EDF Energy Nuclear Generation: Our journey towards zero harm

Summary of our nuclear safety and waste policies and management systems

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Registered Company Details:

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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 one fifth 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.

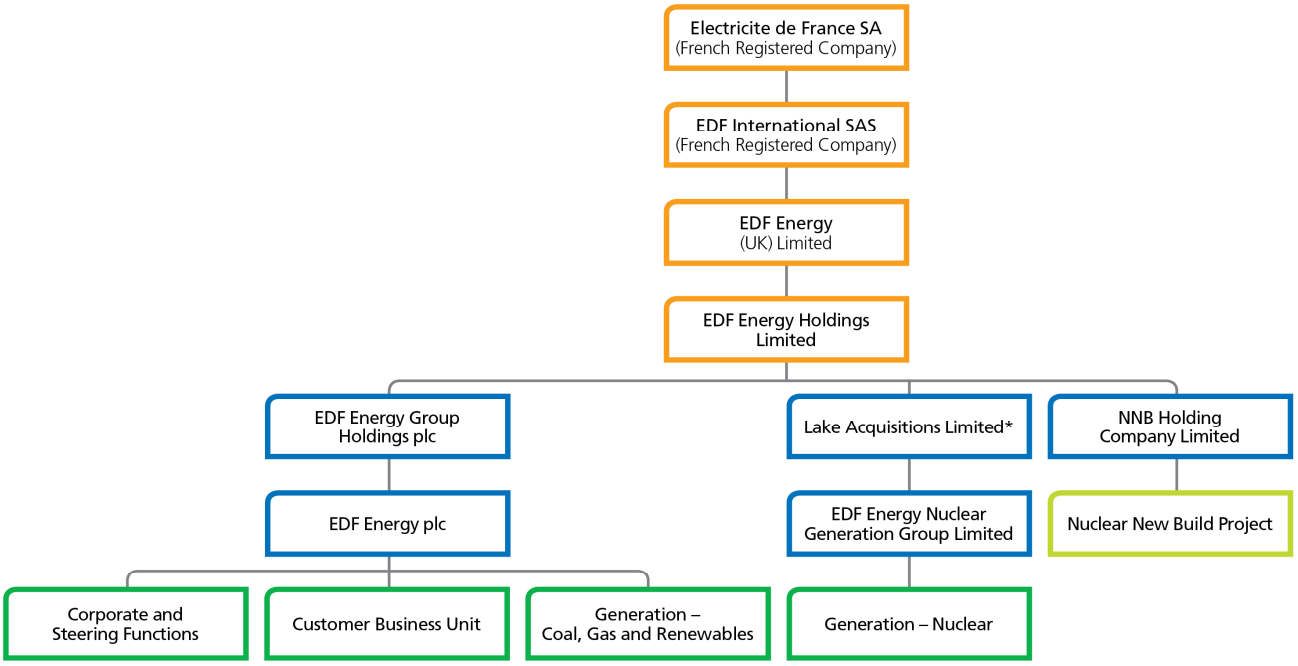
The company is organised into the following business units:

- The Generation business produces 25% of the UK's electricity supply and is responsible for the safe reliable operation of 8 nuclear power stations (15 reactors, 9,600 MW), 2 coal power stations (8 units, 4,000MW), 1 gas power station (3 units, 1,300MW), gas storage facilities and renewable energy sources (N500 MW) in the UK with a total installed capacity of circa 16 GW;
- The Customers business which includes residential and business customers, energy services, smart metering and optimisation; and
- Nuclear New Build which is tasked with the delivery of the new generation of nuclear plants in line with EDF's global programme of producing safe, affordable, reliable, low-carbon production of electricity in the UK.

1.1 Organisational structure

EDF Energy is part of EDF Group, one of Europe's largest power companies. EDF Energy is organised into three business units: Customers, Nuclear New Build and Generation.

Figure 1: EDF Energy organisational structure



* GB Gas Holdings Limited ("Centrica") holds a 20% shareholding in Lake Acquisitions Limited, the company within which the Nuclear Generation business unit sits.

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

EDF Energy Generation (NG) operates eight nuclear power stations in the UK with a combined capacity of almost 9,000 megawatts – electricity that is vital to the UK economy.

Figure 2: EDF Energy's Nuclear Power Stations

Figure 3: About the Nuclear Generation fleet

Station	Reactor type	Date commissioned	Scheduled date of decommissioning	NET capacity in Megawatts (MW)
Hunterston B	2 AGRs	1976	2023	960
Hinkley Point B	2 AGRs	1976	2023	945
Hartlepool	2 AGRs	1983	2019	1,180
Heysham 1	2 AGRs	1983	2019	1,155
Dungeness B	2 AGRs	1983	2018	1,040
Heysham 2	2 AGRs	1988	2023	1,220
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 2014. In particular, Hinkley Point B and Hunterston B have been adjusted to reflect planned operation at approximately 75% load, due to boiler temperature restrictions.

*Based on currently agreed accounting lives. One of EDF Energy's business imperatives is to extend the lifetimes of its nuclear power stations where it is technically and economically viable to do so safely. The current intent is to extend the Dungeness B lifetime to 2028.

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. Unless specified, this information **does not** apply to EDF Energy's Coal, Gas or Renewables plant, nor to the Nuclear New Build project (NNB Generation Company Limited) 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 Generation (NG)). 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. This policy can be found in the document, "Nuclear safety: our overriding priority 2013" dated 27 March 2013.

2. Nuclear safety policy

2.1 Nuclear safety policy statement

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.

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 need to 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 **c**ontrol of reactivity, core **c**ooling and **c**ontainment of the contents of the core and all by-products of nuclear power plant operations whether in reactor, or during movement, disposal or storage (referred to as 3**C**s).

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 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."

Safe nuclear operation is achieved by:

1. 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 (SCWE) in which we all openly report and pursue safety issues or concerns without experiencing a negative reaction;
2. Plant that is well designed, operated and maintained within established safety cases to ensure they operate at a tolerable risk;
3. Processes that are robust and focused on prevention of events, problem identification and resolution;
4. People who are well trained, follow procedures, demonstrate a questioning attitude, uphold the highest standards and coach each other to improve those standards; and
5. A learning organisation that strives for excellence by continuous improvement.

This policy is also supported by the adoption of the following eight principles (from the World Association of Nuclear Operators (WANO) / Institute of Nuclear Power Operators (INPO)):

1. Everyone is personally responsible for nuclear safety

2. Leaders demonstrate commitment to safety
3. Trust permeates the organisation
4. Decision making reflects safety first
5. Nuclear technology is recognised as special and unique
6. A questioning attitude is cultivated
7. Organisational learning is embraced
8. Nuclear safety undergoes constant examination

The health of our Nuclear Safety performance and culture will be periodically assessed to ensure that the objectives of this policy and the eight principles above are being achieved.

EDF Energy Generation (NG) also complies with the EDF Group Nuclear Safety Policy through a combination of its own Nuclear Safety Policy and the supporting Management System.

General

In discharging our legal and moral duty to reduce the risks arising from our operations to a level that is As Low As Reasonably Practicable (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.

2.2 Unplanned plant shut-downs

EDF Energy Generation (NG)'s mission is "Safe, reliable generation over extended life" and is sought within the framework of defined values that guide the behaviour of the organisation and everyone within it. Unplanned shutdown policy is incorporated within the Asset Management Policy (BEG/POL/012). The foundation of the Asset Management Policy is that nuclear safety is the overriding priority. Nuclear, radiological, environmental and industrial safety are placed before commercial gain.

The asset management processes must, as a minimum, ensure compliance with applicable legislation, statutory and regulatory requirements. In addition, they should integrate with, and complement, Generation (NG)'s health and safety, environmental and quality management systems.

The Asset Management Policy requires that processes deliver the following strategic objectives:

- Achieve world class operational safety and excellence
- Improve our financial stability
- Pursue life extension for our stations
- Supporting new nuclear build

Three policy standards are specified:

1. Asset operation, replacement, modification, refurbishment, maintenance, inspection, testing and performance monitoring will be to the approved and documented company standards.
2. Continuous Improvement is delivered locally, at business unit, fleet process and fleet levels through the fleet performance improvement programme. Alignment is achieved through an integrated business planning process which includes the definition of key strategic focus areas for the fleet. The strategic focus areas for 2014 are:

    - Equipment reliability
    - Outage performance
    - Behaviours for success

    This forms the foundation of the company's performance improvement programme.
3. Asset management decisions should be informed by risk management information and analysis. In addition, they should be taken in the context of the following fleet differentiation strategy:

    Unplanned shutdowns challenge the operational safety of a power plant. Consequently EDF Energy Generation (NG) is primarily committed to their reduction and eventual elimination in order to promote Nuclear Safety, Radiation Protection and Public Safety performance. Furthermore reduced plant availability due to unplanned shutdowns has an adverse economic impact in terms of lost revenue and additional costs. EDF Energy Generation (NG) adopts international best practices in this field. The international standards and performance criteria defined in the INPO, WANO, EPRI (Electric Power Research Institute) and IAEA (International Atomic Energy Agency) constitute the foundation used by EDF Energy Generation (NG).

2.3 Incidents and events

The company's management system implements the following principles relating specifically to the avoidance, reporting and mitigation of incidents and events:

- All reasonably practicable steps should be taken to identify and avoid the occurrence of initiating events which have the potential to lead to public harm.
- Maintenance programmes and practices that underpin the sustained delivery of safe, reliable generation are defined to prevent structures, systems and components from degrading or failing and to ensure that actions are taken that promptly restore intended functions.
- The conditions and limits necessary for safety of operations are contained in Technical Specifications in accordance with Nuclear Site Licence Condition 23 (Operating Rules). All operations which may affect safety are carried out in accordance with written instructions in accordance with Nuclear Site Licence Condition 24 (Operating Instructions). These instructions comprise Technical Specifications, Environmental Specifications and Station Operating Instructions derived from Technical Specifications and Environmental Specifications.
- High performance is established, maintained, and improved through the careful selection, training and development of staff, in particular operational staff. People are trained and qualified to gain the necessary knowledge, skills, and abilities to support safe and reliable operation in accordance with Nuclear Site Licence Condition 12 (Duly Authorised and Other Suitably Qualified and Experienced Persons).

All Generation (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 are 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.

2.4 Risk and Nuclear Safety assessments

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 and 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.

There is a fundamental legal requirement for risks to be ALARP (As Low As Reasonably Practicable). 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 as low as reasonably practicable.

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 and 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 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, which set industry best practices e.g. IAEA. 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 Advance Gas-cooled Reactor (AGR) is shut down for statutory maintenance every three years (two years on some AGR stations at present); the Pressurised Water Reactor (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 for the next maintenance period.

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 ONR.

Although subject to monitoring by the ONR, the licensee, EDF Energy Generation (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 which 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.

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 Nuclear Regulator. The more significant hazards originating from within the plant include fire, steam release, hot gas release (AGRs) and loads dropped from cranes.

The safe operating envelope

The reactor operating parameters are restricted at all times such that no credible accident will cause any fuel cans to melt or to fail through any other mechanism. Limits are determined by means of fault studies. A fault study is a simulation of the events following a postulated initial accident or fault. It determines the changes with time of temperature, pressure,

neutron flux and other relevant parameters in the affected part of the reactor. From these it deduces the time at which the guardline initiates the reactor trip. Allowing for the time delays while the control rods are released and the time for them to fall under gravity, it calculates the peak temperature in the hottest fuel can. It then adds appropriate allowances for random variations and uncertainties in the data and compares the resulting temperature with the melt temperature of the can. It repeats this process for a range of reactor operating conditions, thereby establishing which reactor conditions are safe with respect to that particular accident.

A list of credible faults is maintained and is referred to as the Fault Schedule. Fault studies are undertaken for each fault on the schedule. The reactor is operated within a set of conditions which are safe with respect to all faults on the Fault Schedule. This set of conditions is referred to as the Safe Operating Envelope.

2.5 Radiation exposure (to workers and the general public)

We are committed to maintain a comprehensive radiological protection programme safeguarding all our employees and contractors and the general public against the hazards of ionising radiation arising from operating our plants. Our approach is to ensure, as a minimum, compliance with all applicable regulations, to emulate best nuclear industry practices and continuously improve our practices and to work to a common fleet standard. We strive to ensure that any radiation exposure to ionising radiation is kept as low as reasonably practicable (ALARP), to reduce individual and collective radiation doses and prevent any worker exceeding a statutory radiation dose limit.

Radiation dose to the public

The main source of radiation dose to the public from our operations is the impact of radioactive discharges to the environment. In our Environmental Policy we are committed to demonstrating high standards of performance in the way we ensure safety and protect the environment. Recognising our duty to care for the environment, we have a special obligation to assure our nuclear power stations are operated in a manner that safeguards the public and the environment.

Our goal is to achieve excellent environmental performance, recognising that compliance with regulations is not enough on its own to achieve excellence, and holding ourselves to a higher standard.

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

Our policy includes adherence to 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 or Best Practicable Means 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
- A positive culture is fostered within Generation (NG), characterised by communications founded upon mutual trust and by shared values that recognise the importance of excellent environmental performance

2.6 Security

EDF Energy Generation (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. 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.

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.

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

3. Nuclear safety management systems

3.1 General

EDF Energy Generation (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.

Our management system draws on best practice, as defined within the International Atomic Energy Agency (IAEA) Safety Requirements No. GS-R-3, 'The Management System for Facilities and Activities', together with BS EN ISO 9001, BS EN ISO14001, BS OHSAS 18001 and PAS 55-1. 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.

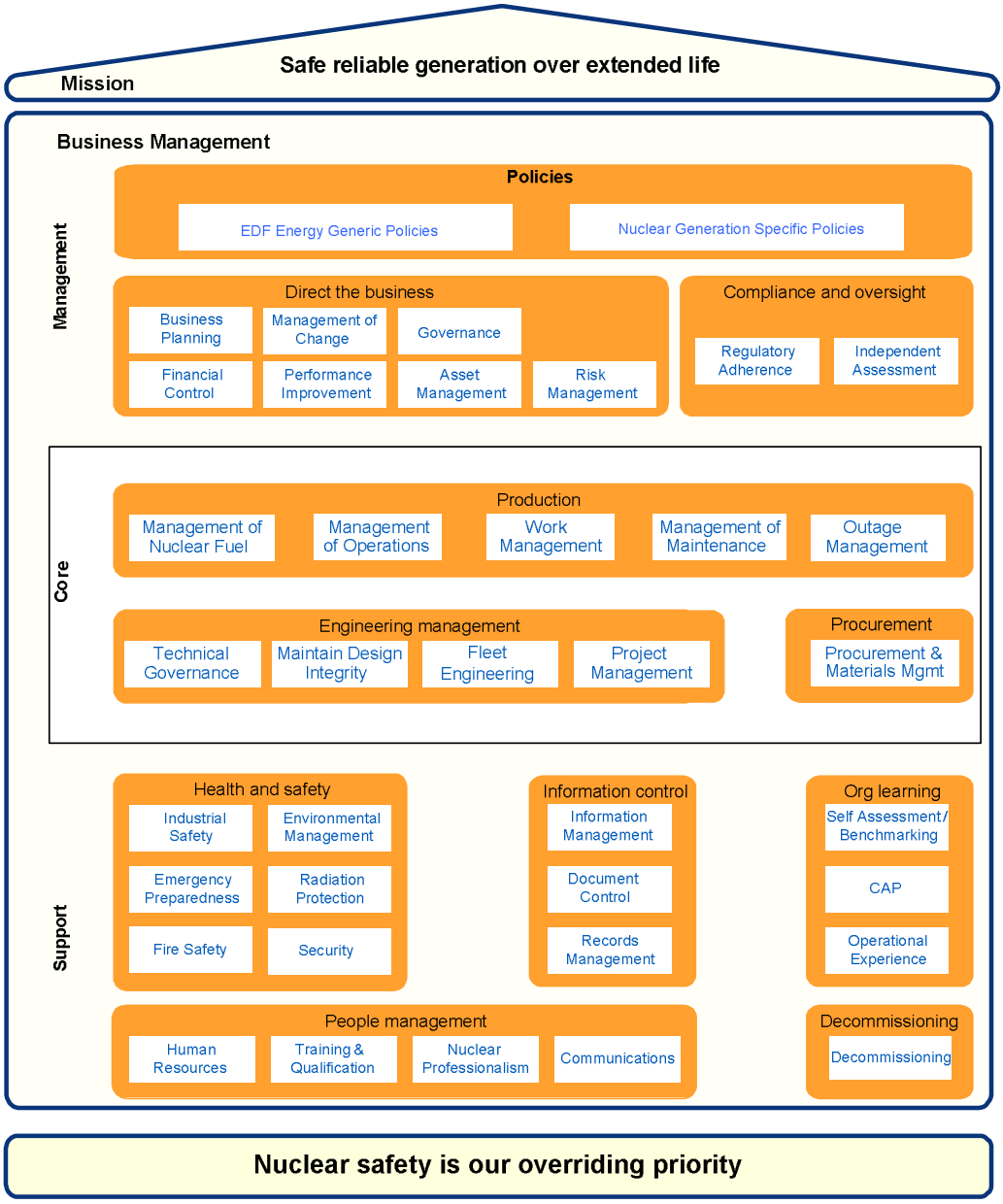
The structure of the system is summarised in the diagram below, which shows how our company vision and associated strategic objectives are implemented through a defined organisational structure and 36 interlocking processes. For each process there is an identified champion in the business who owns the process definition and documentation and is charged with its continuous improvement. The whole 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 staff (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 – the Corrective Action Programme) 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 in 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

Figure 4: Nuclear Generation Limited Management System



3.2 Unplanned plant shut-downs

According to worldwide industry accepted best practice, the implementation of a rigorous process-based approach to plant operational management is an effective and robust means to ensure sustainably high safety and environmental performance including avoidance of Unplanned Shutdowns. Three of the most important processes are:

1. Work Management
2. Equipment Reliability
3. Nuclear Professionalism (human error prevention)

EDF Energy Generation (NG) has implemented Work Management best practices following the INPO guideline AP-928 and continues to implement best practices to support Equipment Reliability as described by INPO guideline AP-913.

The Nuclear Professionalism programme, which includes both human performance and nuclear safety culture components, is in place throughout EDF Energy Generation (NG). This programme focuses on minimising the frequency and consequences of human errors through effective nuclear leadership, training, effective use of human error prevention tools, performance coaching and the identification and reduction of organisational weaknesses through investigations into events, incidents, near misses and performance trending of sub standard conditions.

Work management - INPO AP-928 Implementation
Work Management deals with the identification, planning, scheduling, execution and closure of maintenance and maintenance-related activities.

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

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.

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 EDF Energy Generation (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 nuclear safety and 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.

Nuclear Professionalism

Events leading to an unplanned shutdown derive directly or indirectly from organisational weaknesses. The objective of having a structured nuclear professionalism 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 nuclear professionalism of individuals through nuclear leadership.

The nuclear professionalism programme is founded on the following principles:

- 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

EDF Energy Generation (NG) has deployed and continues to deploy extensive initiatives following these principles and which are based on feedback of experience from the best performers in the nuclear industry worldwide.

The programmes have been developed starting from values and expectations that are supported by training and development of nuclear leaders through the nuclear leadership academy, nuclear leaders coaching in the field to raise standards (including the effective use of error prevention tools), and effective training programmes focused on improving safety and reliability performance.

Both the tools and the training programmes are tailored to each specific working category, including executives, managers, supervisors and engineers/technicians/staff.

All events and incidents are promptly investigated according to a dedicated procedure to determine and address the root causes and underlying organisational weaknesses. Trending of causes is also conducted to judge programme effectiveness and help guide future plans.

Continuous Improvement

All company processes including those described above (Work Management, Equipment Reliability and Nuclear Professionalism) 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 EDF Energy Generation (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.

A good example of this is the development of the Nuclear Leadership Academy. The need to further improve nuclear leadership competencies of supervisors and managers was identified through in-depth analysis into underlying root causes of many safety and reliability conditions in 2008/09. In 2010 a Nuclear Leadership Academy was established to provide this training and development for nuclear leaders. The Nuclear Leadership Academy programme has been tailored for the specific needs of the organisation and is based on international best standards. Training the first group of nuclear leaders through this academy began towards the end of 2010 and, by early 2014, over 900 leaders have been through the programme. Its pedigree as a centre of excellence for nuclear leadership training and development is recognised by supervisors and managers in the business. Further development of the nuclear leadership programmes continues and is being extended across EDF Energy in conjunction with Campus, which is an EDF Energy educational and development centre. The long term success of the nuclear leadership academy will be judged on the impact it contributes towards improved plant safety and reliability performance.

All aspects of the people, plant and organisational resources are continuously updated, developed and re-engineered (where appropriate) in the pursuit of nuclear excellence.

Corrective Action Programme

The Corrective Action Programme (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 problems 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.

For conditions considered significant, or repetitive in nature, these processes ensure that appropriate levels of management are notified, causes identified and actions taken to prevent recurrence. They also ensure that the actions taken to address the identified issues are verified to be complete and effective through formal effectiveness reviews which are scheduled usually 6 months to 1 year later.

Plant staff are expected to identify and report all problems affecting safety by entering a ‘Condition Report’ (CR) into the system. CRs requiring immediate attention are reported immediately to the Shift Manager or Line Supervisor as appropriate.

Daily CRs raised during the previous 24 hours are screened according to their safety and reliability significance, organisational ownership is assigned and actions to be taken to correct the issue are placed.

Where further investigation is required the level of investigation to be performed (root cause or apparent cause) is defined based on the safety and/or reliability significance and a lead investigator assigned. The lead investigator is trained in root cause investigation and/or apparent cause investigation. For root cause investigations, the lead investigator will normally lead a team of experts to collect facts, determine what happened, why it happened and what organisational weaknesses failed to prevent the problem developing into a consequential condition. The potential extent of condition is considered and this helps determine the extent of required corrective and preventative actions. Extent of condition is considered locally, at other stations in the fleet and internationally. Where there are potential international implications reports are submitted through international bodies such as the WANO, INPO and the Nuclear Plant Event Reporting (NUPER) database.

A final report is compiled, which includes a corrective and preventative action plan. This report is subject to oversight from the location Corrective Action Review Board (CARB). The CARB is comprised of senior management and independent company oversight representatives and takes the final judgement on the adequacy of the investigation and appropriateness of the proposed corrective and preventative action plan.

Preventative actions are targeted at the root causes of problem, taking into account the potential extent of condition and are designed so that the benefits outweigh the costs. In certain cases, interim mitigation measures are taken to limit exposure to hazards and to restore adequate confidence while final corrective actions are being generated or deployed. Personnel involved in the original issue receive feedback on what was done. This is important to the reinforcement of prompt reporting behaviour and is vital to appropriate organisational learning. Condition report priorities are regularly reviewed so that resources are applied to those actions with the greatest importance to the organisation.

Routine programme health reporting, which includes CAP trending analysis, is carried out in order to identify degrading conditions early before an adverse trend in safety or reliability performance develops. A standard coding system is used so that effective trend analysis can be done subsequently. Finally, the information from CAP is combined with industry-wide information exchanges and integrated within the Operational Experience Feedback process.

Operating Experience (OPEX)

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 subsequently developed. The Operating Experience (OPEX) processes cover the reviewing, screening, disseminating of internal and external nuclear industry event notices or other operating experience for applicability to specific EDF Energy Generation (NG) facilities. It also provides 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. (An "event" is defined as any significant deviation from the normal expected functioning of a plant.)

The Operational Experience (OPEX) teams produce internal reports, newsletters and briefings for staff about to consider work activity or plant manoeuvres. Of particular value is the "Just-In-Time Briefing" process where the OPEX is collated and presented to operators and staff at the point of work and immediately prior to the activity.

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.

The WANO OPEX Central Team conducts analysis and monitors events across WANO to identify significant issues. Based on the number and significance of events, the Operating Experience Central Team writes Significant Operating Experience Reports (SOERs), Significant Event Reports (SERs) or Just-in-Time briefings (JITs). These reports warrant focused member attention and provide analysed information and learning points that can be applied across all plant types.

To monitor effectiveness there are OPEX process performance indicators, regular self assessments and reviews of the OPEX process.

Within EDF Energy Generation (NG) CAP and OPEX, combined with self assessments and benchmarking processes, ensure that organisational learning is captured, disseminated and retained within corporate memory to reduce events and to lead to continuous improvements.

3.3 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. To this end it is subject to an extensive routine programme of inspection and maintenance. 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 operation 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 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 our Corrective Action Programme (CAP) as described earlier 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.

The emergency organisation is assigned activities and responsibilities to achieve the following objectives:

- To activate the site emergency arrangements.
- To issue appropriate warnings at the correct time and ensure the safe withdrawal of all persons on site to pre-arranged assembly points.
- To notify rapidly all persons and external organisations concerned with implementing remedial actions.
- To assemble and deploy, when necessary, emergency teams to assess and minimise the consequences of the accident.
- To assess the risk and extent of any potentially hazardous situation and ensure timely advice is given on appropriate measures to safeguard the public and that appropriate measures are taken to safeguard station personnel.
- To protect the environment. (Steps taken to protect public health may also provide environmental benefits. Nevertheless, attention is paid to the environmental harm which could result from emergency intervention activities.)
- To minimise and then terminate any release of radioactivity and make the affected plant safe.
- To provide authoritative specialist advice to the Police, Local Authorities and other organisations responsible for taking the necessary action to protect the public. This advice will be provided initially by the Emergency Controller and subsequently by the EDF Energy Generation (NG) Company Adviser or until relieved of the responsibility by the Government Technical Adviser.
- To provide accurate and timely information for the Local Authority to inform the public via the news media.
- To maintain an accurate record of events for later analysis.
- To ensure the safety of unaffected plant.

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 (REPPIR).

3.4 Risk and Nuclear Safety assessments

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 HSE 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.

Periodically there is an additional systematic review, known as the Periodic Safety Review, of all the constituent parts of the nuclear safety case. The main objectives in the review are to risk assess 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, good engineering practice and 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; and
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.

Maintain Design Integrity

The Maintain Design Integrity policy 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.

The key processes included within Maintain Design Integrity are summarised below:

Modifications

The Modification Process (Nuclear Site Licence Condition 22) is used to control changes to the plant and/or safety case, subject to the following overriding principles:

- All changes identified as being design and/or safety case changes will be subject to the modifications process
- Design and/or safety case changes which potentially modify the design intent will be subject to the agreement of the Design Authority
- Users of the modification process shall meet prescribed standards of training and experience and satisfactory performance will be subject to ongoing review
- Risks associated with the modification process are identified and managed through use of a barrier model which provides a framework for use in future investigations in the event of process failure and provides a framework for risk assessment when operating the process. The barriers include verification, independent assessment and oversight

Periodic Safety Review

The Periodic Safety Review (PSR) (Nuclear Site Licence Condition 15) process is a periodic, holistic review of the condition of the plant and of any changes to standards and is used to justify continued operation. The review 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, 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. Part of the benefit of the review is that it confirms that the aggregate effect of minor design changes has not become significant. It also acts as a check that plant documentation is up to date and accurately reflects the plant design.

The PSR is carried out on, approximately, ten-yearly intervals. The reviews identify issues to be addressed, grading of their significance and prioritise and address the issues through systematic business processes. The PSR is provided to the Government's nuclear regulator who accepts the findings and monitors progress of the identified improvements.

Nuclear Safety Committee (NSC) process

The NSC process sets out the arrangements for the compliance with Nuclear Site Licence Condition 13. The most significant design changes and other significant safety matters are referred to the NSC for advice.

Oversight Arrangements

The Oversight Arrangements process consists of the arrangements that Design Authority uses to ensure that the Maintain Design Integrity process is effective, to report on the health of the process and to identify and drive opportunities for improvement. These arrangements consist of collating information gathered across the organisation to provide insight into the effectiveness of the Maintain Design Integrity process across the fleet and at relevant corporate functions.

Engineering Change Training and Accreditation

All safety case role holders will meet specified levels of training and accreditation as defined by this process. Capability is the subject of ongoing review and re-accreditation.

DESIGN AND SAFETY ASSESSMENT

Engineering principles

If a fault occurs at a nuclear power station the installed safety systems are required to operate and fulfil their safety function, e.g. the provision of post trip cooling. In order to make the safety systems more resilient, additional plant over the basic requirement is provided. The principles of redundancy (more plant of the same design), diversity (more plant of different design) and segregation (more plant in a different location) are built into nuclear power station design. In addition, a further important safety principle is the single failure criterion, which requires that no single random failure within a safety system should be able to cause the loss of a safety function. These principles are examples of deterministic (engineering) safety provisions.

Common mode failures in similar plant may be difficult to identify. It is therefore assumed that, however much redundancy a system possesses, its reliability is limited (numerically to one failure per 10,000 demands, or in very exceptional circumstances one failure in 100,000). The implication of the common mode cut-off is that a single safety system / line of protection is insufficient for a frequent fault (classified as faults which are expected to occur more than once in 1000 years) hence a diverse line of protection is provided. For infrequent faults, a single line of protection will suffice provided it is sufficiently reliable.

For all credible faults, one line of trip, shutdown and post cooling is provided. The provision of additional reactor protection is considered in an ALARP framework. In reality two lines of protection are provided for most frequent faults.

There are some safety functions for which redundancy and diversity of protection is not possible. For example, there is only one concrete pressure vessel surrounding an AGR reactor. In such cases, failure of the component has to be made so low that it is essentially regarded as incredible. In order to sustain a claim of incredibility of failure, particularly high standards of design, construction and inspection are needed.

Hazards

A hazard to a plant item is defined as anything outside that item which could cause it to fail. Hazards are classified as external or internal. An external hazard is something imposed on the station site from outside, such as extreme winds or an earthquake. An internal hazard is something caused by a plant failure within the site, such as fire, flooding caused by the breach of a water pipe or a major steam release. Hazards constitute potential common causes of multiple plant failures.

The accepted approach is to demonstrate that there are comfortable margins to survival of each relevant hazard at the one in 10,000 year level for a single line of protection. An additional line of protection is justified for less severe hazards at the one in 1000 year (frequent) level. This approach reflects the difficulties in determining data for very infrequent hazards.

Appropriate measures are in place to limit the potential effects of hazards to an acceptable level. Maintenance procedures are also biased towards plant which poses a hazard to safety related items.

Beyond design basis faults

It is recognised that there are certain extreme fault conditions for which there is no specific design provision - these are termed "beyond design basis faults". There are also unlikely combinations, or sequences, associated with design basis faults that fall into this category.

Such situations have been analysed to confirm that there are large margins available within the design basis fault studies. In particular, it has been shown that there are no "cliff edges" which would result in the fuel safety limits being exceeded in the majority of beyond design basis situations analysed. Therefore, even though specific studies have not been carried out for all possible events, scoping studies have shown the plant to be capable of maintaining safe conditions.

It is very difficult to provide detailed instructions to the Reactor Desk Operator covering all the different extreme situations which may arise at very low frequency. The types of actions which would be most beneficial in these remote circumstances have nevertheless been considered, and this has resulted in the issue of two sets of additional instruction known as Symptom Based Emergency Response Guidelines (SBERGs) and Severe Accident Guidance (SAG):

- The SBERGs give advice in a developing fault situation, for which the normal operating instructions are not valid. This advice concentrates on the symptoms of the fault rather than on specific failures in any one plant system. The SBERGs supply guidance on the most appropriate actions which would be needed to preserve and reinforce the critical safety functions, such as reactor cooling.
- The SAG advises on the management of the reactor after a severe fault. They concentrate on actions to establish the critical safety functions and to minimise the release of radioactivity from the core and plant.

3.5 Radiation exposure (to workers and the general public)

Radiation exposure to workers

Radiological protection is identified as one of the 15 principle processes within our Company.

We have dedicated radiological protection personnel and a radiological protection programme in place to set standards, measure compliance and drive continuous improvement. Many of the improvements that have been introduced over the last seven years would not have been possible without management support and financial investment in the radiological protection programme.

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 to assess 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 performed for each task performed inside the Radiological Controlled Area by a radiation safety engineer and radiological safety work permits are issued to personnel that specify radiological precautions. All work activities are planned, specified and implemented in such a manner as to ensure that individual and collective radiation doses are maintained as low as reasonably practicable (ALARP).

Training and instruction is provided to equip workers with the knowledge required to work safely in Radiological Controlled Areas. 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 reducing the radiation dose that workers receive.

Controls and supervision are provided to oversee the safety of persons required to enter Radiological Controlled Areas. A 'meet and greet' programme has been implemented at the entrance to Radiological Controlled Areas to assess whether workers fully understand the radiological safety requirements for their intended work.

Coaching is encouraged in Radiation Controlled Areas to encourage good behaviours and correct sub-standard practices and behaviours. Radiological protection coaching cards and a database are used to keep a record of coaching performed.

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.

Any workers who purposely disregard radiological protection rules or instructions will, in the interest of their own and other workers' safety, be barred from entering Radiological Controlled Areas until their management has instituted remedial action to prevent a recurrence.

Whenever practicable, engineered and physical control measures are employed to minimise radiological risks in the work place.

Adequate radiological protection monitoring instrumentation and Personal Protective Equipment is provided to ensure the safety of workers. An instrumentation replacement programme was instigated, for installed and portable radiation and contamination instrumentation, to provide an improved monitoring capability. Obsolescent personal contamination exit monitors were replaced at all sites in 2011. The new exit monitors are far more sensitive and their settings are aligned to international standards.

Portable radiological protection instrumentation has systematically been replaced to a common fleet standard. Improved Personal Protective Equipment for work in Radiological Controlled Areas is progressively being replenished by all stations.

All sites use an Electronic Personal Dosemeter which measures radiation dose and warns the wearer if pre-determined dose levels are exceeded. Teledosimetry systems, which can be used to remotely monitor the dose received by workers, have been introduced for work in high radiation dose rate areas.

Tool stores are being established to limit the quantity of equipment taken into the Radiological Controlled Areas. This improvement reduces the manpower required to monitor and clear the equipment from the areas and lowers the risk of inadvertently releasing contaminated equipment.

Together with our contract radiography companies there is alignment with new standards for radiography, that incorporates industry best practices (such as close proximity radiography) with training and learning points from past radiography events. The company encourages the use of close proximity radiography which significantly reduces the radiation risk from this type of work by eliminating the need to wind the radioactive source out of its container.

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.

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

Radiation dose to the public

The main source of radiation dose to the public from our operations is the impact of radioactive discharges to the environment. In our Environmental Management System we identify and plan the operations that are associated with the identified significant environmental aspects consistent with our environmental policy, objectives and targets, in order to ensure that they are carried out under specified conditions 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); and
- Establishing, implementing and maintaining procedures related to the identified significant environmental aspects of goods and services used by EDF Energy Generation (NG) and communicating applicable procedures and requirements to suppliers, including contractors.

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

Each operational site has an Environmental Maintenance, Inspection and Testing Schedule (EMITS) associated with environmentally sensitive plant and significant aspects.

We subscribe to a number of other non-legislative requirements e.g. The Nuclear Sector Plan (a collaborative project between the Environment Agency and the whole nuclear industry that plans to reduce the impact of the nuclear sector on all aspects of the environment, going well beyond the requirements of environmental legislation), ISO14001 and Biodiversity Action Plans.

The company's Environmental Management System (EMS) and all its supporting specifications forms part of the Company Management System and utilises recognised company processes where practicable.

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 site maintains documented procedures to monitor and measure, on a regular basis, the key characteristics of its operations and activities that can have a significant environmental impact.

The procedure(s) include the recording of information to monitor performance, applicable operational controls and conformity with the company's environmental objectives and targets.

Centrally, the Environment Department monitors, measures and reports each site's, and the overall fleet's, environmental performance.

3.6 Security

EDF Energy Generation (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 Office for Nuclear Regulation (Civil Nuclear Security).

ONR conducts its regulatory activities on behalf of the Secretary of State for Energy and Climate Change (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 EDF Energy Generation (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 EDF Energy Generation (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.

EDF Energy Generation (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 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.

4. Nuclear waste policy

4.1 General and operational waste

EDF Energy Generation (NG)'s number one priority is safety and we strive for a Zero Harm Record. Our policy is to be compliant with the UK law and to conform to UK Government policy. In order to achieve our goals we have a suite of governance to manage conventional and radioactive waste across the fleet.

EDF Energy Generation (NG) has implemented an Environmental Management System (EMS) across the business which is certified to the ISO14001 standard.

Our EMS is built around an Environmental Policy, which includes a statement that we will seek to reduce the generation of all types of waste, both conventional and radioactive, to a practicable minimum.

As a business whose prime activity is the generation of electricity we must demonstrate high standards of performance regarding safety and protection of the environment. Recognising our duty of care, we have an obligation to ensure that our nuclear power stations are operated in a manner that safeguards the public and the environment.

Our goal is to achieve excellent environmental performance throughout EDF Energy Generation (NG). We aim to comply with regulations, achieve excellence and continually drive ourselves to a higher standard.

EDF Energy Generation (NG) seeks to achieve the goals set by:

1. 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
2. Promoting the efficient use of energy
3. Continuing to develop a sense of environmental responsibility among staff and contractors
4. Openly reporting performance against environmental targets
5. Assessing the impact of our operations on biodiversity and implementing opportunities for enhancement

To remain certified to ISO14001 standard, EDF Energy Generation (NG) must periodically demonstrate that it has taken action to improve environmental performance.

As far as reasonably practicable we will conduct the following actions to meet our commitments:

- Use of reprocessed uranium in our existing fleet of power stations
- Reduction of generated radioactive waste and spent fuel
- Effective use of the waste management hierarchy

EDF Energy Generation (NG) is committed to working on future improvements in spent nuclear fuel and radioactive waste management and as such EDF SA, Generation (NG) and Nuclear New Build identify synergies and report to the CEO of EDF Energy. The mission of this group is to:

- Share experience for better management by both EDF SA and EDF Energy of their respective national issues.
- Constructing a common knowledge base that will be required for defining future, larger group strategies.

Two key areas of interest at present are the reprocessing and/or long term storage option for spent fuel and the potential for different waste management options including Very Low Level Waste (VLLW). These areas are reviewed as technologies

and capabilities develop. EDF Energy Generation (NG) continues to review the options for reuse of spent fuel material in future reactor designs and is continuing to work with our nuclear partners investing in possible technologies.

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

4.2 Spent fuel

EDF Energy is committed to applying the principles of sustainable development to all its activities. Within Nuclear Spent Fuel this means:

- 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 Government, NGOs and others 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

EDF Energy Generation (NG) is demonstrating the above through numerous programmes of work and control systems, these include:

- 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 (PIE) of fuel and components to ensure our plants are operated as safely and efficiently as possible
- Nuclear Material Accountancy, which ensures that all EDF Energy nuclear material is accounted for at all times
- Supporting our Nuclear Power Academy 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

4.3 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. 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 (BPEO) 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 EDF Energy 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 EDF Energy. (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 EDF Energy Generation (NG) power station decommissioning and waste management comes primarily from the Nuclear Liabilities Fund (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. In practice, to date, the review/revision has been on a greater frequency. This commitment to review ensures the plans reflect best practice, take advantage of OPEX from ongoing decommissioning projects and remain consistent/ aligned with national and international policy, legislation and best practice. The latest submissions and approvals were made during 2013.

The strategy and plans reflect the relevant OPEX from decommissioning of other power stations in the UK and internationally. In developing our decommissioning plans and strategy EDF Energy has worked with experienced contractors involved in Magnox fleet decommissioning and international decommissioning projects. We aim to ensure OPEX on decommissioning relevant to our nuclear fleet is reflected in our associated plans and approach. Hence, the company actively participates 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 EDF Energy Generation (NG) nuclear power station sites. Power station decommissioning, following a planned end of generation, remains some years off. However, detailed baseline decommissioning plans for each of our power stations are in place. These plans have been developed over a number of years/iterations and have been formally approved by our regulators and the NDA.

The detailed Baseline Decommissioning Plans (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, 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 being reported in the national UK radioactive waste inventory, the latest edition being "The 2013 UK Radioactive Waste Inventory" - URN 14D037 NDA/ST/STY(14)0007 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.

It should be noted that a programmatic approach to the decommissioning of the nuclear sites has been developed to ensure synergies and opportunities for cost and waste reduction, etc across the fleet are enabled.

The potential impacts of the company's operational activities on decommissioning are a key consideration. For example, all engineering changes to plant or processes are formally assessed to consider the potential implications to decommissioning,

decommissioning wastes and the associated liabilities. In addition, the company carries out an annual review of any potential impacts of power station operations on decommissioning and liabilities and formally reports this to the NDA within the "Annual Liabilities Report: Part 1" (ALR1). The ALR1 provides a formal route for recording changes in our Generation (NG) decommissioning and waste liabilities which may have occurred over the previous financial year. Any impacts from engineering changes, operational changes and events etc, during the operational period are assessed for potential to impact on decommissioning.

The company is 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).

Decommissioning and waste in the context of Nuclear New Build (NNB)

EDF Energy is developing plans to build 4 European Pressurised Water Reactors (EPR) in the UK through NNB GenCo. All new nuclear build undertaken by the Company will be subject to a corporate decommissioning policy and strategic objectives.

The decommissioning requirements (including radioactive waste management) of our proposed EPR power stations are a key consideration for their design, construction and operation. EDF Energy/NNB GenCo is committed to construction, operation and the ultimate decommissioning of new build power stations in a manner which minimises its impacts on workers, the public and the environment.
EDF Energy/NNB GenCo will ensure environmental optimisation through the application of Best Available Techniques (BAT), which will be applied at all stages of the project lifecycle from design and procurement through operation and to decommissioning and site restoration.

The new build power stations will be designed and built with maintenance and decommissioning in mind, enabling radiation doses to workers and radioactive waste quantities to be minimised when decommissioning takes place. More specifically the design incorporates a number of features which will:

- Minimise the activity level of irradiated components
- Reduce worker dose during decommissioning
- Permit easy decontamination
- Minimise the spread of contamination
- Facilitate the access of personnel and machines for decommissioning and the removal of waste from the reactor building
- Minimise the volume of radioactive waste
- Reduce the operator intervention time
- Minimise the toxicity of the waste.

EDF Energy/NNB GenCo will ensure that wastes generated at all stages of the project lifecycle from design and procurement through operation to decommissioning and site restoration will be minimised through application of the waste hierarchy and in accordance of the principles of integrated waste management .

EDF Energy/NNB GenCo will develop a documented integrated waste strategy which will include the management of all wastes and discharges, both radioactive and non-radioactive, arising from the full range of activities planned over the whole lifecycle of the site.

EDF Energy already undertakes extensive reviews of operational experience and feedback with respect to waste management. NNB will continue this process into the construction and operational phases of the EPR and eventually into

decommissioning. This will include not only reviews of performance at the installation but comparison with other PWRs operated by EDF, the EDF Energy Generation (NG) fleet in UK and other reactors worldwide.

Before NNB can begin the construction of a new nuclear power station it must submit a Funded Decommissioning Programme (FDP) and have it approved by the Secretary of State. An FDP sets out the legal, financial and technical arrangements to ensure that an operator meets the full costs of decommissioning a new nuclear power station, covers the full share of the costs of safely and securely managing and disposing of waste and that in doing so the risk of recourse to public funds is remote.

5. Nuclear waste management systems

5.1 Operational waste

The responsibility for radioactive waste management belongs with each EDF Energy Generation (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 Office for Nuclear Regulation (ONR) under the Nuclear Installations Act 1965 (as amended). Radioactive waste disposal is regulated by the Environment Agency (EA) in England and Wales and by the Scottish Environment Protection Agency (SEPA) in Scotland.

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

• Very Low Level Waste (VLLW) – with exempted or permitted radioactivity,	**Lower Activity radioactive Waste (LAW)**
• Lower Activity – Low Level radioactive Waste (LA-LLW),	
• Low Level Waste (LLW),	
• Intermediate Level radioactive Waste (ILW), and	**Higher Activity radioactive Waste (HAW)**
• High Level radioactive Waste (HLW).	

Examples of VLLW and LLW are redundant equipment and waste from maintenance activities, plastic, rubble and damaged protective clothing from nuclear power stations. ILW may include filters, sludges and resins arising from the treatment of radioactive liquids, and filters from reactor gas systems (some of these waste types can be VLLW and LLW depending on their plant use).

HLW is generated by reprocessing AGR fuel at Sellafield. HLW contains high levels of radioactivity which generates heat.

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

• **VLLW**: Consigned for landfill or off-site incineration.	**EDF does not yet directly use these disposal routes but we are preparing to review viability.**
• **LA-LLW**: Sent off site for treatment and/or disposal.	

- **LLW:** Sent for treatment and/or disposal
  - Volume reduction by super-compaction
  - 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), and 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 planning to build 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 (and new build) 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. *Note: Some LAW, ILW and HLW are collectively referred to as HAW.*

At the end of 2011 we launched a new 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 (RWIP) and Technical Baseline and underpinning Research and Development (TBuRD) 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 Best Available Techniques (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.

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 As Low As Reasonably Practicable (ALARP)
- We apply Best Practicable Means (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 on our Generation nuclear sites
- 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

We have developed new arrangements for the management of HAW to prepare for the packaging of ILW at Sizewell, which began in January 2014 and is continuing in 2014. The AGR stations will be incorporating the HAW management arrangements into their processes from 2014 commensurate to their current requirements.

EDF Energy Nuclear New Build (NNB) plans to build a new generation of nuclear power plants in the UK. Prior to any investment decision in new plants, EDF Energy NNB seeks to ensure that the plant design accounts for BAT to minimise the generation of spent fuel and radioactive waste from operation and decommissioning.

5.2 Spent fuel

The responsibility for spent fuel on EDF Energy Nuclear Generation Limited's (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 suitably qualified and experienced personnel (SQEP). 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 (POMM) 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 EDF Energy Generation (NG) CAP system.

The participation in the CAP, OPEX, Self Assessment and Benchmarking processes underpins the continuous improvement that is present in all Generation (NG) activities including Spent Fuel Management.

The Operational Experience from the EDF Energy Generation (NG) business is not only used internally but shared with the rest of the global nuclear industry to ensure that lessons are learned and the opportunity for improvement is a global opportunity. EDF Energy Generation (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 and so changes to the system are communicated to other organisations. EDF Energy Generation (NG) actively participates in training of not only our own staff and contract partners but also in the training of other organisations by providing both training material and SQEP individuals to deliver training and support.

A process for loading, cleaning and monitoring the flasks to verify that they are radiologically compliant is followed. These processes 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 NDA. The transport of this fuel represents a key activity as the fuel enters the public domain. The operation and maintenance manual for the transport flask is a centrally controlled document to ensure safety and compliance of the transport flask and its contents at EDF Energy Generation (NG) sites, Sellafield and in the public domain. All personnel operating the flasks are trained to do so and any changes to the required procedures are briefed and appropriate training provided. A specialist role exists for personnel who consign radioactive materials. This role requires specific training on a nationally recognised training course. EDF Energy Generation (NG) has a dedicated central team to manage the logistics of movements of fuel and the maintenance and compliance of the transport flasks. This team of SQEP individuals is trained in all aspects of the movement of fuel transport flasks and is focused on safety, security and compliance issues.

Regular inspections of these processes are undertaken not only by EDF Energy Generation (NG)'s internal regulation but also by the UK Regulator for nuclear material transport.

EDF Energy 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.

EDF Energy monitors performance of the systems described above and the performance and progress is reported internally and to the relevant Regulator.

5.3 Decommissioning and waste

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.

EDF Energy'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 EDF Energy during decommissioning periods is contained in the latest publication of the National Inventory Statement (The 2013 UK Radioactive Waste Inventory - URN 14D037 NDA/ST/STY(14)0007 February 2014.

Management systems description

EDF Energy document (BEG/ICP/NFL/001, January 2011) 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 EDF Energy Generation (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.

EDF Energy Generation (NG) is accredited to ISO 14001 for all of its power stations. In addition, the Sizewell B plant has attained registration to the European Eco-Management and Audit Scheme. This demonstrates that environmental concerns are fully integrated in EDF Energy's business and within the Company there are a number of teams and specialists whose role it is to investigate and define environmental policies, strategy, standards and procedures. Others monitor the compliance against targets and provide advice on best practices to achieve them.

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

6. EDF Energy Nuclear Training

Nuclear Site Licence Condition 12 requires EDF Energy to only use Suitably Qualified and Experienced Persons (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 infrastructure such as 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 nuclear professionalism programme covering nuclear safety culture and human performance
- Establishes an independent training standards accreditation board to oversee the process

A training policy statement (BEG/POL/005) 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 to:

- Create world leading nuclear professionals
- Equip our people with the knowledge, skills and behaviours to support a high performing business

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

EDF Energy recognises that training plays a key role in supporting safe and reliable nuclear plant operation via the knowledge and skills of its employees. EDF Energy Generation (NG) is committed to, and accountable for, developing and sustaining training programmes that meet organisational and personnel needs.

Within EDF Energy 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' 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, 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

As noted in BEG/POL/005, Training Policy, "All personnel within the organisation have a responsibility and a role to play in the Systematic Approach to Training to deliver these key elements." Below is a table of responsibilities for the Managers and Supervisors:

Table 1: Training responsibilities for Managers and Supervisors

SAT Process	Managers/Supervisors Role
Analysis	Communicate expectations Monitor performance Address performance shortfalls Provide recommendations Internalise SAT fundamentals Identify training needs
Design	Lead training committees Approve learning objectives Review tests and related materials
Development	Approve selected training materials Support 'dry run' sessions
Implementation	Conduct pre-training briefs, post-training debriefs and kick-offs Observe training and provide feedback Evaluate instructor performance Evaluate worker and staff performance Attend continuing training Facilitate exercise critiques Select On-Job Trainers and Task Performance Evaluators Monitor task performance evaluations Enforce qualification standards Award qualifications Apply qualifications to work assignment
Evaluation	Provide critical feedback Sponsor self-assessments Ensure timely corrective actions Integrate training and line indicators Support timely revisions Provide oversight

Training Organisation

A 'Nuclear Power Academy' provides 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

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/enhances staff capability
- Line management-led training committees to drive the training improvement programmes

Management of Training

EDF Energy Generation (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 committee's 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, concentrating 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 CRC chairs as members. It is the committee's responsibility to promote excellence in training and to evaluate the programme's effectiveness.

The Curriculum Review Committee (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.

Accreditation Process

There are two key phases to the accreditation process. The Accreditation Team Visit (ATV) followed by 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 accreditation or accreditation renewal the TSAB is making a judgement on the ability of the site to carry out effective training for the next four years.

In conclusion, EDF Energy considers training an effective tool to improve the professional performance of individuals and, as a consequence, maintaining and improving safety, reliability and efficiency of EDF Energy's operating nuclear power plants.

7. Nuclear safety and waste data

Performance data for 2011 to 2013 can be found in the Nuclear Generation section of the EDF Energy website.