



Comhshaol, Pobal agus Rialtas Áitiúil
Environment, Community and Local Government

Ireland's National Programme

**under Directive 2011/70/EC establishing a Community framework for the
responsible and safe management of spent fuel and radioactive waste**

1.0 Introduction

In 2011 the Council adopted Directive 2011/70/EC establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste. Article 15(4) of the Directive requires Member States to notify the Commission concerning the content of their national programme for spent fuel and radioactive waste management.

This document now forms the first national programme for Ireland to be reported to the Commission under Article 15(4) of the Directive.

The programme will be updated and revised as necessary as required by Article 11(2) of the Directive in the light, inter alia, of:

- technical and scientific progress as appropriate
- recommendations, lessons learned and good practises from peer reviews.

The Irish national programme is the responsibility of the Department of Environment, Community and Local Government (DECLG) which is the Government Department with policy responsibility in the area of nuclear safety and radiological protection. These responsibilities include implementing national policies and programmes in relation to nuclear matters.

2.0 Background

Ireland currently meets its electricity requirements from a combination of thermal and renewable energy sources. Ireland has chosen not to develop a nuclear power industry and the Government has no current plans for a change of policy in this respect. Factors informing the formation of this policy include concerns about public health and safety, environmental protection and security, as well as concern at the continued absence of an acceptable solution to the problem of the long-term management of the large quantities of radioactive waste produced by nuclear power stations.

The management of radioactive waste in Ireland has been a matter of some concern for decades. Ireland does not have a purpose-built facility for the storage of radioactive waste and this has been identified as a gap in the current Irish waste management infrastructure. Ireland now has “take-back” arrangements in place for all newly imported radioactive sources brought into the country by licensees, i.e. where the foreign supplier is legally obliged to take back radioactive material once it is no longer being used. However, a quantity of legacy materials remains in the State which is not subject to these arrangements.

The Irish Government formally adopted a national policy on radioactive waste management for Ireland in late 2010. In this regard, one of its key initiatives is the reduction of Ireland’s inventory of disused radioactive waste sources held by licensees at multiple locations throughout the country. This is to be achieved through a co-ordinated and phased Inventory Reduction Programme.

In June 2011, the National Implementation Committee (NIC) was established and chaired by DECLG to oversee the national radioactive waste reduction programme in accordance with the 2010 Radioactive Waste Management Policy, agreed by Government. Under this programme, the Departments of Health, Education and Skills, and Defence were tasked with driving waste reduction

programmes in their individual sectors while the Radiological Protection Institute of Ireland (RPII)¹ took responsibility for the reduction programmes in the private and State sectors.

At the end of these reduction programmes, we are now able quantify the amount of waste remaining and this information will be used by a NIC sub-group to develop siting and design criteria for a national radioactive waste storage facility. This facility will be used to store the remaining legacy waste and provision will need to be made for future waste arising of sources currently in use which are not subject to “take-back” agreements. The facility will also be available to house “orphan” or seized radioactive sources until a safe disposal route can be secured.

A Temporary Operational Protocol (attached at Appendix 1) was approved by Government in 2011, setting out the arrangements to manage the safe interim storage of an orphan radioactive source or a source identified for seizure, pending its ultimate disposal.

3.0 Key Elements

The key elements of the Government’s policy agreed in 2010 and the subsequent implementation programme is the adoption of the following activities:

- A National Radioactive Waste Storage Facility for disused radioactive sources is to be established. DECLG and the Environmental Protection Agency (EPA) are to draw up a detailed specification for the facility and make recommendations on the siting, management and resourcing of the facility.
- The current inventory of disused radioactive sources is to be reduced through a co-ordinated and phased Inventory Reduction Programme.
- Interim centralisation of sources by sector in a small number of sector-specific existing storage facilities is to be pursued.
- Further updates to be provided to Government, as necessary, as this work progresses.
- An operational protocol providing for the recovery and management of orphan or seized sources.

The long-term goal of final disposal, possibly in coordination with a third country, remains a policy objective.

Implementation of the waste policy is overseen by a high level interdepartmental government committee and the National Implementation Committee (NIC).

In implementing the Policy, Ireland follows the principles of:

¹ The RPII was merged with the Environmental Protection Agency (EPA) in August 2014, establishing the EPA as the national regulatory body, with the radiation protection functionality being exercised on a day-to-day basis by the Office of Radiological Protection (ORP).

- minimisation of the generation of radioactive waste in any form
- avoidance of the importation of radioactive waste in any form.

Another principle is the management of all sealed sources from “cradle to grave”. This includes a licensing system and take-back arrangements with the original overseas supplier of the sources. If available, the practice of replacement of radioactive sources by non-radioactive alternatives is applied. This includes, for example, prohibiting the import and use of lightning conductors that employ radioactive sources or of radium used in luminescing materials. Ireland, in its transposition of the Directive, provided specifically for certain restrictions in relation to the importation and exportation of radioactive waste and these are enforced by the EPA, the Competent Authority for the Directive.

Key aspects of licensing central to implementing the overall policy on radioactive waste are as follows (it also covers aspects of the responsibilities of licence holders):-

- The licensing system in Ireland for sealed and unsealed sources has been in operation since 1977. As part of that system, information has been gathered and maintained on all such sources. This database provides a useful tool in the “cradle to grave” management of sources.
- Holders of disused sources are required to verify their holdings at specific periods which are set out in their licences and to report any anomalies to the EPA. Sealed sources, whether in use or not, must be leak tested not less than once every two years or as recommended by the manufacturers and reported to the EPA.
- Licence conditions include requirements for the management of radioactive waste.
- Licensees are required, as a prerequisite to licence issue, to have an agreement with the source supplier or manufacturer to take back sources (“take back agreement”) when they become disused. The EPA looks for written evidence from the supplier or manufacturer that the source will be accepted back when no longer required before issuing a licence.
- Many categories of licensees are required to appoint a Radiation Protection Adviser (RPA). Furthermore the EPA maintains a Register of all persons approved to act as RPAs to undertakings in the medical, dental, educational and veterinary sectors. In assessing an application for RPA approval, one of the areas in which an applicant must demonstrate their competency is their knowledge of waste management principles.
- Licensees wishing to transfer sources between sites must comply with the international transport regulations and any licence conditions that the EPA may consider important to impose. A specialised training course for those involved in the transport of relevant radioactive consignments was first approved by the EPA in 2007 and has been re-evaluated on an annual basis since then. Similar arrangements apply to transboundary shipments. Transboundary shipments of sources within the EU are governed by specific pieces of European Community legislation.
- General requirements of the licence include a duty on licensees to keep records, to ensure proper labelling of sources and containers, to provide training and to arrange for the appointment of responsible persons by the licensees. Licensees are obliged to inform the EPA of any changes in the inventory of radioactive waste for which they are responsible and to have their licence amended accordingly.

- Inspectors from the EPA carry out inspections to assess compliance with the licence conditions.
- Members of An Garda Síochána's (national police force) Crime Prevention Office have undertaken security audits of facilities holding large numbers of disused radioactive sources and where necessary improved security measures have been implemented.

As part of the licensing process all licensees are obligated to carry out a risk assessment in relation to all sources in their custody and use including waste management at hospitals for example. Such licensees are also obligated to develop safety procedures to manage the risks identified and to keep doses as low as reasonably achievable. Such risk assessments and safety procedures have to be reviewed and updated periodically.

As a result of a combination of a well-established licensing system, take back arrangements and a comprehensive inventory of sources, there have been very few incidents involving orphan sources. The number of such sources that have been discovered is very low and the EPA has dealt with them in consultation with the DECLG on a case-by-case basis. Where orphan sources have been identified and seized they have been taken into the safe custody of existing licensees. There is now an operational protocol, mandated by Government, in place to deal with the management of such sources.

The licence conditions specify that adequate provision must be made, by way of a financial security or any other equivalent means appropriate to high activity sealed sources (HASS), for the safe management of HASS when they become disused sources. A documented financial costing for the safe management of HASS is required with all licence applications/amendments for HASS. This costing shall be signed by the General Manager or equivalent of the company concerned. In addition, a written guarantee from the General Manager or equivalent of the company concerned to cover the cost of management/disposal is required to accompany all licence applications/amendments. This guarantee covers the return or disposal of HASS, including all packaging, transport and return fees even in the event of the applicant/licensee becoming insolvent or going out of business. Any changes in the financial arrangements have to be confirmed in writing to the EPA on an annual basis.

The status of licence conditions is laid down in the Radiological Protection (Amendment) Act 2002 (Article 3 (1B)). This article states that inter alia that a person who fails to comply with a condition, or any provision of such condition, that is attached to a licence granted pursuant to an order or regulations made under Section 30 of the Radiological Protection Act, 1991 shall be guilty of an offence.

4.0 Current Inventory

Ireland's current radioactive waste inventory is attached as Appendix 2.

Ireland uses radioactive materials in the form of sealed and unsealed sources in support of its high technology industries and its medical and other societal infrastructure. These activities give rise to waste materials such as disused sealed sources. There are also small amounts of naturally occurring radioactive materials that are produced and also discharged as a result of Ireland's exploitation of natural resources. These are the radioactive wastes that are the subject of Irish Government policy

and programmes. All such wastes are regulated by licence and overseen by the EPA and as provided for by the Radiological Protection Act, 1991 and subsidiary legislation. In practice, existing licences are not closed until all activities have been ceased, decommissioned or disposed of in a manner approved by the Regulatory Body or a successor licensee has been established. In this way continuity of responsibility is enforced by Government through the operational activities of the Regulatory Body.

With regard to radioactive sources, the EPA implements a 'take back' agreement requirement which requires at the point of authorisation a facility to make provision for the repatriation of the source or its disposal at the end of its useful life and to ensure that financial provisions are in place to implement that agreement.

Where wastes are held by an authorised party, the conditions under which these wastes are maintained are set out in licence conditions by the EPA. As Ireland has no nuclear facilities by definition all of the waste arising would fall into the IAEA's low level waste category and no formal waste categorisation process beyond that was deemed of value in that context. In practice however, during the surplus sources reduction programme that was undertaken following the Government Decision in December 2010, it proved useful to class sources in terms of 'half-life bands' for management purposes. In addition High Activity Sealed Sources (HASS) have a particular definition in legislation and where they occur in waste, they are specifically identified as HASS.

There is also in place a Temporary Operational Protocol (TOP) for dealing with orphan sources and sources that are seized by the Regulatory Body. In these cases, where the responsible parties cannot be identified then the DECLG will step in to consider funding issues in the management and disposal of sources on a case by case basis.

In practice, radioactive waste in unsealed form arises from the use of radionuclides mainly in hospitals and in a few educational and research establishments. The sources are either imported from the relevant overseas suppliers or short-lived ones generated on the main hospital sites.

Requirements for the licensing of the use and disposal of unsealed sources, or exemption from such requirements, are established by Article 5 of S.I. No. 125 of 2000. Quantities or concentrations requiring licensing under S.I. No. 125 of 2000 are based on Annex I of the EU Council Directive 96/29/Euratom. Normal practice in regard to requirements for licensing is to apply the limits or concentrations used on a daily basis.

The main aspects of the safety and management of unsealed sources in Ireland are as follows:

- The generator cores that produce Tc-99 are returned to the supplier. Most are being imported from the Netherlands or the United Kingdom. Transport to and from Ireland is in accordance with the appropriate Transport Regulations.
- The practice of liquid radioactive waste disposal relates mainly to the medical sector in Ireland. It is a condition of licences granted in the medical sector, where unsealed sources are used, that there is annual recording of the quantities discharged. This data is now collated annually by the EPA and is available to the OSPAR Commission as part of Ireland's reporting requirements under

the OSPAR Convention. In addition, recent assessments have shown that the maximum dose to the critical public group (sewer workers) from such disposals is less than 10 $\mu\text{Sv}/\text{year}$.

- Solid waste materials from hospitals that contain residual activity are segregated and controlled at source. In particular, they are isolated and stored until the levels of radioactivity are such that disposal is permitted under the conditions set out in the hospitals' licence.
- Licensees are obliged to report the quantities which are actually disposed of to sewers in the case of specific radionuclides.
- Licence conditions on hospitals include requirements to ensure that precautions are taken to prevent radioactive contamination, including contamination in the form of excreta from patients.
- The licence condition places an obligation on hospitals and clinics to keep records of radionuclide administrations to patients which will enable estimates of the quantities excreted to the sewers to be made, using established excretion factors.
- The EPA also requires that any licence application to use unsealed radionuclides for medical purposes be accompanied by an estimation of doses to critical groups. In the case of disposal to sewers, the licensee must demonstrate that doses to sewer workers, who are taken as the critical group, will be below 300 $\mu\text{Sv}/\text{year}$. In practice such doses will be below 10 $\mu\text{Sv}/\text{year}$.

Use and Potential use of Holding Tanks for Discharges from Hospitals

There are currently five hospitals in Ireland, which are involved in radioiodine thyroid ablation treatments and therefore use significant amounts of radioiodine (~3-5 GBq/patient). In this regard, the doses to critical groups averted by decay tanks must be balanced against the potential radiation doses to workers involved in their maintenance and risks from bacteriological hazards. All hospitals in Ireland that use significant amounts of radionuclides for therapeutic purpose are situated close to the sea. This means that discharges to sewers pass into treatment works and then via a normally short route to the sea where dilution takes place quickly. There are no discharges from such facilities into fresh water that may be used for human consumption.

Following a review of iodine ablation therapy practices in Ireland, particularly in relation to the possible use of holding tanks for the decay of Iodine-131, the following regulatory position was adopted and remains valid in 2015:

- In the case of existing iodine ablation facilities licensees will not be required to retro-fit iodine holding tanks.
- Licensees with existing ablation facilities will be required to undertake both on- and off-site monitoring to validate the assumptions and calculations in their risk assessments.
- Licence applications for new ablation facilities will continue to be assessed on a case-by-case basis to determine whether holding tanks are required.
- New and existing licensees will be required to undertake appropriate on- and off-site monitoring of discharges to validate the assumptions and calculations in their risk assessments during the operation of their facilities.

Significant Milestones

Inventory of Sealed Sources

In accordance with the priorities identified in Ireland's 2010 national policy on radioactive waste, a programme commenced in 2011 to reduce the inventory of disused radioactive sources held by licensees across Ireland. This programme has resulted in a very significant reduction the national inventory of disused sealed sources, reducing it to a very small fraction of the inventory that existed in the years prior to 2011 (Figure 1).

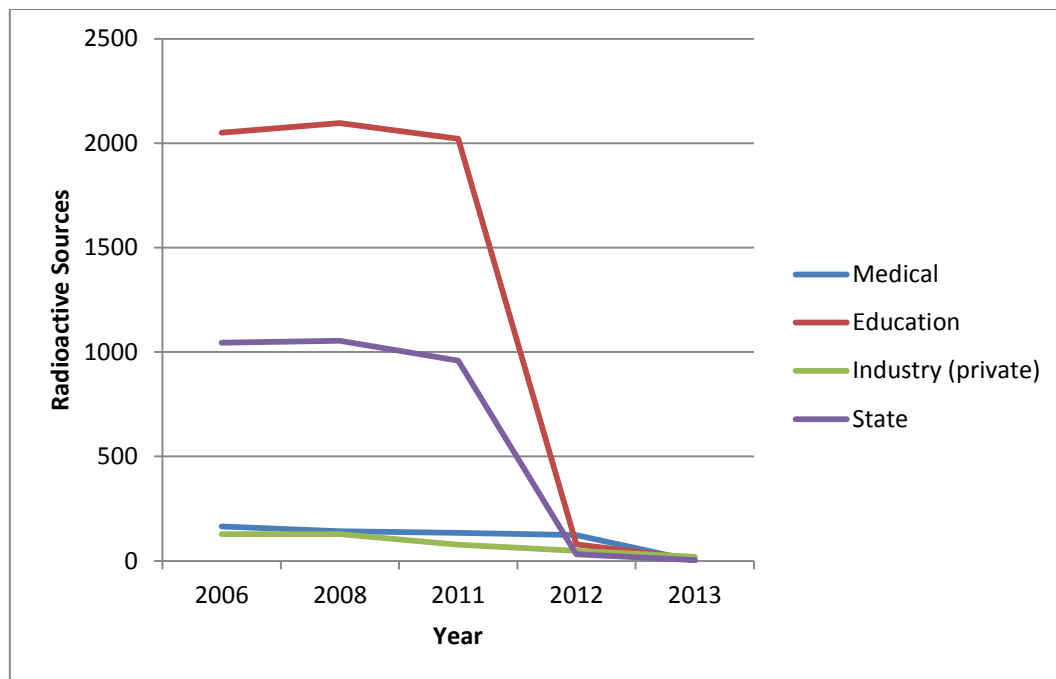


Figure 1: Disused source inventory reduction in all sectors (half-life >10 years)

The few sources that comprise the current disused source inventory arise from acquisitions made prior to the introduction of take-back agreements into normal regulatory practice and so the waste issue in Ireland is substantially a legacy issue. The inventory is comprised of items containing such radioisotopes as Cs-137, Co-60, Am-241 and Sr-90.

Natural Uranium Rods in a Sub-critical Assembly

Until recently, Ireland had in storage 2.5 tonnes of uranium metal in the form of rods that were originally supplied as an experimental sub-critical assembly to a University Department from the United States under the "Atoms For Peace" programme. The sub-critical assembly was used for student experiments until the 1980s after which it was disassembled. The neutron fluxes and consequent build-up of fission products was considered negligible. The rods were stored in boxes and had been declared as radioactive waste. They were maintained in single secure store fitted with CCTV cameras and were the subject of inspections and quarterly reports under the Safeguards Agreement with the International Atomic Energy Agency (IAEA) (INFCIRC/263) and the European Atomic Energy Community (EURATOM).

The sub-critical assembly essentially consisted of an array of uranium in a water-filled steel tank in which fission reactions were initiated by neutrons from an appropriate source. Given its sub-critical nature, a neutron source was required to initiate fission and also to maintain a measurable neutron flux. To that end, a neutron source, made of a quarter gram of Plutonium and Beryllium, was also supplied to the university under the Atoms for Peace Program.

The safe repatriation of all nuclear material was achieved thanks to the financial support of the Higher Education Authorities in Ireland and the facility was officially decommissioned by the IAEA as a storage facility for nuclear materials in 2013.

Iodine-125 Sources

There was a practice in hospitals whereby Iodine-125 seeds used in brachytherapy were recorded as waste. However, there is now a procedure in place for the return of seeds to the supplier. On occasion, issues can arise with the return of individual seeds, and currently one hospital holds a small number of biologically contaminated seeds. These issues are dealt with on a case by case basis.

Radium Sources

In common with all countries, Ireland historically (from about 1900 to 1980) used radium in medical applications and some other applications but has replaced this with safer, more efficient and easier to use radioisotopes. All legacy disused radium sources have now been disposed of abroad as part of the source reduction programme in line with Government policy.

Lightning Preventors Incorporating Radium

In the 1970s a number of lightning preventors incorporating radium in semi-sealed sources were imported and used on a number of buildings in Ireland. They are no longer considered to provide any benefit over conventional lightning conductors and the EPA does not authorise their importation. There was a concerted effort in particular to have these removed from buildings and disposed of and this proved to be very successful. With the exception of a few recently discovered preventors heads, all known lightning preventors were successfully disposed of to authorised overseas facilities.

Technetium 99 (Tc-99)

Until recently there was an estimated 7000 older Tc-99m ($t_{1/2} \sim 6$ hours) generator cores, which were acquired prior to the introduction of the practice of requiring take-back agreements, held in storage. While, strictly speaking, they were not sealed sources they were included under this heading for the purposes of this Report. The generator cores contained the very long-lived and hence low specific activity Tc-99 daughter. All legacy disused Technetium-99 generator cores have now been disposed of abroad as part of the source reduction programme in line with Government policy.

Disused Educational Sources

Until recently, there was an estimated 475 small teaching sources held by post primary schools that were no longer in use and were awaiting disposal. In addition, there was an estimated 9 kg of thorium and uranium components (unsealed) also awaiting disposal. These figures had been extrapolated from a survey of schools undertaken in 2000.

In terms of the disposal programme for disused sources held by secondary schools, a tender seeking specialist waste disposal contractors to dispose of all unwanted schools sources was issued in 2013. Following a successful tender process, a source disposal programme commenced in June 2013. By 2014 1066 disused radioactive sources had been removed from 201 schools. Approximately 42 schools still retain radioactive source which continue to be used for demonstration purposes.

Implementation in Ireland of the HASS Directive

The purpose of the HASS Directive (2003/122/EURATOM) is to prevent exposure of workers and the public to ionising radiation arising from inadequate control of high activity sealed radioactive sources and orphan sources and to harmonise controls in place in the Member States by defining specific requirements ensuring that each such source is kept under control. The Directive was transposed into Irish Law in December 2005 as the Radiological Protection Act 1991 (Control of high-activity sealed radioactive sources) Order 2005 (S.I. No. 875 of 2005). The EPA is designated as the Competent Authority for the purposes of the Legislation and the Directive.

At present there are approximately 1132 licensed sealed sources in Ireland, which have activities that would bring them under the control of the HASS Directive. Most of these are used in the irradiation cells of two sterilisation plants. The majority of the remaining sources coming within the scope of the HASS Directive are held by industrial radiography companies, universities, and hospitals and by a manufacturer of radioactive gauges. All legacy HASS sources, that were no longer required, were disposed of abroad as part of the source reduction programme in line with Government policy.

Progress on Inventory Reduction

Initiatives taken by the EPA and other actors in line with Government policy have resulted in almost the elimination of the legacy sources in all categories. These initiatives included encouraging holders through the inspection process to pursue disposal options available from specialist waste management companies. A particularly successful initiative in the educational sector saw monies made available for the disposal of sources in that sector. They also included the development of a number of waste related regulatory guidance documents aimed at assisting holders to manage and dispose of certain categories of sources. Guidance included:

- A Guidance Note on the Management of Waste Ionisation Chamber Smoke Detectors (ICSDs)
- A Guidance Note for the Disposal of Decayed Sources to Landfill Facilities
- A Guidance Note for the Disposal of Prepared Uranium and Thorium Compounds

In 2011 there were 50 holders of sources across a range of half-lives and management requirements. At the time of reporting in 2015 this number had reduced to 15 but holding only 43 sources.

The EPA continually reviews its licensing and inspection system to ensure that it remains focused on ensuring a high level of safety and security and takes account of developments in radiation protection philosophy and radiation safety standards. Recently implemented or planned activities to improve safety include:-

- The establishment of a National Radioactive Waste Storage Facility for disused radioactive sources. The DECLG and the EPA are to draw up a detailed specification for the facility and make recommendations on the siting, management and resourcing of the facility.
- Further consideration will be given to options for the final disposal of Ireland's small inventory of disused radioactive sources.
- To continue to work with other interested Government Departments and organisations towards implementing national policy for the safe long-term management and ultimate disposal of Ireland's radioactive waste materials.
- Ireland has requested an Integrated Regulatory Review Service (IRRS) mission from the IAEA which is scheduled to take place in September 2015.²
- A new Radiation Protection Advisory Committee has been established to advise the EPA in all issues relation to radiation protection including radioactive waste issues.

In addition the EPA will take the following specific regulatory actions:

- Continue to target holders of radioactive waste in the annual inspection programme bringing pressure to bear to explore disposal options. To date the pressure has been in the form of focusing on waste disposal during inspection and through sectoral pressure in the health and education sectors by respective ministries. Ultimately, where routes are identified and there are no compelling reasons for not exercising them particularly where there are existing 'take back' agreements in place then licences can be revoked and prosecutions can be contemplated though this has not been tested to date. The current strategy is to strongly encourage compliance and there is some evidence that this is working.
- Engage with the Radiation Protection Advisors (RPA) in future workshops to outline the issues and objectives of the inventory reduction programme and to encourage their active participation in source disposal initiatives.
- Establish the regulatory licensing criteria for the design, construction and operation of a National Waste Management Storage facility.
- Introduce a more graded approach to authorisation and to increase to the maximum extent possible, taking full cognisance of safety and security issues, the transparency of the regulatory process
- The introduction of a modern information management system to replace the current system to provide a greater degree of functionality and data management.

² This IAEA Mission has now been completed and can be found on the Department's website at <http://www.environ.ie/en/Environment/EnvironmentalRadiation/InternationalDimension/>

5.0 Conclusion

The National Programme for Ireland has been compiled to comply with the requirements of Article 12 of Directive 2011/70/EC. There has been significant progress made on the source reduction programme over the past three years. During this time, Ireland has gone from having 63 licensees holding over 3,300 disused sources, with half-lives greater than ten years, to 32 sources held by 10 licensees (representing a 99% reduction in total number of these sources). This reflects the on-going implementation of programmes and measures resulting from the Government's policy.

The Government approved a National Policy Position on Nuclear Safety and Radiation Protection in August 2015, attached at Appendix 3.

This National Programme will be updated and revised as necessary to take account fully of all new relevant policy and legislative developments.