained in the requirements of the Nuclear Safety Case and operators in control are individually examined and authorised to the role. The adequacy of the Nuclear Safety Case, the monitoring and maintenance regime and the control of operations is evaluated continually and is formally assessed in comparison to the latest standards every 10 years. To give early warning of any deterioration, whether

[2] The detection and self-report of errors by their authors are promoted and recognised as a positive contribution to safety; on the contrary, the fact of hiding an error is a fault in the safety culture and is subject to disciplinary sanctions.

[3] In safety culture terminology, an "event" does not necessarily have a direct consequence on equipment or a direct impact on the facilities. It can simply involve weakened defence lines, including organisational, with no material consequence.

in plant or operating standards, and to facilitate our goal of continuous improvement every deviation from the expected plant status or the management system procedures is required to be reported into CAP as described later in this document.

In addition to these routine processes the company has detailed plans for the action to be taken if, despite all these precautions, things should go wrong and the public be threatened. We perform regular emergency exercises to test the procedures, facilities, systems and equipment, and enable everyone to practise their role. These are also the main way that we demonstrate the effectiveness of our emergency arrangements to external agencies and the public. These arrangements have been further strengthened following the events at Fukushima in March 2011.

The application of the company's safety standards reduces, to a very low level, the chance of an accidental event which might lead to the release of even small amounts of radioactivity. Nevertheless we have plans and procedures for dealing with an accident or emergency and protecting both our workforce and members of the public. Many of our staff, in addition to their normal job, are also assigned roles in the emergency organisation. They are trained in these roles, practice them regularly and periodically demonstrate them both to internal assessment teams and to the ONR.

If an event should ever occur resulting in a release to the environment of significant quantities of radioactive material then, in addition to our own staff, many off-site organisations would be involved and called upon to take actions to protect the public. These organisations include the Police and other Emergency Services, Local Authorities, Government Departments and Agencies, each of which has its own emergency responsibilities and procedures. These procedures are co-ordinated in the Off-Site Emergency Plan by the Local Authority, which fulfils the requirements under the Radiation Emergency Preparedness and Public Information Regulations.

The nuclear safety message is displayed at the entrance of every nuclear generation location.

At NG, Emergency Plans are practiced regularly. Each shift is exercised at least once per year, and one in-depth exercise is required to demonstrate to ONR the adequacy of the on-site emergency arrangements at each power station. These 'Level 1' exercises are witnessed by the ONR and focus on the actions of the operator. Emergency services are invited to participate to provide a mutual learning opportunity and to add realism to the on-site actions. Level 2 and 3 exercises are aimed at the operation and testing of the off-site emergency plans. Level 2 exercises primarily test the local off-site plan for each station every three years. These exercises enable those agencies with a responsibility in the response to exercise and review their arrangements.

Annually one of the national programme of Level 2 exercises is selected for the purposes of testing the national level response plan. In addition to the Level 2 activities, this involves the setting up of the Nuclear Emergency Briefing Room in Whitehall, or the Scottish Government Resilience Room.

Regulatory exercises are also required to satisfy the nuclear security regulations and the transport of radioactive material.

In addition to the regulatory exercises, sites have tested various aspects of the emergency plans during shift exercises and training drills. The lessons from all exercises have been shared across the fleet and used in revising emergency plans and future exercise programmes.

Examples of some additional key activities in the emergency preparedness area since Fukushima include:

- Provision of further detailed emergency arrangements to support beyond design-base accidents and integration of the post Fukushima recommendations. Proof of concept exercises have been held to test the new extended arrangements, including deployment of back up equipment.
- Increased focus on the alignment of the safety and security response arrangements for the industry and the fleet.
- National forums such as Nuclear Emergency Planning Liaison Group and Nuclear Emergency Arrangements Forum have made significant changes to structure and governance. NG has consistently attended the Department of Energy and Climate Change's (DECC) new National Strategic Framework; this is the governance framework for the national emergency response capability.
- Review by IAEA and ONR on increased extendibility planning and potential increases in Detailed Emergency Planning Zone.
- Following the decision to include emergency preparedness in Peer Reviews there has been increased focus on WANO internal and external activities.

4. Unplanned plant shutdowns

4.1 Policy

Unplanned shutdowns have the potential to challenge the operational safety of a power plant. Therefore, NG is committed to safe, reliable generation through the reduction and eventual elimination of unplanned shutdowns. Furthermore reduced plant availability due to unplanned shutdowns has an adverse economic impact in terms of lost revenue and additional costs. NG adopts international best practices in this field as outlined in INPO, WANO, Electric Power Research Institute and IAEA.

4.2 Management system

At NG, in accordance with worldwide industry accepted best practices, the implementation of a rigorous process-based approach to plant operational management is considered to be the most effective and robust means to ensure sustainably high safety and environmental performance including avoidance of unplanned shutdowns. Some of the most important processes are:

- work management and outage management
- equipment reliability
- organisational learning.

All company processes including those described above (Work Management, Equipment Reliability and Human Performance & Nuclear Safety Culture) apply continuous improvement methodologies. The continuous improvement approach is based on the INPO Achieving Excellence in Performance Improvement model (INPO 09-011) and is prescribed in

the NG Quality Management System procedures. Issues and emerging trends are identified and analysed, solution options are studied and prioritised and the highest value activities are implemented through business plans, improvement plans, asset management plans and other arrangements. Finally an effectiveness review is conducted to ensure that the intended results have been delivered.

4.2.1 Work management - INPO AP-928 Implementation and outage management

NG has implemented work management best practices following the INPO guideline AP-928. This process gives assurance that nuclear safety related equipment "defence in depth" is maintained during routine and emergent maintenance activities. This means that our operators always have the defence of multiple safety systems which will - through carefully planned release schedules - have high availability factors both in normal operation and outage execution.

The guiding principles of an effective work management process are:

1. To ensure nuclear safety and non-nuclear safety by providing timely identification, selection, planning, coordination, and execution of work necessary to maximise the availability and reliability of station equipment and systems.
2. To manage the risk associated with conducting work.
3. To identify the impact of work to the station and work groups and to protect the station from unanticipated transients due to the conduct of work.
4. To maximise the efficiency and effectiveness of station staff and material resources.

The NG long-term outage planning process has been developed to give enhanced clarity with respect to the future outage programmes at each site. The aim of the outage management programme is to significantly reduce outage durations from the existing outage programmes and to maintain outage durations at this lower threshold going forward. Since a significant proportion of the maintenance and maintenance-related activities are carried out during periodic shutdowns (statutory outages), the quality of the outage planning and execution has a significant effect on the safety and reliability of the nuclear power plant, and consequently on the occurrence of unplanned shutdowns.

4.2.2 Equipment reliability - INPO AP-913 Implementation

The nuclear industry has established a documented standardised best practice in the area of equipment reliability based upon reliability-centred maintenance. This has been formalised under the INPO guideline AP-913. A programme is being rolled out in NG to fully implement AP-913. This equipment reliability process represents the integration and coordination of a broad range of equipment reliability activities into one process for plant personnel to evaluate important station equipment, develop and implement long-term equipment health plans to manage their health, monitor equipment performance and condition and make continuing adjustments to preventive maintenance tasks and frequencies based on local, fleet-wide and industry-wide equipment operating experience. All of which is focused on the principal goal of underpinning nuclear safety.

Through the equipment reliability process, the equipment that is critical for safe, reliable operation is systematically identified and the performance is meticulously tracked. Risk based maintenance techniques are then selected and used to define the preventive maintenance programs and the life cycle management strategies to be adopted in order to maximise reliability and availability. This is done at both system and component levels, and is used to anticipate and prevent ageing and degradation effects impacting on nuclear safety and reliability. The process focuses on improving equipment reliability and availability, resulting in increased nuclear safety margins.

4.2.3 Organisational Learning

NG is committed to improving Organisational Learning which encompasses human performance, nuclear safety culture, CAP and operating experience (OPEX). This programme focuses on minimising the frequency and consequences of human errors through training, effective use of human error prevention tools, effective supervision, performance coaching and the identification and reduction of organisational weaknesses through investigations into events, incidents, near misses and performance trending of sub standard conditions.

4.2.3.1 Human performance and nuclear safety culture

Events leading to an unplanned shutdown derive directly or indirectly from organisational weaknesses. The objective of having a structured human performance programme is to prevent safety and reliability related events and incidents and maximise nuclear safety margins. This is done by systematically identifying and addressing organisational weaknesses which lead to error-likely situations, promoting fundamental behaviours that reduce human error, and by developing a nuclear safety culture which instils a defence-in-depth philosophy supplementing and reinforcing the human performance of individuals through nuclear leadership.

The following principles have been used to inform the development of our human performance programme:

- humans are fallible, even the strongest performers make mistakes;
- error-traps are predictable, manageable, and preventable;
- human performance tools are used to minimise the frequency and severity of errors;
- individuals achieve high levels of performance based largely on the encouragement and reinforcement received from supervisors, peers and direct reports;
- understanding the reasons human errors occur and applying the lessons learned from past errors can prevent events;
- organisational processes and values influence individual behaviour;
- performance improves when members of the organisation learn from their successes and failures.

Our programme now also encompasses the ten traits of a healthy nuclear safety culture as previously discussed.

4.2.3.2 Corrective Action Programme

The CAP is a cornerstone of continuous improvement and organisational learning. An effective CAP is fundamental to the management of plant safety and reliability. The objective of CAP is to identify, document, evaluate and trend undesirable conditions (problems) and to take actions to correct them and their causes. The aim is to proactively identify sub-standard conditions and practices at a local, low consequence level and take positive action to prevent more significant consequence events arising and adverse trends developing.

CAP establishes the processes to ensure that deficiencies, non-conformities, weaknesses with processes, documents or services, or conditions that adversely impact, or may adversely impact, plant operations, personnel, nuclear safety, the environment, or equipment and component reliability are promptly identified and resolved in accordance with their inherent risk to nuclear safety and reliability.

4.2.3.3 Operating Experience

Together with CAP, the effective sharing and utilisation of experience is a fundamentally important process established by the nuclear industry from the lessons learned initially following the Three Mile Island accident in 1979 and developed extensively over the years that followed. The OPEX processes cover the reviewing, screening, disseminating of internal and external nuclear industry event notices or other operating experience for applicability to specific NG facilities. They also provide the basis for external communication of events from within the organisation for the benefit of the worldwide nuclear community through the WANO global event reporting system.

At the global level, WANO and INPO maintain a database of events reported by every nuclear power plant on the secure WANO members' website. WANO has established specific reporting information categories, including causes, corrective actions and learning points. Members are encouraged to report events promptly, so that others can benefit from their experience.

5 Risk and Nuclear Safety assessments

5.1 Policy

As noted in the nuclear safety policy section, the company - as an owner and operator of commercial nuclear power plant - is responsible for the safety of its employees and the public. It aims to minimise risks arising from normal operation and from any nuclear accident arising from its installations and from natural events (e.g. flooding, earthquakes, extreme winds,

climate change, human error, fires, loss of coolant, loss of power) to an acceptable level in line with national and international standards and industry best practice. The nuclear safety case therefore includes risk assessment of:

- plant-based faults, e.g. loss of coolant
- internal hazards, e.g. steam release
- external hazards, e.g. flooding, earthquakes.

Our primary focus is to ensure nuclear safety through positive control of reactivity, core cooling and containment of the contents of the core and all by-products of nuclear power plant operations whether in reactor, during movement, disposal or storage.

Safe nuclear operation is achieved by:

- plant that is well designed, well operated and well maintained;
- processes that are robust and focused on problem identification and resolution;
- people who are well trained, follow procedures, demonstrate a questioning attitude, uphold the highest standards and who coach each other to improve those standards;
- a learning organisation that strives for excellence by continuous improvement;
- an organisation that has a positive nuclear safety culture.

The safety of the company's nuclear power stations was determined prior to construction through use of agreed contemporary advice, including national and international standards and guidelines and is also assessed as issues arise against the company's (deterministic and probabilistic) Nuclear Safety Principles.

The company's Nuclear Safety Principles have been defined taking into account the document issued by the Health and Safety Executive entitled 'The Tolerability of Risk from Nuclear Power Stations' (TOR) and subsequently developed further in 'Reducing Risks, Protecting People' (R2P2), which reflects current thinking on tolerable levels of risk, both to individuals and to society as a whole. In common with TOR and R2P2, the concept of reasonable practicability is also an important feature of the Nuclear Safety Principles.

There is a fundamental legal requirement for risks to be ALARP. This responsibility is fully recognised by the company and leads it to continuously improve the maintenance of nuclear safety standards in its nuclear power plants. The safety cases for plant-based faults, internal hazards and external hazards all minimise consequences and drive risks ALARP.

5.1.1 Reviews of the nuclear safety case and risk assessment

The nuclear power stations were constructed to agreed contemporary advice, including national and international standards and guidelines. Each entered service with a single document summarising its safety case, which included assessment of risks, i.e. plant-based, internal and external hazards. The stations are expected to operate for a number of decades, during which time guidelines will change. In addition, there will be numerous changes to plant and procedures at each station, each of which is separately documented and represents a small change in the safety case.

The entire safety case, including risk assessments of plant-based internal and external hazards, is therefore reviewed at intervals against current national and international standards and industry best practice. The review also encompasses operating experience gained within the company, the global nuclear industry, e.g. Fukushima, and through global high hazard industry events. The review process, which is referred to as Periodic Safety Review, is carried out at intervals of approximately 10 years in accordance with Nuclear Site Licence Condition 15.

Less comprehensive reviews of the station safety case, including risk assessments, are also undertaken at intervals of two to three years. Typically each AGR is shut down for statutory maintenance every three years (two years on some AGR stations at present); the PWR interval is currently 18 months. Following each statutory maintenance outage, the findings are presented to the ONR, who must approve the return to service until the next maintenance outage.

5.1.2 Regulation

Each nuclear power station is subject to a Nuclear Site Licence, which is issued by the ONR. The licence has 36 conditions, which govern all aspects of safe operation of the station. The ONR monitors the performance of the power station operator and appoints a site inspector for each station. All significant changes to the plant or to its operating procedures are subject to approval by the ONR.

Although subject to monitoring by the ONR, the licensee, NG, is self regulating. It has an independent internal safety and oversight department. All significant proposals for changes to plant or operating conditions are referred to these departments for Independent Nuclear Safety Assessment before they are put into effect. Each station has a Nuclear Safety Committee that advises on safety matters and is required to approve all significant changes to the safety case before they are submitted to the ONR. The membership of the Nuclear Safety Committee consists of the Station Director, senior safety officers of the company and independent safety experts.

5.1.3 Design philosophy

Nuclear power stations are designed so that failures and malfunctions can be tolerated without the risk of a release of radioactivity. The objective of the safety case is to assess risks and demonstrate that, in the event of any credible accident; the reactor can be shutdown and cooled without the risk of failure of the fuel cans. The reliability of safety systems is secured by the design principles of redundancy, diversity and segregation.

Redundancy is the provision of duplicate plant items in excess of the number that can be foreseen as necessary. Redundancy enables safety systems to perform satisfactorily even if individual plant items fail to perform on demand. It also allows items to be taken out of service for maintenance.

Redundancy may not, however, be sufficient if there is a common failure mode. A row of pumps which rely on a common electrical supply would be of no use if that supply were to fail. Even if they have electrical supplies from a variety of sources, there may be an unforeseen fault, for instance a substandard batch of bearings, which might conceivably cause breakdowns at a critical time. Important safety systems are therefore provided with diversity: they are duplicated by alternatives of a different type or design. All the nuclear power stations have diverse trip, diverse shutdown and diverse post trip cooling systems.

Redundant and diverse systems located within the same area may still be subject to a common form of mechanical damage, for instance fire or flooding. The final stage in securing reliability is therefore segregation. Diverse systems are kept apart, or if this is not possible, are separated by suitable barriers.

Detailed consideration has been given to hazards which might damage the plant. Appropriate protective measures have been incorporated such that the worst damage that might potentially be inflicted by each hazard would not prevent safe reactor trip, shutdown and post trip cooling. The more significant hazards originating from outside the station include flooding, earthquakes and extreme winds. Aircraft impact is treated differently because it is not practicable to consider all possible effects in detail; a probabilistic argument is therefore used instead. It is shown that the likelihood of a crash causing damage leading to a release is acceptably low, and is within guidelines drawn up by the ONR. The more significant hazards originating from within the plant include fire, steam release, hot gas release (AGRs) and loads dropped from cranes.

5.2 Management system

Periodic Safety Reviews assess the risk of any potential faults arising within the reactor and reactor support systems and compare the results against the company's Nuclear Safety Principles in order to:

- confirm that the installation is adequately safe for continued operation within the current safety case/safety assessment;
- identify and evaluate any factors which may limit the safe operation of the plant in the foreseeable future;
- identify any safety enhancements that are reasonably practicable.

The assessment encompasses not only all radiological risks from the reactor but also considerations of criticality safety, the fuel route and radioactive waste treatment plant. The assessment covers plant-based faults, internal hazards such as steam release and external hazards such as seismic, high winds, climate change leading to rising sea levels and flooding amongst

others. The assessment encompasses current national and international standards which set industry best practices e.g. IAEA. The review also considers operating experience gained within the company, the global nuclear industry, e.g. Fukushima, and through global high hazard industry events.

Nuclear safety reviews employ:

a) Expert assessment of the design and system of operation including all relevant scientific, technical and human factors, plus good engineering practice. They also take into consideration accepted precedents and recognised codes and standards.
b) Structured safety arguments demonstrating the acceptability of the topic under review by assessment against Deterministic Principles and, where relevant, against the Probabilistic Principles, the Doses to Workers Principle and Methods for Supporting Safety Case Claims.
c) Appropriate quality assurance arrangements for the design, procurement, construction, installation, commissioning and operation of structures, systems and components. Similarly, appropriate arrangements are required for the production of nuclear safety documentation of adequate quality.

5.2.1 Maintain Design Integrity

The Maintain Design Integrity process ensures that the design intent is met and that, where changes are made to the design, this is done in a controlled manner and rigorous configuration control is maintained over the reference plant documentation.

Plant changes may result for a number of reasons, including: self modification (ageing), obsolescence, operating experience, periodic reviews (e.g. safety system reviews or periodic safety reviews) or enhancements.

Design changes may arise in a number of other company processes, including asset management, risk management, outage management, emergency preparedness, procurement and materials management, waste management, environmental management, operational experience, security, radiation protection, human performance, industrial safety and corrective action.

Some plant design changes are identified and scheduled well in advance of the work whereas other plant changes result in plant breakdown requiring urgent action. Irrespective of the motivation for the work, any change to plant and/or the safety case will be subject to the Maintain Design Integrity process.

5.2.2 Beyond design basis faults

It is recognised that there are certain highly improbable extreme fault conditions for which there is no specific design provision. These are termed "beyond design basis events". These could in principle arise either from extremely unlikely initiating events which are inherently severe enough to cause extensive plant damage, or from extremely unlikely sequences of events in which the many levels of designed-in 'defence in depth' fail following a more minor initiating event.

Our safety management arrangements are based around:

- Demonstrating plant resilience to beyond design basis initiating events, in particular an absence of 'cliff-edges' just beyond the design basis so as to provide confidence in the existence of a healthy safety margin.
- Maintenance of the reliability of the plant required to provide the designed defence in depth, so that the sequential failure of that plant is avoided with high confidence.
- Provision of advice to the operators on how to regain control of the plant should there be challenges to the above.
- Provision of remotely stored Deployable Back Up Equipment and arrangements/instructions to use it, so as to increase the levels of defence using supplementary means of delivering the essential safety functions should all the above fail.
- Provision of advice about the objectives/actions to mitigate the risk to the public should none of the above prove effective.

If an event at any station is, or threatens to become, a significant challenge to the operators, we activate a highly developed, exercised and tested set of company Emergency Preparedness processes to support the affected station(s). These arrangements involve bringing all the relevant company resource to bear in managing the event, and would always be activated if a beyond design basis event were to occur.

6. Radiation exposure (to workers and the general public)

6.1 Radiation dose to workers

NG is committed to a robust radiological protection programme to safeguard staff.

6.1.1 Policy statement

NG has a radiological protection policy that states:

"EDF Energy Nuclear Generation is committed to maintaining a comprehensive radiological protection programme to safeguard staff, contractors, visitors and the general public against the hazards of ionising radiation arising from its operations. Our approach is to ensure compliance with all applicable regulations, emulate best nuclear industry practices and to work to a common fleet standard. We will strive to ensure that any exposure to ionising radiation is kept as low as reasonably practicable."

6.1.2 Policy standards

1. Radiological protection of workers is paramount in the planning and execution of work involving ionising radiation. Work must be fully justified in terms of its net benefit.
2. Work activities will be planned, specified and implemented in such a manner as to ensure that individual and collective radiation doses are maintained ALARP.
3. Whenever practicable, engineered and physical control measures will be employed to minimise radiological risks in the work place.
4. Radiological protection infrastructure will be provided to ensure that the radiological protection programme is adequately implemented and maintained.
5. Adequate radiological protection monitoring instrumentation and personal protective equipment will be provided to ensure the safety of workers.
6. Corporate and station ALARP Committees will periodically review radiological performance with a view to improving radiological protection standards and reducing radiation dose to workers.
7. Best nuclear industry practices will systematically be deployed to improve overall radiological protection programme standards. Common radiological practices and processes will be deployed wherever possible.
8. Radiological protection control measures and performance will routinely be reviewed and corrective actions implemented when required.
9. Training and instruction will be provided to equip workers with the knowledge required to work safely in Radiation Controlled Areas (RCAs).
10. Controls and supervision will be provided to oversee the safety of persons required to enter RCAs.
11. Coaching will be encouraged in RCAs to re-enforce good practices and behaviours and correct sub-standard practices and behaviours.
12. Workers are expected to obey radiological protection rules, minimise the dose they accrue, limit the generation of radioactive waste and to correctly use personal protective equipment and monitoring instrumentation.
13. Any workers who purposely disregard radiological protection rules or instructions will, in the interest of their own and other worker's safety, be barred from entering RCAs until their management has instituted remedial action to prevent a recurrence.
14. Counselling and reassurance monitoring will be made available when appropriate to workers in instances where an individual has radiological concerns.

6.1.3 Management system

Radiological protection is one of the key processes within our company (see our management systems model, Figure 5).

We have dedicated radiological protection personnel and a radiological protection programme in place to set standards, measure compliance and drive continuous improvement.

We have adopted a 'programme of health' based on WANO's performance objectives and criteria, together with a set of performance metrics that are routinely reviewed and reported. Regulatory compliance is monitored by an internal control process linked to the 'programme of health'. Anomalies that are identified are analysed, reported and addressed.

Our radiological protection improvement plan focuses on processes, training, instrumentation, manpower and benchmarking. The plan is aimed at addressing performance gaps and replicating best practices across the fleet. We measure delivery and station implementation.

Independent corporate surveillances are undertaken at stations to assess the adequacy of radiological protection outage programme control measures, and progress to implement radiological protection improvement plans to the fleet standard.

Radiological protection of workers is paramount in the planning and execution of work involving ionising radiation. Work is fully justified in terms of its net benefit and risks from work with ionising radiations are assessed within a formal process linked to all work performed. A radiological risk assessment is carried out by a radiation safety engineer for each task performed inside the RCA and radiological safety work permits are issued to personnel that specify radiological precautions. All work activities are planned, specified and implemented in such a way as to ensure that individual and collective radiation doses are maintained ALARP.

Training and instruction is provided to equip workers with the knowledge required to work safely in RCAs. Workers undergo induction training and job orientation. In addition, simulator training has been developed to train personnel and contractors to an agreed standard, covering fundamental requirements for working in and exiting contamination areas. Mock up training facilities have also been provided which simulate the reactor and plant. These help to train workers to safely execute work in high risk radiological areas. This training has resulted in improved standards and has contributed to further reducing the radiation dose that workers receive.

Workers are expected to adhere to radiological protection rules, minimise the dose they accrue, limit the generation of radioactive waste and to correctly use personal protective equipment and monitoring instrumentation. The programme is focused on:

- controls and supervision to oversee the safety of radiological workers;
- coaching is encouraged in RCAs to encourage good behaviours;
- improving the engineered and physical control measures to minimise radiological risks, where practicable;
- providing best practice radiological protection monitoring instrumentation and appropriate personal protective equipment;
- establishing best working practices to minimise the risk of inadvertently releasing contaminated equipment.

Our reactor design and comprehensive radiological programmes have ensured that our station collective radiation dose performance is among the best in the international nuclear power industry.

Together with our contract radiography companies, we have introduced a unique radiography inspection technique which is regarded as a world best practice as it reduces the risk associated with this work.

Corporate and station ALARP committees periodically review radiological performance with the objective of improving radiological protection standards and reducing radiation dose to workers.

We have never had an incident resulting in a significant uptake of radioactivity by a worker and no worker has received a radiation dose above the legal limit. In the highly unlikely event that a worker be exposed to a dose above the statutory dose limit, reporting procedures are in place and specialist staff would be engaged in counselling the individual about the dose received. However, at these levels no specialist treatment would be required. Should the dose to the individual be truly excessive then there are specialist hospitals designated for the treatment of casualties exposed to very high levels of radiation and the individual would be referred to one of these for treatment.

6.2 Radiation dose to the public

The main source of radiation dose to the public from our operations is the potential impact of radioactive discharges to the environment.

6.2.1 Policy

Recognising our duty to care for the environment, we have a special obligation to ensure our nuclear power stations are operated in a manner that safeguards the public and the environment.

EDF Energy has an Environment Policy within which we are committed to ensure every job will be done safely to protect the environment, employees, contractors and the communities that could be impacted by our operations.

We seek continuous improvement in our environmental performance and comply with all applicable legal and other requirements by:

- reducing the environmental effect of our activities, products and services to a practicable minimum by the prevention of pollution, reduction of waste and the efficient use of resources;
- promoting the efficient use of energy;
- continuing to develop a sense of environmental responsibility among staff and contractors;
- openly reporting performance against environmental targets;
- assessing the impact of our operations on biodiversity and implementing opportunities for enhancement.

NG's approach to environmental management is informed by the following standards:

- Clear compliance criteria are defined for all environmental permits, authorisations and consents that, if met, will ensure we remain within the strict requirements of the regulations.
- Best Available Techniques (BAT) or Best Practicable Means (BPM) are used where required.
- Clear and documented support is obtained from the environmental regulatory bodies for our interpretation of their environmental permits, authorisations and consents.
- We work with the environmental regulators to ensure our permits, authorisations and consents are based on sound science and are documented to avoid uncertainty in scope or interpretation.
- Activities are planned, specified and implemented in a manner that achieves environmental excellence.
- Plant is operated within the bounds of permits, authorisations, consents and other applicable environmental regulations.
- Plant design and operating margins are recognised and carefully guarded at all times by investigating and resolving problems promptly.
- Equipment is maintained so that it can perform fully as required in permits, authorisations and consents and other applicable environmental regulations.
- Operational decisions and actions are based upon the need to maintain margins of compliance to environmental limits.
- Decisions are made, based on the fullest information available, toward a long-term view of operation.
- Fostering a positive culture that is characterised by communications founded upon mutual trust and by shared values that recognise the importance of excellent environmental performance.

6.2.2 Management system

EDF Energy's Environment Policy includes a statement that: "The Executive Team will ensure that EDF Energy operates an effective certified environmental management system."

In NG's Environmental Management System (EMS) we identify, plan and mitigate the risks associated with any operations with the potential to adversely affect the environment. We do this by:

- Establishing, implementing and maintaining a documented procedure(s) to control situations where their absence could lead to deviations from the environmental policy, objectives and targets.
- Stipulating operating criteria in the procedure(s).
- Establishing, implementing and maintaining procedures related to the identified significant environmental aspects of goods and services used by NG and communicating applicable procedures and requirements to suppliers, including contractors.

Broadly, there are two types of environmental documents that make up the EMS. The first type describes specific environmental processes that are generally applicable to all environmental regimes e.g. maintenance and operation of equipment and training of staff. The second type specifies how the company complies with particular "major" environmental legislation.

Each operational site has Environmental Specifications that are the mechanism for satisfying the above requirements from the Central Control Room. These cover both radiological and non-radiological environmental processes.

7. Security

NG recognises the value of the people, physical assets, information and systems that it utilises to undertake its business and the necessity to protect them.

7.1 Policy

Security is about protecting our physical assets and information, our staff, and the public from any event which could adversely affect the integrity of our assets or availability of information. Security is also about ensuring that the right systems, processes and procedures are in place to deliver safe, secure and responsible nuclear electricity. The risk of theft or non-civil misuse of nuclear fuel is fully taken into consideration by EDF Group companies, in strict compliance with the requirements of international organisations (IAEA, European Atomic Energy Community - EURATOM) as complemented by national regulations.

There are a series of safety and security measures in place at each of our nuclear power stations in addition to the inherent physical security provided by the robust design of the nuclear reactors. Access to nuclear power stations is strictly controlled and armed police are deployed at the UK's nuclear sites to complement existing security measures. The Civil Nuclear Constabulary (CNC) is a specialised armed force whose role is the protection of civil nuclear sites and nuclear materials. The overall purpose of the CNC is to deliver an effective and efficient armed response capability to ensure security against a specified threat.

EDF Energy's security policy takes account of the business drivers and perceived business risks as well as our obligation to fulfil security requirements of the ONR Civil Nuclear Security (CNS), the security regulator for the civil nuclear industry in the UK. It is this responsibility to address these risks that differentiates NG from other, equivalent, non nuclear organisations. This responsibility also drives us towards the need for high quality security regimes that align with achieving zero harm and being a sustainable business. They also require the optimum balance of physical, technical, operational, personnel and information security requirements.

The objectives of our security policy are to ensure that EDF Energy organisational units and controlled subsidiaries:

1. Identify threats to the security of: our staff while they carry out their work; contractors working on our sites; visitors to our site; nuclear sensitive information; our commercially sensitive information; commercially sensitive information supplied to us under contractual arrangements; customer information that is entrusted to us; staff personal information held by us; our physical assets.
2. Have arrangements in place to control such threats in an economic manner.
3. Meet legislative and regulatory requirements relating to security.
4. Meet the expectations of key stakeholders relating to security and in doing so protect EDF Energy's reputation and brand from damage.

7.2 Management system

NG takes security very seriously and recognises that people working in the civil nuclear industry and the public at large, are entitled to a safe and secure civil nuclear industry environment. Security staff are routinely trained, exercised and developed, and security systems are subject to regular checks and evaluation.

Civil nuclear security in the UK is regulated by the ONR (specifically, the CNS, which is the section of the ONR responsible for nuclear security).

The ONR conducts its regulatory activities on behalf of the Secretary of State for DECC under the authority of the Nuclear Industries Security Regulations 2003 (NISR 03), as amended in 2006. It works in close conjunction with nuclear security policy officials in DECC and with other government departments and agencies and with overseas counterparts. It is responsible for approving security arrangements within the industry and ensuring compliance with NISR 2003 which is enforced in the form of a Security Policy Framework and the National Objectives, Requirements and Model Standards, covering all aspects of security.

Through NG's Corporate Security function a management system has been established, comprising operational (including armed police), physical and technical information and personnel security controls, supported by processes, standards and guidelines that meet both our business and regulatory requirements. All staff are made aware of security requirements and trained appropriately. In particular they are made aware of their individual security responsibilities, regulatory compliance and event reporting. The system also demonstrates how NG achieves compliance with nuclear site licence conditions and applicable security, regulatory and legal requirements as well as meeting the prime security requirements of the business. NG's approach to security is risk based and designed to ensure that appropriate and proportionate controls are implemented and maintained; to ensure a safe and secure environment. The perceived security risks are assessed and subjected to regular internal and external review. The risk profile covers all the perceived security threats to the business from normal crime and malicious behaviour through to protestor disruption, cyber attacks and terrorism. As part of the process of continuous improvement, the security regimes are developed in the light of operational experience in the UK and abroad, and appropriate use is made of developing technologies, capabilities and processes. Frequent internal security assessments and external regulatory security inspections provide the basis for effective and dynamic security regimes. The overall state of security in the civil nuclear industry in the UK is given by the ONR (CNS) in its annual report 'The state of security in the civil nuclear industry and the effectiveness of security regulation'. The report provides an independent reflection on security performance.

8. Nuclear waste

8.1 General and operational waste

Our overriding priority is safety and we strive for a zero harm record. As a minimum we aim to comply with all relevant environmental regulations, standards and other codes of practice.

8.1.1 Policy

In order to achieve our goals we have a suite of governance arrangements to manage conventional and radioactive waste across the fleet.

In the context of radioactive waste and spent fuel management, as far as reasonably practicable, we have the following aims:

- reducing generated radioactive waste and optimising spent fuel
- effectively using the waste management hierarchy
- using reprocessed uranium in our existing fleet of power stations where appropriate.

NG is committed to working on future improvements in spent nuclear fuel and radioactive waste management and as such, we work together with the wider EDF Group to identify synergies.
Currently two key areas of interest are the reprocessing and/or long term storage options for spent fuel and the potential for optimising waste management options. These areas are reviewed as technologies and capabilities develop. NG continues to explore the options for reusing spent fuel material in future reactor designs and continues to fund research in this area.

NG is committed to continuous improvement in all areas of its business including Radioactive Nuclear Fuel and Waste Management.

8.1.2 Management system

We manage our nuclear waste under our EMS which is explained in section 6.2.2. We will seek to reduce the generation of all types of waste, both conventional and radioactive, to a practicable minimum.

The responsibility for radioactive waste management belongs with each NG site, as required by the Nuclear Site Licence Conditions. The safe management of radioactive waste on nuclear licensed sites in the UK is regulated by the ONR under the Nuclear Installations Act 1965 (as amended). Radioactive waste disposal is regulated by the Environment Agency in England and Wales and by the Scottish Environment Protection Agency in Scotland.

In the UK, solid radioactive waste is defined by the following categories:

Lower Activity radioactive Waste (LAW)

- Very Low Level Waste (VLLW) – with exempted or permitted radioactivity
- Lower Activity – Low Level radioactive Waste (LA-LLW)
- Low Level Waste (LLW).

Examples of LAW could be: redundant equipment; waste from maintenance activities; plastic; rubble; old protective clothing from our nuclear power stations; used filters and resins.

Higher Activity radioactive Waste (HAW)

- Intermediate Level radioactive Waste (ILW)
- High Level radioactive Waste (HLW).

HLW results from the reprocessing of AGR fuel at Sellafield. HLW contains high levels of radioactivity which generates heat. There is no HLW stored on any EDF Energy power station. It should also be recognised that spent nuclear fuel is not considered to be waste but a zero value asset.

8.1.3 Waste disposal routes

Provided the radioactive waste meets specific criteria, each category of radioactive waste is managed as follows:

- VLLW: Consigned for landfill or off-site incineration*
- LA-LLW: Sent off site for treatment and/or disposal*
- LLW: Sent for treatment and/or disposal
  - Volume reduction by supercompaction
  - Recycled at a metals recycling facility
  - Volume reduced at a high temperature incinerator
  - Disposal - LLW may be disposed of at the national Low Level Waste Repository (LLWR).

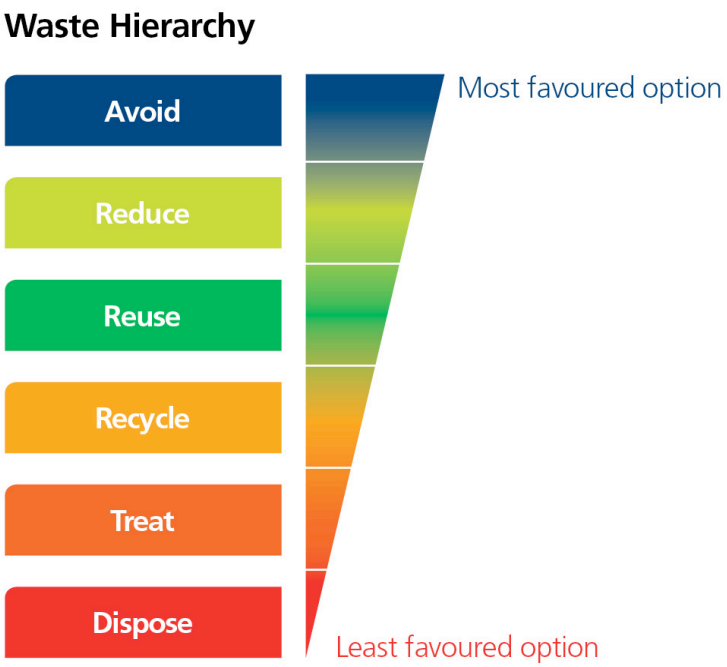
- ILW: Stored in purpose built facilities for radioactive decay and/or pending packaging for disposal. Where the capacity of plant storage facilities does not meet the volume of operational arisings, the relevant wastes are packaged to the anticipated requirements of a future national repository (for English stations). They are then placed in on-site interim storage. Scottish national policy differs in so far as ILW will be packaged in preparation for long term storage in Scotland.

- HLW: Under historic contractual arrangements, spent fuel from our AGRs is transported to Sellafield for reprocessing or storage. Once processed, HLW exists in the form of glass contained within stainless steel canisters for long term storage at Sellafield. HLW is not stored at any of our sites. Spent nuclear fuel is not currently classified as waste since it can be reprocessed to extract uranium and plutonium for re-use. However, unprocessed spent fuel will require disposal using a similar approach to ILW. At our Sizewell B PWR station spent fuel is stored on site until a final decision is determined on how it will be disposed of. We are building a new facility to enable accumulation of the station's spent fuel until the end of its operational life. Currently, the government's policy for the management of spent fuel from Sizewell B is that it will be directly consigned from on site storage to a national disposal repository. Disposal of spent fuel from Sizewell B will not occur for a number of decades.

* NG does not yet directly use these disposal routes but we are preparing to review viability.

We have a process called Sustainable Approach to Waste Management (SAWM), which aims to improve our performance whilst integrating with existing related company processes. A new Fleet Strategy (FS) for waste, Radioactive Waste Improvement Plan and Technical Baseline and underpinning Research and Development documents have been issued, the requirements of which will be implemented across the fleet. SAWM, through the FS, will develop and manage the use of performance indicators. Fleet strategy and waste management practices are defined through a suite of company specifications for all waste types, for which compliance and BAT are routinely reviewed. Consideration of the waste management hierarchy underpins these company specifications to ensure that waste disposal to land is always the final option. The waste management hierarchy provides a framework for preventing, minimising, treating and disposing of waste.

Figure 6: Waste management hierarchy



Our arrangements for the management of radioactive waste ensure:

- Radiation doses to the workforce and the general public from radioactive waste management operations, including disposal, are within legal limits and are ALARP.
- We apply BPM and BAT to ensure the generation of radioactive wastes is minimised as far as is reasonably practicable.
- We dispose of all wastes as soon as practicable where a safe and economic route has been established.
- We maintain safety cases for all waste management activities including handling, accumulation and storage of wastes.
- By closely working with our supply chain, we develop technology and processes required for the safe retrieval, treatment, packaging and interim storage of wastes.
- We co-operate with other UK waste producers on radioactive waste policy and strategy issues and manage major stakeholder relationships effectively.
- We maintain an inventory and records of radioactive waste arisings, accumulations and disposals.

The following principles underpin the objectives and arrangements identified above:

- Radioactive waste will, at all times, be adequately controlled and/or contained so that it cannot leak or escape.
- Radioactive waste will be accumulated and stored in a manner that is safe.
- Radioactive wastes will be characterised in terms of the rate of arising, the chemical, physical and radiochemical composition.
- Radioactive wastes with different chemical, physical and radiochemical properties will be segregated where practicable.
- Radioactive waste volume reduction and decontamination techniques will be employed where practicable.
- Radioactive wastes for which there is no available disposal route will be safely stored pending the availability of a disposal route.
- The condition of radioactive waste stored on site will be monitored in accordance with site licence requirements.
- For each radioactive waste stream, the optimum method and timing for the retrieval, processing and packaging will be determined, taking account of safety, costs, the availability of a disposal route, the decommissioning strategy and non-foreclosure of future options.
- Our governance arrangements ensure that our systems for processing and packaging radioactive wastes meet the requirements of future final disposal facilities.

8.2 Spent fuel

EDF Energy is committed to applying the principles of sustainable development to all its activities.

8.2.1 Policy

Within NG we apply this in the context of Nuclear Spent Fuel by:

- Giving the highest priority to safety and the protection of people and the environment, and playing a leading role in the drive for continuous improvement in these areas across the worldwide nuclear industry.
- Maintaining responsibility for managing our wastes including working with key external stakeholders to demonstrate real progress towards implementing a long term UK radioactive waste solution for the industry.
- Ensuring there is both the funding and know how available to future generations to deal with the decommissioning and waste management needs of our stations.
- Being open and transparent in these businesses and demonstrating we can be trusted to act to the highest professional standards in relation to nuclear security issues.
- Not allowing nuclear materials from our business to be used for non-peaceful purposes. This is a legal requirement in the UK.
- Supporting development within the UK of the skills necessary to sustain these nuclear businesses through our work with schools, universities and other bodies.

NG is demonstrating the above through numerous programmes of work and control systems, these include:

- Nuclear Material Accountancy, which ensures that all of NG's nuclear material is accounted for at all times.
- Continuous learning though the active engagement in a CAP, OPEX, self assessment and benchmarking programmes to support our continuous improvement across our entire nuclear business.
- Research and development of new fuel types and designs to improve efficiencies and fuel utilisation to minimise spent fuel arisings.
- Investment in Post Irradiation Examination of fuel and components to ensure our plants are operated as safely and efficiently as possible.
- Supporting Campus (EDF Energy's online learning portal for employees) through provision of expert knowledge for training of our staff, contract partners and other organisations who are involved in the handling, transportation, storage and management of spent fuel and waste.

8.2.2 Management system

The responsibility for spent fuel on NG's nuclear licensed sites rests with EDF Energy Nuclear Generation Limited as Licensee. The safe management of spent fuel is a primary focus in delivering safe operation and our Zero Harm targets.

Spent Fuel is handled under carefully controlled conditions and the process is managed and operated by SQEP individuals. The spent fuel management on station includes dismantling, cooling, temporary storage, containment, loading for transport and finally, despatch off-site. The processes for spent fuel management on station are unique to individual stations to maximise safety and efficiencies on site. The operation and maintenance of the transport flask is set and controlled via the Package Operations and Maintenance Manual the requirements of which are incorporated into station working documentation.

All of these processes are carried out under controlled procedures to ensure safety and compliance at all times. The processes are constantly reviewed by the SQEP individuals carrying out the tasks and any improvements are identified via the CAP system.

The participation in the CAP, OPEX, self assessment and benchmarking processes underpins the continuous improvement that is present in all NG activities including spent fuel management.
The Operational Experience from the NG business is not only used internally but shared with the rest of the nuclear industry around the world to ensure that lessons are learned and all opportunities for improvement are global. NG also actively reviews OPEX from not only the UK Nuclear Industry but also the rest of the world and we have nominated individuals to ensure that these areas of learning and opportunities for improvement are maximised. OPEX is available via internal IT systems and is also discussed at pre-job brief and regular team briefings.

Changes to the management system for spent fuel can often have an impact on other companies and organisations. Therefore any changes are communicated to other organisations. Our staff are highly trained and we also support the training of our key contract partners and other supporting organisations.

All processes for loading, cleaning, monitoring and transporting the flasks are thoroughly verified to ensure that they are radiologically compliant. All activities are carefully carried out and documented to ensure that safety, security and compliance is maintained at all times.

Spent Fuel from our fleet of AGR stations is transported to Sellafield for either reprocessing or long term storage in line with the government policy managed via the Nuclear Decommissioning Authority (NDA).

All personnel involved in these processes are specifically trained and authorised to do so with ongoing training provided. Personnel who are authorised to consign radioactive materials are required to undertake specific training on a nationally recognised training course. In NG we have a dedicated highly trained central team to manage the logistics of movements of fuel and the maintenance and compliance of the transport flasks. Regular inspections of these processes are undertaken by both our internal regulators and ONR.

NG also participates in nuclear industry working groups to investigate and address industry opportunities for improvement in both the management of spent fuel and its transportation.

NG monitors performance of the systems described above and the performance and progress is reported both internally and externally.

8.3 Decommissioning and waste

The company as owner operator and licensee is responsible for ensuring the safe decommissioning of all of the nuclear power station sites.

8.3.1 Policy

The company decommissioning policy, strategy and plans have evolved over a number of years and have been developed using multi-attribute decision analysis to ensure that the best practicable environmental option is being pursued. The strategy and plans take due consideration of the nuclear, industrial and environmental safety implications. The company policy and strategy objective of decommissioning is to return the power station sites to a state suitable for unrestricted alternative use.

It should be emphasised that NG remains responsible for the decommissioning of our existing power station sites. The responsibility for discharging all aspects of the decommissioning works and management of the associated wastes rests with NG. (The decommissioning responsibility does not transfer to the NDA following end of generation). The role of the NDA, as agent for UK Government/Secretary of State, is to administer the Liabilities Management Agreements, including the approval of Nuclear Liabilities Fund (NLF) payments for decommissioning and waste management.

The funding for NG power station decommissioning and waste management comes primarily from the NLF, but also from EDF Energy/EDF Group Accounts.

The decommissioning strategy, policy and plans are subject to regular review. At minimum, a 5 yearly review of the plans is undertaken. This commitment to review ensures the plans reflect best practice, take advantage of OPEX from ongoing decommissioning projects and remain consistent with national and international policy and legislation. In developing our decommissioning plans and strategy NG has worked with experienced contractors involved in the Magnox fleet decommissioning and international decommissioning projects. We actively participate in a range of industry decommissioning forums, including those focussed on associated research and development into decommissioning and waste management.

It should be noted that no decommissioning has yet been carried out for any of our nuclear stations and this remains some years off. However, detailed baseline decommissioning plans (BDPs) for each of our power stations are in place. These plans have been developed over a number of years and have been formally approved by our regulators and the NDA.

The BDPs include site-specific detail on each individual decommissioning activity and process including the requirements to transition from an operational site to a decommissioning site following end of generation. The transition from operation to decommissioning includes consideration of the associated resourcing and training requirements.

The BDPs include detailed decommissioning work scope, schedules, and costs and include a comprehensive decommissioning radioactive waste inventory – which is the basis for the company's annual inventory return. The inventory of decommissioning waste reported in the national UK radioactive waste inventory, the latest edition being "The 2013 UK Radioactive Waste Inventory", February 2014.

The estimates of decommissioning waste inventory are robust and based on comprehensive waste assay and characterisation. The decommissioning waste inventory will be maintained and formally reported throughout the decommissioning period to reflect the actual, in practice, waste inventory as it arises. This OPEX will be used to refine any subsequent decommissioning waste estimates.

Any potential impacts of our operational activities on the agreed decommissioning plans are assessed and summarised in an annual review and formally reported to the NDA within the "Annual Liabilities Report: Part 1" (ALR1). The ALR1 provides a formal route for recording changes in our NG decommissioning and waste liabilities which may have occurred over the previous financial year.

We are focused on ensuring that there are no breaches in minimum performance standards which would potentially result in a detrimental impact to decommissioning (increase cost, wastes etc).

8.3.2 Spent Fuel Management during decommissioning

Currently all spent fuel from the AGR is transferred off-site to Sellafield for long-term storage or reprocessing. For PWR (Sizewell B) the current long-term spent fuel management plans include a purpose built facility at the Sizewell site. The spent fuel will be stored on site until national facilities are available for off-site disposal of fuel.

Radioactive wastes that arise during decommissioning will either be stored or disposed of depending on the availability of appropriate disposal routes, in accordance with UK Government and Scottish Government policies, noting that radioactive wastes will be disposed of where a disposal route exists.

The LLWR site near Drigg in Cumbria is currently available for the disposal of operational and decommissioning LLW within the constraints of its acceptance criteria and is expected to remain operational until at least 2050. It is Government intent that a National Repository (Geological Disposal Facility - GDF) for ILW will be constructed, although it is presently not expected to be available before 2040.

NG's decommissioning plans detail the sequence for dismantling the stations and calculate the amounts of radioactive and non-radioactive material that will be created. These plans use sustainability and recycling principles to ensure materials created are stored, recycled and disposed of in a manner consistent with safety and environmental legislation.

In this context, 'disposed of' reflects the strategic end point assumption for the waste when the waste has been conditioned/packaged, emplaced within the GDF and the GDF facility is closed. For the waste strategic end point - waste disposed of to GDF - there are no alternative strategic options, this is the end state.

The inventory of materials projected for NG during decommissioning periods is contained in the latest publication of the National Inventory Statement.

8.3.3 Management system

NG has a document that specifies the arrangements by which decommissioning of our power stations will be controlled to ensure compliance with all statutory and mandatory requirements. It describes the regulatory compliance (Site Licence), interface requirements and arrangements necessary for managing decommissioning at NG's power stations.

Radioactive wastes will be managed in accordance with the Corporate Radioactive Waste Management Strategy and the Integrated Company Practice for Environmental Compliance and Management.

In addition to our ISO 14001 accreditation, the Sizewell B plant has attained registration to the European Eco-Management and Audit Scheme, demonstrating that environmental concerns are fully integrated in our business. There are site and central teams and specialists whose role it is to investigate and define environmental policies, strategy, standards and procedures, monitor compliance and provide advice on best practices.

The Company's environmental policy will continue to apply to its decommissioning sites.

9. EDF Energy Nuclear Training

Our training mission is: "to provide the right training to the right people at the right time".

9.1 Policy

Nuclear Site Licence Condition 12 requires NG to only use SQEP to perform safety related work. This requirement has been achieved through the implementation of a systematic approach to training which:

- ensures qualified staff can work independently;
- encourages line ownership;
- ensures training is targeted at maintaining and improving performance;
- includes significant investment in training and development infrastructure such as Campus, the Nuclear Power Academy at Barnwood, training buildings and training departments at each power station and new and enhanced simulators at each power station;
- includes development of a human performance and nuclear safety culture programme;
- establishes an independent training standards accreditation board to oversee the process.

Our training policy statement sets the direction and approach. This policy lays the foundations for utilising training for performance improvement, the implementation of the systematic approach to training, line ownership, establishment of training committees and accreditation against internationally recognised training objectives and criteria.

Our training vision is: "Creating world leading nuclear professionals, equipping our people with the knowledge, skills and behaviours to support a high performing business."

Our policy recognises that "training is a critical tool supporting personnel investment and performance improvement. As such, NG is committed to, and accountable for, developing and sustaining training programmes that meet organisational and personnel needs. A systematic approach to training is essential to ensure that training needs are accurately identified, training is effectively delivered to the right audience, and line managers are integrally involved".

9.1.1 Policy standards

1. Training is a key leading indicator to succession management and the long term health of the organisation.
2. Line managers are responsible for the effective training and qualification of their personnel.
3. Line managers monitor personnel performance to ensure that training contributes to safe and reliable plant operation and to identify training opportunities and solutions.
4. Training reinforces management standards and expectations. Training programmes integrate key messages and expectations (e.g. Human Performance) to embed future and expected behaviour.
5. Training provides the knowledge and skills needed for independent job performance and incorporates operating experience from previous internal and external events.
6. Training resources (personnel and facilities) meet the needs of the organisation.
7. Training is developed and conducted following consistent, rigorous processes to ensure effectiveness.
8. Personnel assigned training responsibilities are the organisation's best and can influence others to a higher level of performance.
9. All personnel within the organisation have a responsibility, and a role to play, in the Systematic Approach to Training to deliver these key elements.
10. Training processes, programmes and content will be standardized across the fleet where possible and practical. INPO ACAD 02-001, Revision 0, The Objectives and Criteria for Accreditation of Training in the Nuclear Power Industry, will provide the standards to which training aspires. Satisfactory achievement of these objectives, as determined by independent evaluation, will be the measure of long-term progress/success.

Within NG the Systematic Approach to Training is essential to ensure that:

- training needs are accurately identified through job and task analysis;
- training objectives are defined according to job performance requirements;
- training materials, methods and instructor lesson plans are developed to address learning objectives;
- training is effectively delivered to the right audience and line managers are integrally involved;
- training is evaluated using the 'Kirkpatrick Model'[4] which includes trainee feedback, assessments at end of training sessions to determine objectives of training have been met (such as examination), post training in the field evaluations to ensure knowledge and skills have been transferred to the workplace and performance evaluations to confirm business improvements have occurred;
- while the training organisation owns this process, line managers and supervisors have a responsibility to be involved and to support all phases of this process in order to achieve quality training for their workforce.

9.2 Training Organisation

Our Campus training organisation and Nuclear Power Academy provide a focus for the company-wide improvements, with the role of:

- setting the fleet standards;
- developing and delivering the initial technical training programmes for engineering, maintenance and operations;
- developing and delivering a fleet certified instructor programme;
- coordinating the fleet accreditation programme;
- coordinating the fleet training improvement programme and providing governance;
- maintaining a central apprentice programme for the fleet.

[4] The Kirkpatrick Model comprises four levels: Reaction, Learning, Behaviour and Results.

Each power station and central engineering has established:

- A training department and training facilities (classrooms, workshops with simulators/rigs) with a mandate to provide training which maintains and enhances staff capability.
- Line management-led training committees to drive the training improvement programmes.

9.3 Management of Training

NG has adopted a hierarchy of committees at each of its power stations and centrally, to guide and monitor the training function and to address the various levels of training oversight and ownership. The committees' goal should always be optimising training to improve performance.

The Strategic Training Committees involve the highest level of leadership at the station and in Central Engineering. They concentrate on strategic issues such as ensuring that training is improving staff and plant performance and promoting ownership and stewardship of training by line management. Training Advisory Committees focus on one particular training programme and include the Training Programme Owner and Curriculum Review Committee (CRC) chairs as members. It is the committee's responsibility to promote excellence in training and to evaluate the programme's effectiveness.

An engineer operates the plant remotely from the main control room.

The CRC establishes and reviews training plans, approves learning objectives, reviews course feedback and determines the details of content, scheduling, delivery and evaluation of training programme events.

The use of self assessments is a tool used by the organisation to identify areas for improvement or opportunities for replication of good practices. A programme of training self assessments is undertaken by each area of the business to determine alignment with the training objectives and criteria. The output from these forms a key input to the training committees.

9.4 Accreditation Process

There are three key phases to the accreditation process; a comprehensive self-assessment, Accreditation Team Visit (ATV) followed by attendance and discussion at the Training Standards and Accreditation Board (TSAB).

The purpose of an ATV is to ascertain how plant training and personnel qualification programmes implement the systematic approach to training and address the accreditation objectives. The team is comprised of independent experts who can provide an objective view of the conduct of training. The output from this visit is a primary input into the TSAB meeting.

The TSAB, which is managed via Campus, will be solely concerned with making accreditation decisions on the training programmes within the scope of the process. The decisions will be based on a combination of evidence provided via the previous relevant TSAB report, the stations' self assessment, the ATV report, the ATV team leader's verbal report and the TSAB questioning of the site representatives at the meeting. The TSAB members sit in judgement of the capability and demonstrated performance of the evaluated line and training organisations to ensure nuclear personnel are being trained and qualified to perform their assigned activities safely, reliably and efficiently. By granting or renewing accreditation, the TSAB has judged that the site is able to carry out effective training for the next four years.

In conclusion, we consider training an effective tool to improve the professional performance of individuals and, as a consequence, maintaining and improving safety, reliability and efficiency of our nuclear power plants.

10. Nuclear safety and waste performance

This section outlines our nuclear safety and waste performance from 2012-2014.

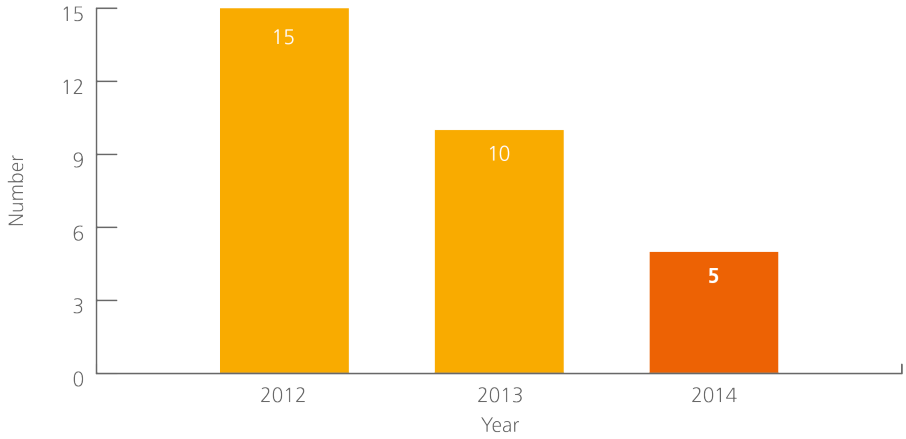
10.1 Incidents and Events

Over the last 6 years, the reactors operated by NG have seen an overall safety improvement linked to a major effort to upgrade the facilities and a strong emphasis on further improving equipment reliability and operational focus.

10.1.1 Nuclear Safety Events

The International Nuclear Event Scale (INES) is a rapid alert system used for consistent communication of events across the nuclear industry. INES applies to any event associated with the transport, storage and use of radioactive material and radiation sources, whether or not the event occurs at a facility.

Figure 7 – Level 1 INES events



These are categorised between Level 1, which is an anomaly with no impact on the safety of the general public or workforce, and Level 7 which represents a major accident. Events that have no safety significance are rated as level 0.

We have had no events rated higher than INES1 in the last 5 years. We had a total of 5 INES 1 events in 2014.

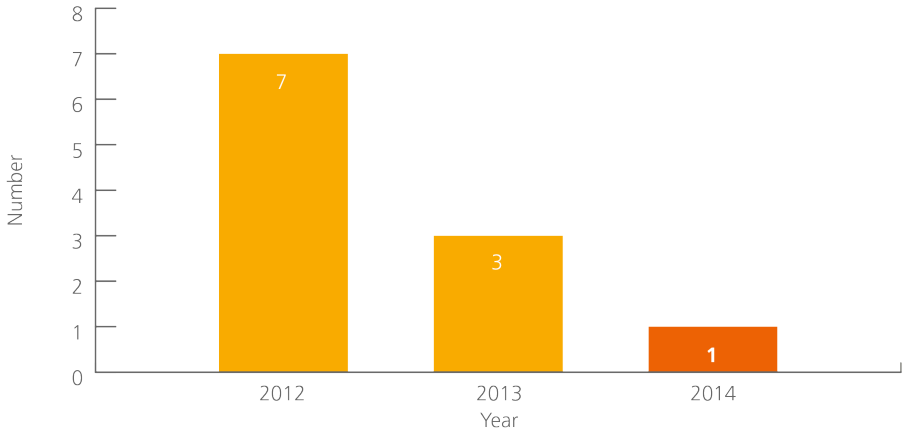
10.1.2 Nuclear Reportable Events

Within NG, an open reporting culture is positively encouraged. As a result a large number of 'conditions adverse to quality' are reported each year. Each of these reports is categorised and allocated either to immediate action, to further investigation or for data trending. A very small number of events are identified as requiring formal reports to the ONR under our nuclear Site Licence Compliance arrangements or the reporting requirements of responsible government departments. The large number of condition reports that are raised within NG is a good indication of the open reporting culture that exists within the business.

The most significant events are known as immediately reportable Nuclear Reportable Events (NRE).

In 2014 we had one NRE that was immediately reportable to the ONR. This was due to the discovery of a defect in a boiler spine at Heysham 1.

Figure 8 – Nuclear reportable events

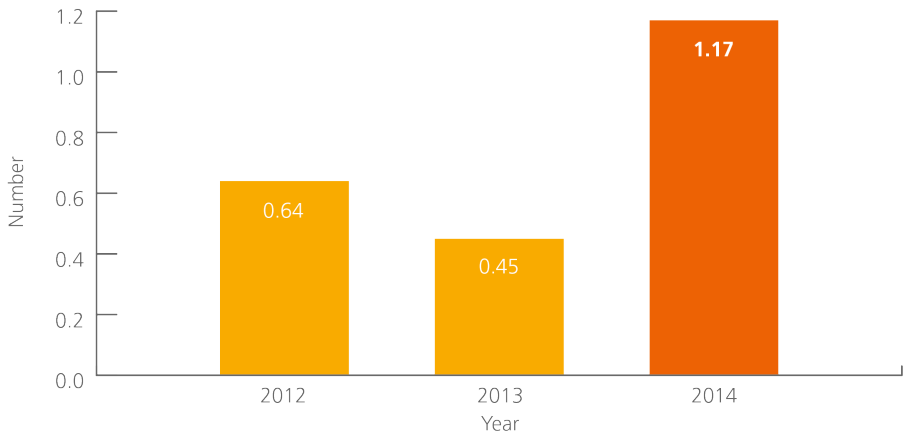


10.1.3 Unplanned plant shutdown

The unplanned automatic trip rate (UATR) is the number of unplanned automatic trips per 7,000 hours of reactor operation as defined by WANO. A low figure indicates that the reactor and turbine are operating safely and reliably.

Increased focus has been given to equipment reliability to ensure that learning from unplanned automatic trips is embedded across the fleet. The overall UATR for all our nuclear stations at the end of the calendar year 2014 was 1.17. This is one of our key performance metrics that we monitor and act on appropriately. At the start of 2014 we identified an adverse trend in the unplanned automatic trip rate and launched an intervention that effectively curtailed (and has begun to reverse) this trend by the end of 2014.

Figure 9 – Number of unplanned automatic trips per 7,000 hours of operation



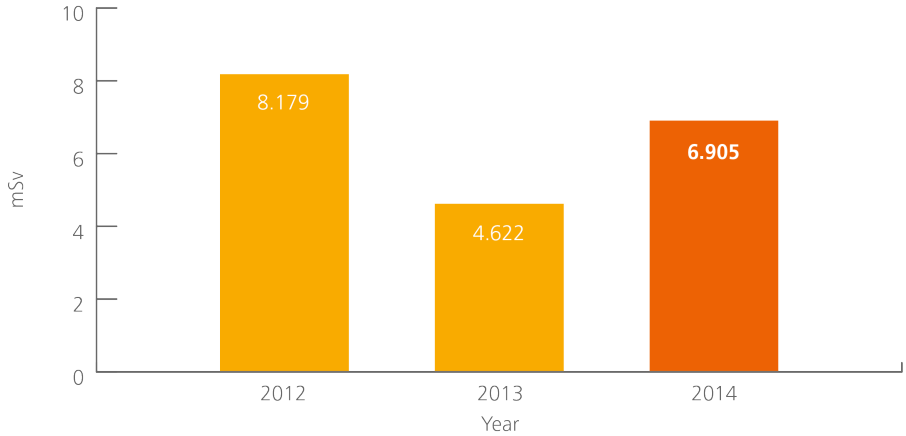
10.2 Radiation Exposure

The dose received by any worker required to enter a radiological controlled area is measured by an electronic personal dosimeter.

10.2.1 Collective radiation exposure (dose)

Radiation dose is measured in units of milli Sieverts (mSv). The legal dose limit is 20 mSv per year. We operate to a lower company dose restriction level of 10 mSv.

Figure 10 – Highest individual dose



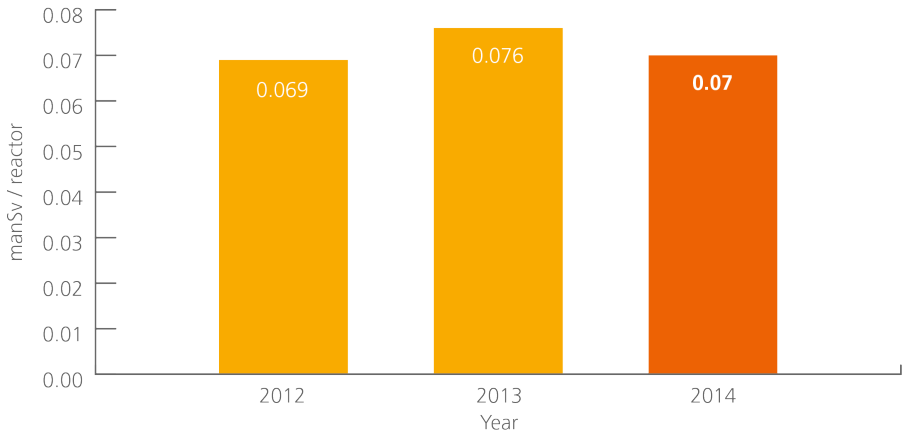
In 2014, the average individual dose received by all our employees and contractors on our sites was 0.062 mSv and 0.112 mSv respectively. The highest individual dose received on our sites in 2014 was 6.905 mSv. This dose was received by a contractor involved with boiler spines work at Heysham 1 and boiler inspections at Hunterston B. Radiological protection performance on NG sites has continued to exhibit year on year improvement with respect to radiation exposure due to enhanced governance, investment in training and equipment. The Collective Radiation Exposure (CRE) in 2014 was higher at Heysham 1 (AGR) in 2014 due to additional work on boiler spine inspections but still remained below the revised company dose target for 2014.

The three year collective CRE provides a good measure of performance as it smoothes out the variations due to the cyclical outage programme.

The three year collective CRE result was better than target. By comparison with other nuclear operators the radiation dose received by workers at NG is low; primarily due to the design of the AGRs, good PWR dose performance at Sizewell B and excellent control of all high dose work performed across the company. NG applies stringent procedures to reduce to a minimum and check the radiation doses received by staff and contractors on all existing sites. Improvements have been made in dose predictions for AGR in vessel work and rigorous ALARP Committee oversight has been exercised.

The three year average CRE for NG at the end of 2014 as defined by WANO was 0.07 manSv/reactor versus a target of 0.079 manSv/reactor. To put this into context, at the end of 2014 the CRE dose for the best performing quartile of stations worldwide was 0.35 manSv/reactor (source: from across WANO centres).

Figure 11 – Company 3-year collective radiation exposure



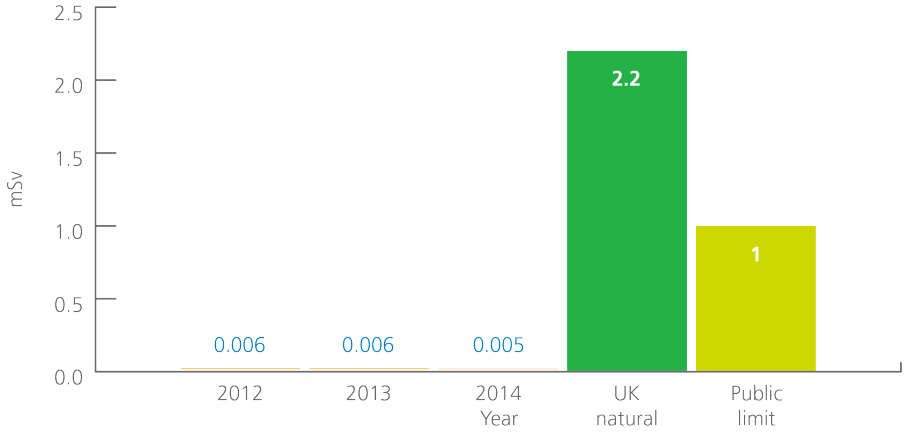
10.2.2 Dose to the most exposed members of the public

We are required to assess the radiation dose to the most exposed members of the public in the vicinity of our sites using the results of environmental monitoring. However, this does not distinguish between the impact of our discharges and those of neighbouring operators. Discharge modelling is used to make a conservative assessment of the impact of our discharges on the local population; the assessment for the three years 2012 to 2014 is given below.

Doses to the public are a very small fraction of the legal limit and the average radiation dose due to natural background in the UK. The maximum dose received over this period (0.005 mSv in 2014) is equivalent to the natural radiation dose received during a single flight from London to Rome.

The consistent level of very low public dose from 2012 to 2014 is evidence of the company's successful efforts to employ best practicable means to minimise the impact of its discharges on the public (a formal requirement of our discharge permits).

Figure 12 – Dose to the most exposed member of the public



10.3 General and operational waste performance

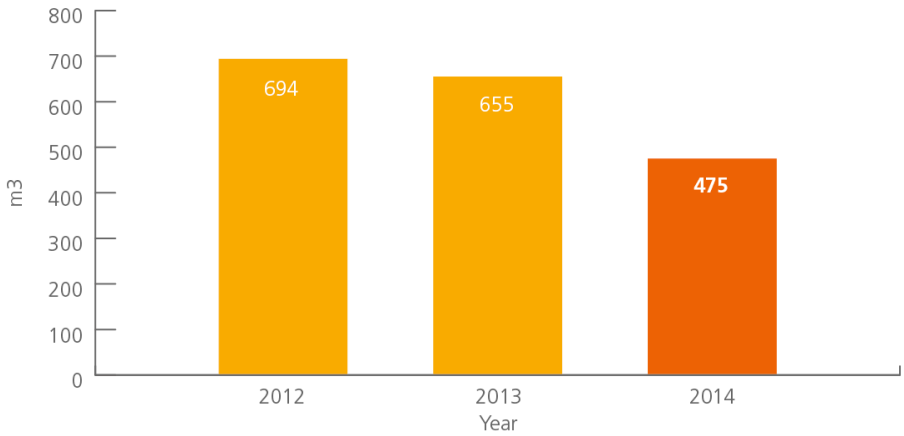
The total amount of radioactive waste (LLW or waste that will be disposed of as LLW) that was sent from all NG sites is displayed in figure 13.

10.3.1 Low level waste (LLW)

Higher volumes of LLW disposed off site indicates better management of radioactive waste on stations. Stations are encouraged to address the backlog of LLW accumulated on site. The greater the volume consigned for disposal in a year, the greater the reduction in accumulations.

Radioactive waste production depends on operating and maintenance patterns, so longer term trends are a better indicator than year to year comparisons. Annual values depend largely on the amount of maintenance carried out on the plant within the year. Higher volumes of waste are loosely correlated to increased levels of maintenance or are indicative of a particular waste management project that may have been undertaken in addition to routine waste arisings.

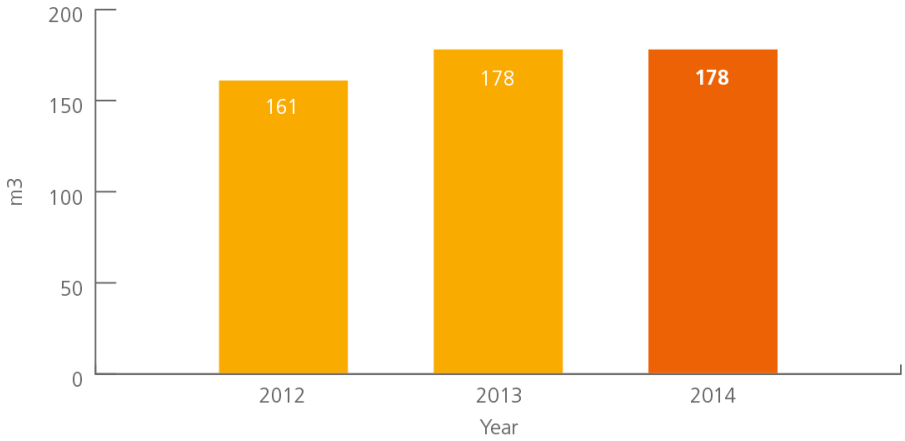
Figure 13 – Total waste sent off site disposed of as LLW



10.3.2 Intermediate level waste (ILW)

The ILW indicator is derived from the UK's 2013 Radioactive Waste and Materials Inventory (UK RWMI) issued by DECC and the NDA. It provides an estimate of the annual arising volume of waste that will be disposed of as ILW at the end of the site's life. The waste volume is given as a packaged waste volume based on currently proposed waste processing techniques and package types. In 2013, the assumptions underlying the UK RWMI were updated therefore comparison between 2012 and 2013 onward data for ILW in this graph is not possible.

Figure 14 – Intermediate level waste produced

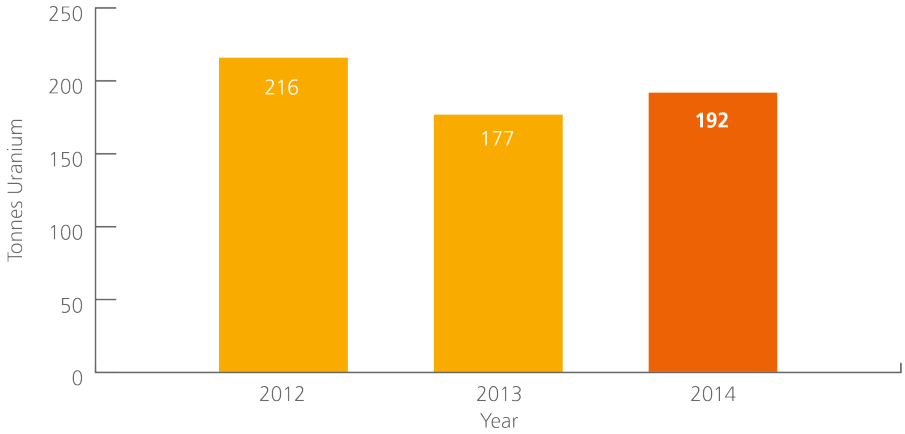


10.4 Spent fuel performance

HLW arises from the reprocessing of our spent AGR nuclear fuel at Sellafield. The spent AGR nuclear fuel is transported to Sellafield in specially designed flasks. The spent fuel from our AGRs can be temporarily stored in cooling ponds on site. Spent fuel at our PWR at Sizewell remains in storage on the site.

We have contracts with the NDA for the management of our spent AGR fuel and we monitor the performance and progress of the management by the NDA and its subcontractor, Sellafield Ltd, of materials created from our fuel. Under our contracts, the NDA determine whether spent fuel is reprocessed to separate uranium and plutonium for possible future use or stored for the longer term. Spent fuel is not considered a waste until a decision has been taken to dispose of it. In either case safety and protection of the environment are paramount. Spent fuel sent off site will vary from year to year due to numerous factors which include cooling times, optimising transport arrangements and operation capabilities within the UK nuclear industry. Spent fuel stored in our cooling ponds is a function of electricity generation and will generally show an increasing trend as PWR spent fuel remains stored on site.

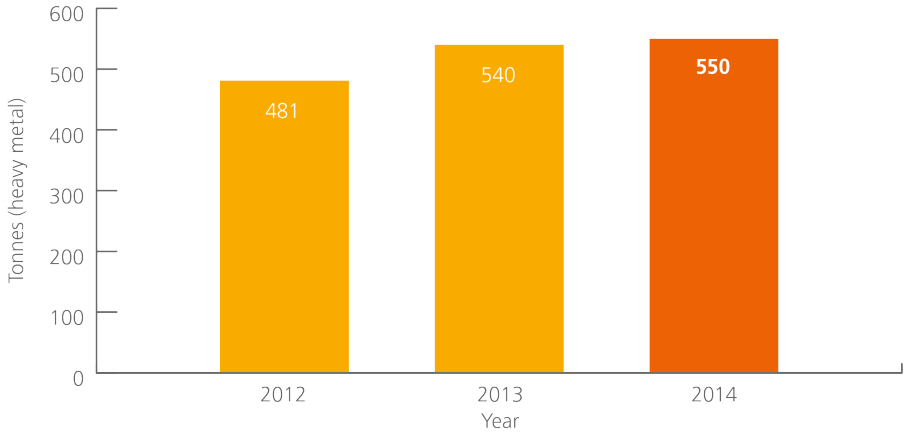
Figure 15 – Spent fuel sent off site



10.5 Decommissioning and waste

We have no nuclear power stations at the decommissioning phase. Our decommissioning strategy is discussed in section 8.3. Once plants cease operation and move into the decommissioning phase, we will report on the progress of their decommissioning plans and the wastes arising from decommissioning activities. During the enactment of decommissioning, regular review and reporting of the actual waste inventory of arisings will include a comparison of the estimates used in planning the activities. This information will be used to refine subsequent estimates.

Figure 16 – Spent fuel stored in our cooling ponds



11 Appendix 1: EDF Group Nuclear Safety Policy

Common commitments for all nuclear companies of the Group

- An overriding priority is placed on nuclear safety at every stage of the plant lifecycle : design, construction, operation and decommissioning. That priority is the responsibility of all and is demonstrated via the individual commitment of all staff within the Group. Each company ensures that its contractors enforce that requirement, and employ well-trained and professional staff.

- The Group recognises that excellence in everything we do is underpinned by equipment reliability, human performance and efficient work management, as these are the main drivers of nuclear safety and reliability.

- The Group recognises the importance of establishing a good nuclear safety culture among its staff and contractors. This is characterised by people having a questioning attitude and being free to raise safety concerns, using error prevention techniques, reporting in a timely and transparent way, being conscious of risks and continuously assessing them. The Group values highly, and encourages, independent oversight and challenge.

- Although it is mobilized to minimise the risk of any incident or accident, the Group must respond adequately to such an event with the aim to protect public health and safety. The Group's companies maintain comprehensive emergency plans at a high state of readiness, including carrying out regular emergency drills with local and national authorities. The Group uses these opportunities to reinforce its communication towards the public and to enhance the safety culture of its staff.

- Continuous improvement is promoted and organised using the full range of knowledge and services within the Group and within international organisations. Operational experience is collected, analysed, reported, and acted on.

- International experience enriches continuous improvement and the drive for excellence : the Group's companies commit both to receive regular international peer reviews and provide suitable peers for such reviews in other companies. All recommendations are considered and acted on.

- Openness and transparency : we aim to build openness and trust internally and externally by creating an open culture and actively engaging with our stakeholders and communities through clear and timely communications on nuclear safety issues and incidents. We strive for a constructive, open and trusting, relationship with our Stakeholders, including our staff, our suppliers' staff, regulators, trade unions and local communities.

Application

The responsibility for the deployment of this policy, and the overall operation of the business unit, lies unambiguously with the line management. Group is responsible for checking, using appropriate mechanisms, that the policy has been adequately deployed and the standards and quality for the delivery of nuclear safety are being adequately maintained by the line management.

Paris, 20 JAN. 2012

12 Appendix 2: List of acronyms

AFIs	Areas for improvements
AGR	Advance Gas-cooled Reactor
ALARP	As Low As Reasonably Practicable
ALR1	Annual Liabilities Report: Part 1
ATV	Accreditation Team Visit
BAT	Best Available Techniques
BDPs	Baseline decommissioning plans
BPM	Best Practicable Means
CAP	Corrective Action Programme
CNC	Civil Nuclear Constabulary
CNS	Civil Nuclear Security
CRC	Curriculum Review Committee
CRE	Collective Radiation Exposure
DECC	Department of Energy and Climate Change
EMS	Environmental Management System
EURATOM	European Atomic Energy Community
FS	Fleet Strategy
GDF	Geological Disposal Facility
GWe	Gigawatts electrical output
HAW	Higher Activity radioactive Waste
HLW	High Level radioactive Waste
INES	International Nuclear Event Scale
INPO	Institute of Nuclear Power Operations
IAEA	International Atomic Energy Agency
ILW	Intermediate Level radioactive Waste
LA-LLW	Lower Activity – Low Level radioactive Waste
LAW	Lower Activity radioactive Waste
LLW	Low Level Waste
LLWR	Low Level Waste Repository
mSv	milli Sieverts
ManSv	Man Sieverts
MWe	Megawatts electrical output
NDA	Nuclear Decommissioning Authority
NG	Nuclear Generation
NGL	Nuclear Generation Limited
NISR	Nuclear Industries Security Regulations
NLF	Nuclear Liabilities Fund
NNB	Nuclear New Build project – NNB Generation Company Ltd
NRE	Nuclear Reportable Events
ONR	Office for Nuclear Regulation
OPEX	Operating Experience
PWR	Pressurised Water Reactor
R2P2	'Reducing Risks, Protecting People'
RCA	Radiological Controlled Area
SAWM	Sustainable Approach to Waste Management
SQEP	Suitably qualified and experienced personnel
TOR	'The Tolerability of Risk from Nuclear Power Stations'
TSAB	Training Standards and Accreditation Board
UATR	Unplanned automatic trip rate
UK RWMI	Radioactive Waste and Materials Inventory
WANO	World Association of Nuclear Operators
VLLW	Very Low Level Waste