ENVIRONMENTAL STATEMENT
TO ACCOMPANY
AN APPLICATION FOR PLANNING PERMISSION FOR
THE LANDFILL DISPOSAL OF LOW LEVEL
RADIOACTIVE WASTE IN PHASES 4B, 5A AND 5B OF
THE CURRENTLY PERMITTED HAZARDOUS WASTE
LANDFILL AT THE EAST NORTHANTS RESOURCE
MANAGEMENT FACILITY, NORTHAMPTONSHIRE

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Appendix B  Scoping opinion from Northamptonshire County Council dated 18 June 2009 and a copy of the responses from the statutory consultees

Appendix C  The Authorisation Application “Application for disposal of LLW including HV-VLLW under the Radioactive Substances Act 1993, for the East Northants Resource Management Facility.”
1. Introduction

1.1 Augean PLC has developed new proposals for its East Northants Resource Management Facility (RMF) for the disposal of wastes such as soils and construction materials that arise from sources that include hospitals and the decommissioning of nuclear power stations. These wastes have small amounts of low level radioactivity which while of low risk means that they must be sent to specifically authorised and approved landfill sites. The East Northants RMF is located south east of Duddington and north of Kings Cliffe as shown on Figure 1. The current planning permission for the site reference EN/05/1264C permits the deposition of hazardous waste and inert materials used for restoration.

1.2 Many of the nuclear power stations in the UK which have provided power to the nation over the last 50 years have reached or will soon reach the end of their operational life and will need to be decommissioned to render the sites safe for the long term and to protect the environment. The decommissioning process will produce large volumes of radioactive waste the vast majority of which has only small amounts of radioactivity. Dealing with the nuclear legacy is a pressing issue according to the Nuclear Decommissioning Authority and must be dealt with as a matter of urgency.¹

1.3 An inventory of the radioactive waste present and likely to be generated in the UK carried out on behalf of the government identified that a substantial amount of Low Level Radioactive Waste (LLW) will arise in the UK as a result of current waste generation and the proposed programme of decommissioning of nuclear power generating sites. Based on the inventory it was concluded by government² that the currently available supply of LLW disposal capacity cannot meet foreseen future demand. Landfill disposal to authorised landfill sites is an approved option for the disposal of solid LLW that contains limited amounts of low level radioactivity³. LLW

² A Public Consultation on Policy for the Long Term Management of Solid Low Level Radioactive Waste in the United Kingdom. February 2006. DEFRA, DTI and the Devolved Administrations
comprises approximately 90 per cent of future radioactive waste arisings by volume but it contains less than 0.0003 per cent of the total radioactivity⁴.

1.4 LLW comprises radioactive waste with a radioactive content not exceeding 4,000 becquerels per gram (Bq/g) of alpha activity or 12,000 Bq/g of beta or gamma activity. LLW includes waste described as Very Low Level Radioactive Waste (VLLW) which has a radioactivity content up to 4 Bq/g (40Bq/g for tritium) with other limits set for individual loads in some cases.

1.5 It is proposed that the designated wastes permitted for importation and deposition at the site under the planning permission are extended to include a subset of LLW comprising waste which has a level of radioactivity up to 200 Bq/g. The radioactivity of the wastes that will be accepted at the site is low and the site will be operated to ensure that exposures resulting from the disposal of the waste are significantly less than the exposure of the average person to naturally occurring radiation in the UK. The East Northants RMF is a suitable facility for LLW because of the specification of the engineering, the location and the specialised experience of Augean staff in managing wastes which are difficult to handle.

1.6 The proposed development the subject of the planning application which is accompanied by this Environmental Statement comprises the disposal of LLW at East Northants RMF in addition to the hazardous waste already permitted for disposal at the site. The proposed development will not change the rate or volume of waste deposited at the site or the physical features that were assessed during the decision process that resulted in the granting of the current planning permission for the site. There will be no change to the permitted vehicle movements or noise generating activities associated with the importation or landfilling of LLW at the site. The site will be capped and restored progressively in accordance with the conditions of the current planning permission and the current Environmental Permit. There will be no change to the consented operational lifetime of the site and no

change to the restoration and aftercare proposals for the site as a result of this application for planning permission.

1.7 The East Northants RMF is the subject of an Environmental Permit for the landfill disposal of hazardous waste. To permit the disposal of LLW the site must be the subject of an authorisation under the Radioactive Substances Act 1993 for which the regulator is the Environment Agency. An application for an authorisation is being submitted to the Environment Agency in parallel with the submission of this planning application to Northamptonshire County Council.

1.8 MJCA are commissioned by Augean PLC to undertake an Environmental Impact Assessment (EIA) of the proposed development. The EIA has been carried out based on discussions with Augean PLC and Northamptonshire County Council and the experience of MJCA together with specialist technical advice from the United Kingdom Atomic Energy Authority (UKAEA) Harwell, the Health Protection Agency and Galson Sciences Limited who are preparing the risk assessments which will be included in the application for the Authorisation. Discussions have been held with the Environment Agency during the preparation of the application. This document comprises the Environmental Statement that has been prepared based on the EIA and in accordance with the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 as amended.
2. **Approach to the Environmental Impact Assessment**

2.1 The Environmental Impact Assessment (EIA) of the proposed development has been undertaken in accordance with the EC Directive 85/337/EEC\(^5\) (as amended) on the assessment of the effects of certain public and private projects on the environment and in accordance with the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999\(^6\). Guidance produced by the Department of Communities and Local Government formerly the Office of the Deputy Prime Minister\(^7\) has been considered.

2.2 The fundamental principles of EIA are embodied in Directive 85/337/EC as amended by the Directive 97/11/EC\(^8\) in which it is stated that:

> ‘...the best environmental policy consists in preventing the creation of pollution or nuisance at source, rather than subsequently trying to counteract their effects…’

In the Directive it is stated that there is a need to take into account environmental effects at the earliest possible stage in all technical and planning decision making.

2.3 The Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 specify the projects that will and the projects that may be the subject of an EIA. Schedule 1 of the Regulations lists projects for which it is mandatory to undertake an EIA and Schedule 2 lists projects for which an EIA may be necessary. The proposed development falls under paragraph 3g or 13 of Schedule 2 of the 1999 Regulations. Under paragraph 3g of Schedule 2 an EIA is

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\(^6\) SI 1999 No 293.

\(^7\) Planning Circular 02/99:Environmental Impact Assessment dated 12 March 1999

necessary if the installation resulting from the development will require an authorisation under the Radioactive Substances Act 1993. Under category 13 an EIA is necessary if the proposed development may have significant adverse effects on the environment. In consultation with the planning authority it has been determined that an EIA of the proposed development will be carried out. The area of the proposed development is approximately 6.07 hectares.

2.4 For the purpose of carrying out the EIA and preparing the Environmental Statement the baseline studies in respect of hydrology and hydrogeology, traffic and ecology undertaken for planning applications and environmental permit applications submitted in 2005, 2006, 2007 and 2008 have been reviewed and where relevant to the proposed development the findings of the baseline studies are included in this Environmental Statement. Additional assessments of the impacts on population and ecology as a result of the disposal of radioactive waste have been carried out. Taking into account the findings of the baseline studies together with the operational procedures which will be implemented at the site the impacts likely to arise from the proposed development have been determined and assessed.

2.5 In section 6 and 8 of this document a description is provided of the proposed development for which approval is sought from the Planning Authority. Information on the operational controls that will be implemented at the site to minimise the environmental impact are presented.

2.6 In the Environmental Statement the information collated, the results of the investigations, the details of the development and the results of the assessment are presented and the positive and negative effects of the development are explained. The Environmental Statement presents a description and evaluation of the baseline environmental conditions at the site against which the assessment of the environmental impact is made.

2.7 Detailed technical information comprising the Authorisation application is presented at Appendix C to the Environmental Statement. A non-technical summary of the Environmental Statement is provided. A copy of the non-technical summary can be
downloaded from the Augean website. Copies of the Planning Application and Environmental Statement together with the Authorisation application are available through the Augean website.
3. **Screening and scoping**

3.1 The Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 as amended state that the applicant can request a screening opinion under paragraph 5 and a scoping opinion under paragraph 10 from the local planning authority to whom the application will be submitted when completed. The screening opinion allows applicants to ascertain whether it is necessary for an Environmental Impact Assessment to be undertaken for a Schedule 2 development. A scoping opinion provides the opinion of the local planning authority together with the opinions of the statutory consultees regarding the scope of the assessments that should undertaken as part of the EIA.

3.2 At a meeting with Northamptonshire County Council on 28 January 2009 the proposed development was discussed and it was agreed that the proposed development is a Schedule 2 development under the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999. It was agreed that since it is likely that the development has the potential to have significant effects on the environment by virtue of its nature it is not necessary to seek a screening opinion in accordance with paragraph 5 of the 1999 Regulations. It was agreed that the proposed development will be the subject of an EIA and the application for planning permission will be accompanied by an Environmental Statement.

3.3 In accordance with good practice the scope of the assessment was determined by consultation with the local authority, statutory consultees and interested parties. A scoping document was prepared including a brief description of the proposed development and the proposed scope of the EIA. The document was circulated to Northamptonshire County Council, East Northamptonshire District Council, Peterborough City Council, the Environment Agency, Natural England, the Health Protection Agency (East Midlands), Northamptonshire Primary Care Trust, Health and Safety Executive, Highways Agency, Kings Cliffe Parish Council, Duddington with Fineshade Parish Council, Collyweston Parish Council, Thornhaugh Parish Council, Wansford Parish Council and Easton on the Hill Parish Council. A copy of
the scoping document is presented at Appendix A. The scoping opinion was provided on 18 June 2009. Copies of the scoping opinion and responses to the scoping report from the statutory consultees are presented at Appendix B. The proposed development has been the subject of extensive consultation with the Kings Cliffe Local Liaison Group and other members of the public as explained in the Statement of Local Engagement which accompanies this application. The questions and issues which are material to the planning application and the EIA which were raised by the statutory consultees and the public during the consultation process are presented in Table 1 to this document. In Table 1 cross references are provided that show where the issues raised during the scoping consultation process are addressed in the Environmental Statement and or elsewhere in the application documents. Wider issues raised during the consultation process and addressed as a series of questions and answers which are presented in the Statement of Local Engagement and will be displayed on the Augean website.

3.4 Based on the results of the scoping exercise it is concluded that that the key issues which must be assessed in order to determine the environmental impacts of the proposal to accept LLW are the potential effects associated with population, ecology, water resources and air quality. It is concluded that there will be no potential for environmental impacts as a result of the proposed development with respect to soil resources, landscape and visibility, cultural heritage and the traffic associated with the proposed development. Notwithstanding that the transportation of LLW is dealt with by transport specific legislation an assessment is carried out of the effect of accidents involving LLW.
4. Site location and description

4.1 The proposed area for the landfill disposal of LLW is centred at National Grid Reference TL 011 999. Duddington is approximately 2.2km north west, Kings Cliffe is approximately 2.5km south and Collyweston is approximately 3.3km to the north north west of the proposed development as shown on Figure 1. The proposed development area occupies approximately 6.07 hectares in the south eastern corner of the East Northants RMF including Phases 4B, 5A and 5B of the current hazardous landfill as shown on Figure 2. The development site is located within the area the subject of planning permission and an Environmental Permit for the current landfill.

4.2 The current highway access to the East Northants RMF will continue to be used for the proposed development. The access is from Stamford Road which is an unclassified road that runs adjacent to the eastern boundary of the East Northants RMF from the A47 to the north of the RMF and to Kings Cliffe to the south as shown on Figures 1 and 2. The access road enters the reception area adjacent to and south east of the landfill. Lockable gates are located at the entrance from Stamford Road. The security fencing at the site comprises a combination of chainlink fencing and mature vegetation.

4.3 The East Northants RMF currently comprises a hazardous landfill occupying the eastern half of the site, a site reception area adjacent to and south east of the landfill, materials storage areas, the landfill gas management and surface water pumping compound to the west of the landfill and a soil treatment facility to the west of the landfill (Figure 2).

4.4 The proposed development will be accessed using the internal haul roads in the site that are used currently for deliveries of waste to the landfill and for access to other areas of the site. The main haul road is hard-surfaced from the site entrance to the wheel wash which is located on the southern boundary of the site adjacent to the south eastern corner of the landfill area. In accordance with current proposals new
haul routes will be constructed from the current haul route to provide access to Cells 4B, 5A and 5B.

4.5 The landfill comprises 5 phases of landfilling with each phase of landfilling subdivided into two. Phases 4 and 5 are located in the south east of the landfill. Landfilling operations are complete in Phases 1, 2 and 3 which substantially have been capped. Currently landfilling operations are being carried out in Cell 4A in the north of Phase 4 and Cell 4B in the south of Phase 4 has been engineered to receive waste. Phase 5 has yet to be developed. The proposals which are the subject of this application are for the disposal of LLW into Cells 4B, 5A and 5B.

4.6 Adjacent to the northern boundary of the area the subject of planning permission for the current landfill is the Collyweston Great Wood. To the east north east of the proposed development area is an area of woodland known as Easton Hornstocks (Figures 2 and 3). Part of the Collyweston Great Wood and Easton Hornstocks comprise a Site of Special Scientific Interest (SSSI) and a National Nature Reserve (NNR).

4.7 To the east of the site and Stamford Road are Westhay Cottages and Westhay Farm which is operated as a haulage yard and a farm with associated agricultural and commercial buildings. To the south of the site are farm buildings and open agricultural land. To the west of the landfill area there is open agricultural land and North Spinney Wood (Figure 3). The boundary of the operational training airfield at RAF Wittering is located approximately 800m to the north east of the application site.

4.8 The site is located in an area of the country with natural background levels of radiation that are elevated compared with average levels in the country due to the emission of radon from the underlying rocks. The average annual exposure in the
site area from natural sources is 3.6 mSv/yr compared with an average annual exposure of the UK population from natural sources of 2.2 mSv/yr\textsuperscript{9}.

\textsuperscript{9} Ionising radiation exposure of the UK population: 2005 Review. Health Protection Agency. HPA-RPD-001
5. Properties and population

5.1 The disposal of LLW by landfill is proposed in the south eastern corner of the existing hazardous landfill site at the East Northants RMF. The East Northants RMF is located in an area which predominantly is rural with scattered woodland blocks as shown on Figure 3. The main settlements in the vicinity of the East Northants RMF are Duddington which is located approximately 2.2km to the north west of the application boundary, Kings Cliffe which is located approximately 2.5km to the south of the application boundary and Collyweston which is located approximately 3.3km north north west of the application boundary. The distribution of population within 1km of the application boundary has been examined.

5.2 The occupied properties at Westhay Cottages are located approximately 55m to the east of the application boundary and are the closest residential properties. The agricultural and commercial buildings at Westhay Farm are located approximately 125m east of the application boundary. The commercial buildings form part of a haulage business operated from the Westhay Farm site. Westhay Lodge is located approximately 624m south of the application boundary. A further residential property Law’s Lawn is located approximately 1.1km south east of the application area.

5.3 There are no public rights of way that cross or are adjacent to the application area or the East Northants RMF. The public right of way closest to the application area is approximately 845m west of the application boundary and passes through North Spinney Wood. The bridleway closest to the application area is located approximately 880m south of the application boundary.
PART I THE PROPOSED DEVELOPMENT
6. **Principles of the development**

6.1 In this section of the document the principles of the development are described and in sections 7 and 8 the current operations at the site together with the proposed operations and the site infrastructure are set out.

6.2 The wastes containing low levels of radioactivity that will be disposed of at East Northants RMF typically will comprise construction and demolition waste such as rubble, soils, crushed concrete and metals from the decommissioning of nuclear power plants, buildings and infrastructure, lightly contaminated miscellaneous wastes from maintenance and monitoring at these facilities such as plastic and metal and wastes from manufacturing activities, science and research facilities and hospitals where radioactive materials are used. The wastes will be subject to acceptance criteria which are set out in the Authorisation.

6.3 LLW is characterised as materials that have a level of radioactivity up to 4000 Bq/g for alpha activity and up to 12,000 Bq/g for beta or gamma activity. The waste that will be deposited at East Northants RMF will be a subset of LLW limited to material that has a level of radioactivity up to 200 Bq/g.

6.4 The operations at the landfill will continue as currently. The EIA and the Environmental Statement address the additional impacts or the impacts that may change due to the importation and landfill disposal of LLW at the site. The disposal of LLW at the site will not increase the currently permitted total waste importation rate of up to 249,999 tonnes of waste per annum. There will be no change to the permitted vehicle numbers, transportation routes or other movements associated with transport or noise generating activities associated with the importation of LLW to the site.

6.5 The disposal of LLW at the site will not change the footprint of the landfill site or the restoration profile or restoration proposals for the site. The engineered containment, the leachate and gas management infrastructure of the landfill and the
surface water management scheme will not change as a result of the acceptance of LLW and the phasing of the landfilling activities will remain the same.
7. **Current operations at the site**

7.1 The East Northants RMF comprises a hazardous landfill occupying the eastern half of the site which is the subject of the landfill planning permission, a site reception area adjacent to and south east of the landfill, materials storage areas, a landfill gas management and surface water pumping compound to the west of the landfill and a soil treatment facility adjacent to and west of the landfill (Figure 2). The activities at the landfill site are the subject of an Environmental Permit that is issued and enforced by the Environment Agency. The rate of waste importation is limited to 249,999 tonnes per year.

7.2 The landfill comprises a number of phases of landfilling. The landfill cells constructed in each phase are designed and constructed in accordance with the Environmental Permit and are the subject of Construction Quality Assurance Plans and Reports. The nature of the site containment including the basal and side wall lining system and the capping layer are specified in the Environmental Permit. Cell construction in Cells 4B, 5A and 5B will comprise a leachate drainage layer of 500 mm of crushed aggregate above a sealing liner comprising a 2 mm thick high density polyethylene (HDPE) geomembrane and at least 1.5m thickness of engineered low permeability clay. The capping layer will comprise a composite cap consisting of a gas drainage layer, geotextile protector, geosynthetic clay liner, low density polyethylene (LDPE) geomembrane liner and soil cover.

7.3 Approved procedures are in place at the site for the assessment and acceptance of waste. Only hazardous waste and inert waste for use in engineering and restoration is accepted at the site. The procedures include pre-acceptance procedures which are carried out prior to the delivery of waste to the site and site acceptance procedures that are carried out when waste is delivered to the site. In accordance with legislation the hazardous wastes that are permitted for deposition at the site are subject to a maximum total organic carbon content of 6% by weight.

7.4 Waste delivered to the site is directed to the engineered, prepared landfill cell where it is deposited at the working face. Waste is compacted and covered progressively
through the day and at the end of the day with inert cover material to ensure that deposited waste is not exposed. When a cell has been filled to the approved final restoration level the engineered low permeability cap is laid and restoration soils are placed above the cap.

7.5 The generation of fugitive dust as a result of vehicle movements, landfill engineering works, site restoration works and as a consequence of general operations in the waste reception area and other areas of the site is controlled in accordance with detailed procedures. To minimise the potential for dust generation as a result of site traffic during dry weather haul routes are kept damp with water delivered from a bowser or other spray. The running surface of unsurfaced roads are maintained to prevent the formation of ruts and potholes that may trap silt laden water which could cause dust when it dries. The movement of mobile plant and site traffic is restricted to defined haul routes which will be treated. Vehicle speed limits are imposed to reduce the potential for dust to be raised. All site vehicle exhausts are upward pointing to prevent dust being ‘blown’ up from the road surfaces. During landfill engineering works clay is in a damp condition to ensure that the optimum moisture content is maintained. Significant dust emissions during landfill engineering operations are rare.

7.6 Noise from the site is the subject of a management scheme for mitigating and monitoring the effects of noise nuisance in accordance with the current planning permission. All plant, machinery or vehicles used on site are fitted with silencers maintained in accordance with the manufacturers’ recommendations and specification.

7.7 Leachate is formed as a result of the release of liquids contained or entrained in deposited wastes and following the infiltration of rainfall through the waste. The engineered landfill containment system includes a leachate management system for the collection and extraction of leachate. A leachate drainage blanket and collection sumps are constructed at the base of the site immediately above the low permeability basal liner. The leachate levels are controlled by pumping leachate from the leachate collection sumps or other extraction wells drilled as necessary.
The collected leachate is stored temporarily in bunded tanks and removed from the site by tanker for treatment at a waste water treatment plant. The leachate level at which the leachate is maintained is specified in the Environmental Permit.

7.8 The waste types accepted prior to July 2004 which is when the limitation on organic content was implemented generate significant quantities of landfill gas. Even though the wastes deposited currently at the site have a limited organic carbon content there is residual potential for the generation of small quantities of landfill gas and volatile organic compound vapours at the site. Landfill gas control and management measures are designed and implemented at the site to minimise the uncontrolled emission of gas and vapour and the migration laterally through the ground during the operational life of the landfill and following closure. A dual system of migration control is operated. The engineered low permeability basal and sidewall liners impede lateral gas and vapour migration and the low permeability cap reduces the emissions to the atmosphere. A pumped landfill gas extraction system is operated which prevents the accumulation of gas under elevated pressures in the landfill minimising further the risk of the lateral migration of gas and the emissions of gas to the atmosphere. The collected gas is directed to the gas flare to the west of the landfill and burnt.

7.9 Clean surface water that has not been in contact with waste is collected in a series of drainage ditches. The surface water management system is set out in a scheme which is developed in accordance with the Environmental Permit for the site. The surface water management system is being installed progressively as landfilling continues. The surface water management system comprises a series of ditches which drain either to a surface water management pond in the north west corner of the East Northants RMF approximately 320m west of the landfill or to a proposed pond in the south east of the East Northants RMF adjacent to the landfill. The ditches and ponds at the landfill have been designed to provide sufficient capacity to manage a 1 in 100 year rainfall event.

7.10 Groundwater quality up and down hydraulic gradient of the landfill is monitored routinely in boreholes external to the waste based on a groundwater monitoring
plan which is prepared in accordance with the Environmental Permit. Surface water quality at and around the landfill is monitored based on a surface water monitoring plan prepared in accordance with the Environmental Permit.

7.11 Monitoring of airborne and deposited particulate matter including asbestos fibres is undertaken at the site based on a particulate and asbestos monitoring plan which is prepared in accordance with the Environmental Permit.

7.12 Landfill gas and volatile compounds are monitored in boreholes installed in the waste, in monitoring boreholes external to the waste located around the landfill and at the gas flare. The gas and vapour monitoring is carried out based on a gas monitoring plan which is prepared in accordance with the Environmental Permit.

7.13 The site operations and monitoring schemes all are carried out in accordance with the Augean Environmental Management System (EMS) which is externally certified and accredited to the ISO14001 standard. The EMS together with the health and safety and quality management systems are integrated in accordance with the PAS99:2006 integrated management system standard. The EMS comprises a cycle of setting targets and objectives, planning, implementation, auditing and review together with undertaking where necessary corrective action and setting new targets and objectives. Through the EMS and liaison with the local community Augean seeks to address potential environmental issues before they become a problem or nuisance.

7.14 The whole of the landfill area is the subject of the Environmental Permit. The management and engineering controls which are specified in the Environmental Permit will continue at the site following the cessation of waste acceptance and restoration. In accordance with the legislation the Environmental Permit will remain in place until in the opinion of the Environment Agency the site no longer represents a potential risk to the environment. In accordance with the Environmental Permit the site is the subject of Financial Provision which is a bond provided by the operator for use in the event that the company no longer exists.
8. **Proposed development**

8.1 The proposals the subject of this application for planning permission at East Northants RMF comprise the disposal of solid LLW with levels of radioactivity up to 200 Bq/g in Cells 4B, 5A and 5B of the current hazardous waste landfill. LLW is waste that contains very small amounts of radioactivity. The waste typically will comprise construction and demolition waste such as rubble, soils, crushed concrete, bricks and metals from the decommissioning of nuclear power plant buildings and infrastructure, small amounts of lightly contaminated miscellaneous wastes from maintenance and monitoring at these facilities such as plastic and metal and wastes from manufacturing activities, science and research facilities and hospitals where radioactive materials are used.

8.2 Prior to agreement that an LLW consignment can be accepted at the site, Augean will request amongst other information detailed characterisation information regarding the physical nature, the chemistry and radioactive content of the waste together with information regarding the quantity, form and proposed packaging of the material. Augean will need to be provided with a copy of the Environment Agency Authorisation for the transportation of the waste from the source site. The information will be assessed by Augean technical assessors and the site management to determine if the material is suitable for disposal at the site and is consistent with the conditions of the planning permission and Authorisation. On approval by the technical assessor and site management the consignor will be permitted to make a booking to deliver the waste to the site. The consignor will be advised of the delivery requirements for the waste including an external exposure limit of 10µSv/hr at a 1m distance from each package.

8.3 The waste will be transported to the site in accordance with relevant transport regulations that apply to radioactive wastes. The regulations are established to control the risks from for example transport accidents that result in waste spillage. Due to the limited amount of radioactivity in LLW, most wastes which will be delivered to the site will not need any form of special packaging or shielding during handling or transport. However for ease of handling and in order to minimise the
potential for spillage Augean will oblige waste producers to ensure that waste is transported in drums, bulk bags or other containers. Some large items of waste such as metal sheeting may not be transported in containers but will be wrapped.

8.4 Prior to delivery wastes will be pre-notified to the site in accordance with the transportation regulations and pre-acceptance checks will be carried out regarding the suitability of the waste for deposition at the site. Prior to the packing of each package or similar group of packages of LLW a representative sample will be taken and retained by the source site for a year after the disposal of the package at the landfill. The samples will be stored by the source site and identified uniquely to the package. Augean will request random samples from the source site to undergo independent checking by a specialist laboratory prior to the dispatch of the main package. Augean will audit the consigning facilities routinely to confirm that the characterisation and packaging procedures are followed. The detailed procedures will be outlined in the Authorisation issued by the Environment Agency.

8.5 The current access to the site from Stamford Road will be used for the delivery of LLW to the landfill. Prior to acceptance onto the landfill site the site chemist will confirm that the characterisation information which accompanies the waste load is adequate, conforms with the pre-acceptance information and is acceptable for deposition at the site. Wastes arriving at the landfill will be subject to a physical check on the integrity of the packaging and monitoring to check that the external radiation dose is no more than 10 µSv/hr at a distance of 1m from the package. The packages will not be opened or sampled at the site in order to minimise unnecessary exposure.

8.6 In the unlikely event that unacceptable wastes are received at the site and the waste can be returned safely to the consignor the wastes will be refused entry to the site and returned to their source. In the unlikely event that a waste consignment is found on arrival to be unacceptable for receipt at the site and may not be safe to return to the sender quarantine measures will be implemented. The Environment Agency will be notified immediately. A quarantine area will be provided that is marked and physically separate from the rest of the site. The detailed procedures
for quarantine will be specified in accordance with the radiation protection plan for the site which will be established in accordance with the Authorisation in order to meet the requirements of the Ionising Radiation Regulations\textsuperscript{10}

8.7 The site haul road is hard-surfaced to the wheelwash area on the southern boundary of and close to the south eastern corner of the landfill. Other site haul roads are formed of compacted hardcore or similar material. All vehicles carrying LLW will cross the weighbridge on entering and leaving the site so that the weight of the waste is recorded.

8.8 Once the waste has been accepted the delivery vehicle will travel along the internal haul roads to an unloading point adjacent to the active landfill area. The waste packages will be lifted from the delivery vehicles using mechanical handling machines such as fork-lift trucks and placed in the landfill. Waste will not be tipped into the landfill. The waste will be disposed of in the operational working cell or cells and will be placed alongside hazardous waste. The discharge of waste will take place only under the supervision of a trained operative who will be responsible for the operation of the plant at the disposal face.

8.9 Immediately after placement the deposited wastes will be covered with a minimum thickness of 300mm of suitable cover material over all exposed surfaces. The radiation levels at 1m above the top of the cover material will be measured to check conformance with the specified dose rate of 2\(\mu\text{Sv/hr}\). If the radiation level exceeds the specified dose rate additional cover will be placed as necessary until the specified dose rate is achieved.

8.10 As the predicted doses of radiation to which workers at the site will be exposed are below those specified under the Ionising Radiation Regulations 1999 no workers will be defined as Classified Persons. Specific personal protective equipment will not be necessary during normal site operations additional to the standard

\textsuperscript{10} The Ionising Radiations Regulations 1999. Statutory Instrument 1999 No. 3232
equipment used and worn by workers at the site currently. Passive dosemeters will be worn by staff working in the LLW reception and disposal areas as reassurance to confirm that the exposures received are in accordance with the predictions.

8.11 The current specification for the containment engineering of the base, side walls and cap to the landfill will not change as a result of the acceptance of LLW. The engineering works will continue to be carried out in accordance with Construction Quality Assurance procedures as specified in the Environmental Permit.

8.12 The current leachate collection system will continue to be used to control the level of leachate in the landfill by facilitating the efficient removal of free leachate from each cell. The level of leachate in the landfill will continue to be monitored during site operations in accordance with the Environmental Permit and will be maintained at or below the maximum level specified in the Permit by the Environment Agency.

8.13 The leachate from Phases 4 and 5 will not be recirculated above the ground. The excess leachate will be pumped into the leachate storage tank and removed from site by tanker for treatment at a waste water treatment plant. Radiochemical monitoring of the leachate at the site will be carried out based on a scheme which will be prepared in accordance with the Authorisation.

8.14 The hazardous and inert wastes currently disposed of at the site have a negligible potential to generate landfill gas. The LLW wastes that will be disposed of at the site will exclude biodegradable materials as far as is reasonably practicable. The levels of radioactivity in LLW are too low to give rise to a risk from radiolytic hydrogen gas evolution. It is unlikely that significant quantities of landfill gas will be generated from Phases 4B, 5A and 5B. If sufficient quantities of gas are generated at the site, the gas will be collected in the installed gas management system and directed to the gas flare for combustion. Radiochemical monitoring will be carried out of gas emissions in accordance with a scheme that will be agreed with the Environment Agency as part of the Authorisation.
There are operational controls in place currently at East Northants RMF to minimise litter, odour and dust. LLW will be delivered to the site in containers or as wrapped individual items. The waste will be disposed of in the landfill in the containers or wrapping and covered immediately after placement. It is considered highly unlikely that there will be litter or dust generated as a result of the disposal of LLW. If necessary the operational controls in place currently such as damping down of dry, dusty loads will be used to minimise dust. Dust collected at the site in the dust monitors will be subject to radiochemical monitoring in accordance with a scheme that is agreed with the Environment Agency as part of the Authorisation.

As the LLW disposed of at the site will contain negligible quantities of putrescible waste it is considered unlikely that there will be odour generated from the waste.

LLW is unlikely to include any waste that may comprise a food source that is attractive to birds or vermin. It is considered that it is unnecessary to provide specific controls for birds and vermin at the site. The hazardous wastes that are deposited at the site currently and will continue to be deposited alongside the LLW is similarly unattractive to birds and vermin. The wastes placed at the site are covered immediately with a minimum thickness of 300mm of inert material. Accordingly birds and vermin alighting at or travelling across the site will not come into contact with the wastes.

Surface water at the site which has not come into contact with waste will continue to be managed based on the current surface water management scheme. Radiochemical monitoring of surface water will be carried out in accordance with a scheme that is agreed with the Environment Agency as part of the Authorisation.

Groundwater quality in boreholes located around the site will continue to be monitored based on the scheme specified in the Environmental Permit. The monitoring scheme will be extended in agreement with the Environment Agency and in accordance with the Authorisation to include radiochemical monitoring of groundwater samples.
8.20 A site wide radiochemical monitoring scheme will be prepared and will be subject to approval by the Environment Agency and the Health Protection Agency. The Health Protection Agency will carry out independent assessment and monitoring of the LLW disposal activities at the site. It is anticipated that the monitoring scheme will include regular reassurance monitoring of working areas for surface contamination such as the wheel wash, traffic routes, the site access and site offices. As part of the Authorisation for the site emergency procedures will be prepared and agreed with the regulatory authorities.
9. **Restoration**

9.1 There are no changes proposed to the approved restoration scheme for the landfill area including the application site which is specified in accordance with condition 6 of the planning permission for the hazardous waste landfill. The approved restoration scheme is shown on Figure 5.

9.2 The objective of the approved restoration scheme is the development of a self-sustaining long term land use that is integrated into the surrounding countryside and complements the adjacent Collyweston Great Wood. The scheme comprises the development of an area of low intensity agriculture with the main aim of enhancing ecology and biodiversity. The scheme comprises:

- The development of two grassland fields separated and surrounded by a combination of existing and new hedgerows
- A woodland planting block along the north west, south east and eastern boundaries
- Tree planting within existing and new hedgerows
- Scrub and rough grassland developed along the northern bank
- A footpath around the boundary to facilitate future access

9.3 The landfill site will be restored in accordance with the agreed plan. In accordance with condition 33 of the current planning permission waste acceptance at the site must cease not later than 31 August 2013 and the site must be restored within 3 months. The deposition of LLW at the site will not affect the restoration and afteruse proposals for the site.
10. Alternatives

10.1 The consideration of alternatives to the proposed development is an obligation under Schedule 4 Part 1 of The Town and Country Planning (Environmental Impact Assessment)(England and Wales) Regulations 1999 as amended. It is specified that the Applicant must include in an Environmental Statement:

‘An outline of the main alternatives studied by the Applicant or Appellant and an indication of the main reasons for his choice taking into account the environment effects’

10.2 The main alternatives considered in relation to the proposed development are the options for alternative management methods for LLW, the disposal of LLW at sites other than the East Northants RMF, the development by Augean of sites other than East Northants RMF for the disposal of LLW and the disposal of other waste types at the site.

10.3 It is considered good practice to address the ‘Do nothing’ or ‘No Project’ scenario as a baseline against which the environmental effects of the project can be assessed. In this case the ‘Do nothing’ scenario would mean the site would continue operations as a hazardous waste landfill under the current planning permission. If the proposed development does not proceed the site still will continue to be filled with hazardous waste to achieve the approved restoration scheme. There will be no adverse local environmental effects if the proposed development does not proceed.

10.4 It is identified in the assessment of the need for the development section 8 of Volume 1 of the Planning Application that there is a significant shortfall in the capacity needed for the disposal of solid LLW. In the government policy for the long term management of LLW it is stated that postponing final disposal to future

generations is unjustified and management solutions should be implemented early rather than late. The provision of new, fit-for-purpose disposal capacity for LLW will provide a significant positive effect in the contribution it will make to the safe decommissioning of the national legacy of nuclear power generation. If the proposed development does not proceed the shortfall in LLW disposal capacity will continue and the positive effects achieved as a result of decommissioning may not be achieved in the timescale identified by the government as necessary.

**Alternative management methods for LLW**

10.5 Before LLW is directed for disposal to landfill the producer of the waste must first have considered alternative options for its minimisation, re-use or treatment. The UK Government policy\(^\text{12}\) states that nuclear and non nuclear sites which produce LLW must prepare a LLW Management Plan. The consultation draft of the NDA strategy for the management of LLW\(^\text{13}\) reiterates the commitment to the implementation of the waste hierarchy and the development of site specific LLW management plans. One of the principles of the management plan will be the minimisation of LLW in terms of both activity and mass. LLW producers will be obliged to manage their waste in accordance with the waste management hierarchy set out in UK waste strategy documents\(^\text{14}\). For LLW this means:

- Avoidance of generation
- Minimisation, re-use and recycling
- Treatment
- Disposal

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10.6 The consultation draft of the 2009 NDA Strategy\textsuperscript{15} is based around three themes which are the application of the waste hierarchy, the best use of existing assets and new fit-for-purpose waste management routes. The application of the waste hierarchy is seen by the NDA as critical in ensuring the availability of safe, secure and environmentally appropriate disposal capacity.

10.7 It is recognised in UK Government policy that some of the steps in the waste hierarchy require different considerations from those required for conventional (non-radiological) wastes. For instance, the avoidance of waste creation is less relevant in the case of materials which are already contaminated by historical activities.

10.8 Following the minimisation of waste generation in accordance with the waste management hierarchy wastes should be re-used and recycled where possible followed by waste treatment. It has previously been considered by the NDA that opportunities to apply the principles of re-use and recycling to radioactive waste were limited; however over recent years there has been more success in realising these opportunities within and outside of the nuclear industry. Re-use and recycling of LLW may be limited to particular waste forms, for example metals, where recycling opportunities are most likely.

10.9 Waste treatment activities include waste compaction and incineration. However even though compaction can substantially reduce the volume of the waste the residual, compacted waste still will need to be disposed of. The thermal treatment of LLW through incineration or pyrolysis is carried out at present but the capacity of the facilities is limited.\textsuperscript{16}

10.10 The Government LLW policy recognises that for wastes that cannot be prevented, further minimised, diverted for recycling or re-used, final un-retrievable disposal is the end point for all LLW. The disposal of LLW is therefore considered the last


option available to LLW producers. It is concluded that only wastes which cannot be managed at a point higher in the waste hierarchy will be consigned for disposal including at the East Northants RMF.

**The disposal of LLW at sites other than East Northants RMF**

10.11 Most LLW that arises currently is disposed of at the LLW Repository near Drigg (LLWR). LLW has been deposited at the disposal facility at the research reactor site at Dounreay, Caithness but it is intended that this waste will be retrieved, packaged into containers and consigned to a planned new solid LLW disposal facility adjacent to the Dounreay site. Current LLW arisings are being stored on site as an interim measure while this new facility is developed.

10.12 Currently the only other route for the disposal of LLW from the nuclear industry is at the commercial landfill site at Clifton Marsh in Lancashire. The site accepts domestic, commercial and industrial waste as well as quantities of very low level radioactive waste (VLLW) and some LLW. The site currently accepts VLLW and LLW only from the Capenhurst and Springfields nuclear fuel fabrication and uranium enrichment sites. Wastes with up to 100Bq/g of alpha activity are permitted for disposal at the site. The site currently has planning permission for operations up to 2012. Proposals are being developed for an application for authorisation to dispose of VLLW at a commercially operated non-hazardous waste landfill at Lillyhall near Workington in Cumbria.

10.13 Most LLW generated by the non-nuclear industry are sent to regional incinerators, local landfills where the wastes comprise material that does not need to be sent to specially authorised sites and to the LLWR for disposal for wastes which must be deposited at specially authorised sites. Disposal at the LLWR is regarded as a last resort for those wastes which cannot be dealt with by incineration or local landfill.

10.14 The LLWR has limited capacity which is addressed in section 8 of Volume 1 of the planning application. The LLWR is designed and engineered for wastes in the upper activity range of LLW. The NDA 2009 Strategy aims to make the best use of
the LLWR by husbanding the void for the disposal only of wastes that need the protection afforded by the multi-barrier containment which is in place at the LLWR.

10.15 At the time of submission of this application with the exception of the LLWR and the in-house facility at Dounreay there are no operating or planned facilities for the disposal of LLW with levels of radioactivity up to 200Bq/g.

10.16 There is a demonstrable need for the development of new, fit-for-purpose landfill capacity for the disposal of LLW as alternatives to the current disposal options.

The development by Augean of sites other than the East Northants RMF for the disposal of LLW

10.17 In assessing the alternative locations only sites and land owned by Augean plc were considered. The East Northants RMF is deemed the most suitable and readily available of the Augean owned sites due to its remaining capacity and location.

10.18 The site is centrally located in England (Figure 5) and for the wastes arising at the locations of the major LLW waste producers in the south of the country. It is considered that the location of the site is well placed to serve the producers of LLW from the nuclear and non-nuclear industries. For many of the LLW producers who dispose of their LLW currently at the LLWR near Drigg the East Northants RMF will provide a closer and more convenient alternative.

10.19 The proposed development is located at an existing, established and well used site for the disposal of hazardous waste. Augean PLC and East Northants RMF personnel are experienced in the handling and management of hazardous wastes. It is considered that the East Northants RMF is the most suitable and readily available of the Augean owned sites that can contribute towards the demonstrably necessary capacity for the disposal of solid LLW.
The nature of the waste

10.20 The site currently has planning permission and an Environmental Permit for the disposal of a wide range of hazardous waste. Alternative types of radioactive waste have been considered for disposal at the site. It has been established in section 8 of Volume 1 of the planning application that a clear national need exists for the development of new, fit-for-purpose facilities for the disposal of LLW. Historically almost all LLW has been deposited at the LLWR near Drigg in Cumbria. Large amounts of waste produced by the decommissioning and clean up process will have low levels of radioactivity which do not require the engineered containment capability of the LLWR at Drigg. It has been demonstrated that the LLWR has insufficient capacity to dispose of all the LLW being produced now and that it is forecast will be produced in the future.

10.21 The disposal at East Northants RMF of LLW with higher levels of radioactivity than that proposed in this planning application would introduce the need for enhanced engineering of the site containment systems and the introduction of additional special controls on the unloading and deposition of the waste. For the wastes with activity in the range up to 200 Bq/g no changes are needed to the engineering which is constructed at the site currently in order to contain the hazardous waste which is deposited at the site.

10.22 The higher activity wastes within the LLW category are prioritised for disposal at the LLWR near Drigg leaving large volumes of the lower activity wastes for disposal to alternative sites.

10.23 It is proposed that a subset of LLW i.e. those wastes with a radioactivity level up to 200 Bq/g will be disposed of at the site. This subset includes significant volumes of waste from the nuclear decommissioning process as well as from non nuclear sources. The site is currently suitable and capable in terms of its engineered environmental protection and on-site management experience of handling hazardous wastes.
10.24 It is concluded that the East Northants RMF will provide a new, fit-for-purpose alternative site for the disposal of LLW from both the nuclear and non-nuclear industries that will contribute to the national need for capacity to address the identified shortfall.
PART II      ASSESSMENT OF THE ENVIRONMENTAL EFFECTS
11. Introduction to the assessment of the environmental effects

11.1 The proposed development is for the deposition of a limited range of LLW at the operational hazardous waste landfill site at East Northants RMF. It is necessary to assess the environmental effects that result from the proposed development. As explained in section 6 of this document the disposal of LLW at the site will not increase the currently permitted total waste importation rate of up to 249,999 tonnes of waste per annum. There will be no change to the permitted vehicle numbers, transportation routes or other movements associated with transport or noise generating activities associated with the importation of LLW to the site. The disposal of LLW at the site will not change the footprint of the landfill site or the restoration profile or restoration proposals for the site. The engineered containment and the leachate and gas management infrastructure of the landfill site will not change as a result of the acceptance of LLW, the phasing of the landfilling activities will remain the same and the surface water management scheme will not change. Accordingly the impact assessments that are relevant to the proposed development are those which relate to the effect of the radioactivity of the waste which will be deposited in the site.

11.2 The proposed development must have both planning permission and an Authorisation in order to operate. The Environment Agency is the regulator with responsibility for pollution control and for ensuring the safety of the public and the protection of workers as a result of the proposed development, the Health and Safety Executive is responsible for ensuring the safety of the site workers and the Department for Transport is responsible for safety during transportation. As part of the application to the Environment Agency for the Authorisation quantitative risk assessments are carried out using a conservative predictive model. The risk assessments will be scrutinised robustly by the Environment Agency and the other regulators during the Authorisation application process. An Authorisation for the site will be issued only if the agencies are satisfied that the site can be operated in the short, medium and long term without an unacceptable impact on human health and the environment.
11.3 The Authorisation application which includes the quantitative risk assessments is being submitted in parallel with this planning application. A copy of the risk assessment report is presented at Appendix C for information. Summaries of the scenarios that are assessed in the risk assessments are presented in this document to demonstrate how the environmental effects have been assessed, to confirm that a robust assessment has been carried out and to support the conclusions reached with respect to the assessment of environmental effects that may result from the proposed development.

11.4 Risk assessments have been carried out for a number of scenarios which cover the operational and post operational period of the site together with the period in the long term when management of the site may no longer be in place. The scenarios which are assessed include expected events as well as events and accidents which it is considered are unlikely to occur. The exposure routes which are assessed include direct exposure of site workers and members of the public as well as indirect exposure through the water and air pathways. Exposure of flora and fauna also is assessed. The exposure pathways which are assessed are summarised in Table 2 of this document and are explained further in the relevant sections of this document where the effects are assessed.

11.5 The risk assessments have been carried out using a modified SNIFFER methodology to calculate potential doses. The SNIFFER methodology was developed with regulators, operators and wider stakeholders to provide the regulators and stakeholders with an agreed and consistent approach to assessing the potential of landfill sites to accept LLW.

11.6 The risk assessments are carried out based on the nuclides which represent the worst case in terms of activity levels and decay rates and illustrative calculations are carried out based on an assumed mixture of radioisotopes which result in a calculated level of radioactivity in the material. The risk assessments take into

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account the emissions from daughter nuclides that are generated as a result of nuclide decay. The exact mixture of radionuclides that will be sent to the landfill for disposal will not be known until the site becomes operational and waste producers identify the specific loads of waste that will be sent to the site for disposal. As a consequence of the pre-acceptance procedures that will be in place the exact mixture of radionuclides in any consignment will always be known prior to receipt at the site.

11.7 In the site Authorisation a total radiological capacity will be set for the LLW deposited at the site. The capacity limit will apply from the date of issue of the Authorisation up to the date of closure or the point at which the capacity limit is reached whichever is sooner. The landfill will not be permitted to receive any further LLW once the capacity limit is reached. The capacity limit cannot be expressed as a single number because it depends on the exact mixture of nuclides received taking into account their daughter nuclide chains.

11.8 The amount of radiation a person is exposed to is known as the dose and is measured in millisieverts (mSv) or microsieverts (µSv) per year. 1,000µSv/yr is equivalent to 1mSv/yr.

11.9 For workers at the landfill site the legal dose limit is 20mSv/yr however the dose criterion applied for workers in the Authorisation application is 1mSv/yr which is the same as the current legal dose limit for the public. The public legal dose limit is 1mSv/yr and there is a dose constraint criterion of 0.3mSv/yr from a single source however the dose criterion applied for design purposes for this application is 0.02mSv/year. For the post operational period the design dose criterion applied for this application for all persons is 0.02mSv/yr. Inadvertent intrusion into the site is not expected to occur but this scenario has been assessed in the risk assessments. For unlikely events such as inadvertent intrusion a dose guidance level of 3mSv/yr is used which is at the lower end of the dose range of 3mSv/yr to 20mSv/yr in the
In Table 3 the dose criteria that will be applied at the site are set out in context with other more familiar sources of radiation exposure.

**11.10** The risk assessments are conservative in the assumptions made with respect to the long term management of the site. In the risk assessments it is assumed conservatively that following closure of the landfill site management measures will be in place for a period of only 60 years which is consistent with the current financial provision in place in accordance with the Environmental Permit. In practice the landfill will be the subject of an Environmental Permit and under management control and the subject of financial provision until the Environment Agency are satisfied that the site no longer represents a significant risk of harm to human health or pollution of the environment. This period will almost certainly be considerably longer than 60 years. In the risk assessments it is assumed that after 60 years people may penetrate into the landfill in a way that results in continuous exposure to the LLW without realisation of the radiological hazards present. Dose criteria are set based on the likelihood of occurrence so that design scenarios which are expected to occur are set lower dose criteria and accidents or events unlikely to occur are set higher dose criteria which take into account their low probability of occurrence. The dose criteria used for each of the exposure assessments are shown in Table 2.

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12. Population

Baseline

12.1 Potentially sensitive receptors within 1km of the proposed development are described in section 5 of the Environmental Statement. As the waste types currently accepted at the site will change due to the proposed development it is necessary to address the potential impacts on population due to radioactivity that will be present in the LLW deposited at the site.

12.2 The site is located in an area of the country with natural background levels of radiation that are elevated compared with the average in the country due to the emission of radon from the underlying rocks. The average annual exposure in the site area from natural sources is 3.6 mSv/yr compared with an average annual exposure of the UK population from natural sources of 2.2 mSv/yr. The variability in the background levels of radioactivity across the country is significantly greater than the dose criteria of 0.02 mSv/year used in the design and assessment of the site.

Assessment of environmental effects

12.3 As part of the application to the Environment Agency for the Authorisation quantitative risk assessments are carried out using a conservative predictive model. The Authorisation application which includes the quantitative risk assessments is being submitted in parallel with this planning application. A copy of the risk assessment report is presented at Appendix C. Risk assessments have been carried out for a number of scenarios which cover the operational and post operational period of the site together with the period in the long term when management of the site may no longer be in place. The scenarios which are assessed include expected events as well as events and accidents which it is considered are unlikely to occur. The exposure pathways which are assessed are summarised in Table 2 of this document and are explained further below.
12.4 Risk assessments have been undertaken for site workers, members of the public exposed directly to solid LLW, members of the public using potentially contaminated groundwater or surface water resources, members of the public living on the site after closure and the withdrawal of controls. Risk assessments have also been undertaken for workers at the leachate treatment facility together with the public at the location where the sludge from the leachate treatment plant will be disposed of and a fishing family consuming fish caught from waters into which treated effluent is discharged.

**Exposures of workers and members of the public during the operational phase-expected events**

*Direct exposure*

12.5 The risk assessments are based on the conservative assumption that no shielding is afforded by the waste containers and that workers will spend time in a LLW disposal cell. In fact operational procedures will specify that all wastes are handled by machines with air conditioned and filtered cabins and that operatives generally will not enter the operational area on foot. On most days the only reason that an operative would enter the operational area on foot is for final inspection at the end of the day which takes no more than 15 minutes and often is carried out from a vehicle. In the conservative risk assessments it is concluded that the doses of radiation to which the workers will be exposed as a result of direct contact with LLW during the handling and placement of the waste are below the relevant assessment criteria.

12.6 Calculations have been carried out of the risks of direct exposure of members of the public at a distance of 50m from the waste for 8 hours a day every day and that waste with the maximum level of radioactivity is in their direct line of sight for the entire period. The calculations show that the risks to members of the public are negligible. No account is taken in the risk assessment of the significant shielding afforded by the soil screen bund at the boundary of the site.
Exposures of workers and members of the public during the operational phase – expected events

**Exposure from gas emissions**

12.7 The exposure of site workers and members of the public to gas emitted from the landfilled LLW has been assessed. The risk assessment is based on the assumption that although carbon based gases such as methane and carbon dioxide may be generated by the negligible proportion of biodegradable wastes deposited with the hazardous wastes at the site it is highly unlikely that carbon based gases will be generated from the LLW deposited at the site. Accordingly the risk assessment is based on the potential for exposure to the radionuclides tritium (\(^{3}\text{H}\)) and radon (\(^{226}\text{Ra}\)) rather than \(^{14}\text{C}\). The risk assessment is based on exposure to gas emitted through the surface of the site and from the flare stack.

12.8 In the conservative risk assessments it is concluded that the doses of radiation to which the workers and members of the public will be exposed as a result of gas emissions from the site are below the relevant assessment criteria.

**Leachate treatment at a wastewater treatment works**

12.9 Leachate levels at the site are maintained by pumping excess leachate from the site for transportation by tanker to a water treatment plant at Avonmouth. Following treatment water is then discharged into an estuary. There is a potential for workers and members of the public to receive doses from radionuclides as a result of the treatment process and following the disposal of sewage sludge and discharge of treated effluent. The risk assessment includes a quantitative review of the doses which may be received by the following groups through the specified exposure pathways:

- Sewage treatment workers:
  - External irradiation from radionuclides in raw sewage and sludge.
- Inadvertent inhalation and ingestion of raw sewage and sludge containing radionuclides.

- A farming family living on land conditioned with sewage sludge:
  - Consumption of food produced on land conditioned with sludge and incorporating radionuclides.
  - External irradiation from radionuclides in sludge conditioned soil.
  - Inadvertent inhalation and ingestion of sludge conditioned soil.

- A fishing family (based on the assumption that treated effluent from the water treatment works is discharged to an estuary/coastal water)
  - External irradiation from radionuclides deposited in sediments.
  - Consumption of fish incorporating radionuclides.

12.10 In the conservative risk assessments it is concluded that the doses of radiation to which the workers and members of the public will be exposed as a result of the treatment of leachate at a waste water treatment plant are below the relevant assessment criteria. The leachate removed from the site for treatment and disposal will be the subject of an activity limit specified in the Authorisation regulated by the Environment Agency.

*Drilling through the emplaced waste in order to install new leachate extraction wells or monitoring boreholes*

12.11 During the operational life of the landfill site drilling works may be carried out for the purpose of installing new leachate monitoring or extraction wells or gas monitoring boreholes. As these works will be carried out only when the site is operated under the regulatory supervision imposed by the Authorisation and the Environmental Permit drilling will only be permitted in accordance with appropriate and agreed controls on exposure to radiation. Accordingly it is highly unlikely that unacceptable risks will be presented by this activity.
Exposures of workers and members of the public during the operational phase – unexpected events

Dropped waste container resulting in spillage of LLW

12.12 LLW will be delivered to the site in containers such as drums or bags and the waste will be placed in the landfill in the container or wrapping. Consequently the potential for the release of dust contaminated with radioactivity is low. There is a low probability that containers of LLW may be split or dropped at some point during the unloading and placement of the waste. Procedures will be in place and will be implemented at the site in the event that any LLW is spilled from a container or a container is dropped. Under normal operating conditions the unloading will only take place in the landfill operating cell. A bowser will be on standby in the cell. If waste is dropped or spilled the waste will be immediately doused to suppress dust and covered with suitable soil material in the location where the waste is spilled. In the unlikely event the waste is spilled outside the landfill the procedure will include measures for rapid collection and safe disposal of the waste and verification monitoring of the area at and around the spillage to confirm that all the spilled material has been retrieved.

12.13 The potential exposure of site workers and members of the public through exposure to spilled LLW has been assessed in the quantitative risk assessments. The risk assessment is based on the assumption that a dropped container contains the maximum permitted amount of radioactivity, that 10% of the load is spilled or exposed, that the spilled LLW is a loose dry material that disperses readily, that the worker does not respond appropriately and remains very close to the dropped waste without taking any precautions or retreating for 30 minutes, that a member of the public is located 50m from the waste and remains at that location for 30 minutes and that atmospheric conditions are still representing the worst case.

12.14 In the conservative risk assessments it is concluded that the doses of radiation to which the workers and members of the public would be exposed as a result of a dropped or spilled container of LLW are below the relevant assessment criteria.
Contamination as a result of LLW entering an open wound

12.15 Workers at the landfill site would not normally be expected to handle wastes and will wear personal protective equipment including overalls and gloves and it is standard good practice that any open wounds would be treated rapidly and covered. In all normal circumstances the usual site health and safety precautions together with the procedures that will specify that LLW is not handled directly will prevent any radioactive material entering open wounds. During a dropped or spilled container incident there is the potential for cuts to the hands or arms from handling loose material. Simple, standard precautions such as the wearing of gloves will reduce the potential for such wounds and for subsequent contamination.

12.16 The potential exposure of site workers by contamination by exposure to radioactivity through an open wound has been assessed in the quantitative risk assessments. The risk assessment is based on the assumption that the radionuclide with the potential for generating the highest internal dose is incorporated into the wound. In the conservative risk assessment it is concluded that the dose of radiation to which the workers would be exposed as a result of contamination through an open wound is below the relevant assessment criteria.

Failure of the engineered containment barrier

12.17 The risks that may arise as a result of possible damage or defects in the engineering lining system which could lead to the release of leachate to groundwater have been assessed. The site has been engineered based on detailed and approved designs. The construction of the lining system has been the subject of verification and Construction Quality Assurance programmes. The lining system comprises a HDPE membrane and a low permeability clay layer. The standard risk assessments include conservative assumptions regarding the presence of holes in the HDPE liner and degradation of the HDPE liner over time. Clay is a natural mineral which will not degrade over geological time and which is resistant to chemical attack. It is concluded that the risks to people and the environment from failure of the engineered containment barrier is negligible.
Site remediation activities

12.18 Deliberate intervention to maintain, remediate or re-engineer the site could lead to the creation of contaminated dust. Records will be maintained of the location of the LLW at the site and any remediation work would be carried out with the knowledge that there was radioactive material at the site. As remediation works would be carried out only when the site is operated under the regulatory supervision imposed by the Authorisation and the Environmental Permit works will only be permitted in accordance with appropriate and agreed controls on exposure to radiation. Accordingly it is highly unlikely that unacceptable risks will be presented by this activity.

Fire at the site

12.19 Fires in landfill sites can be associated with the deposition of hot or burning loads of waste or the collection and utilisation of methane in landfill gas at sites which accept significant quantities of biodegradable wastes. There will be insignificant amounts of biodegradable or combustible material in the LLW and the hazardous waste deposited at the site hence a fire starting in the site as a result of the ignition of combustible material is considered unlikely. The wastes in the landfill, the cover materials and the LLW have an extremely low combustibility. The current waste acceptance criteria for the landfill excludes material with an organic carbon content above a specified level and flammable wastes are prohibited. It is considered that the potential for a fire in the LLW at the site is negligible.

Failure of the leachate collection system

12.20 For an operational hazardous waste landfill site the controls on cap construction and leachate monitoring will prevent or identify at an early stage releases through this pathway. Accordingly it is highly likely that remediation will be carried out as necessary cognisant of the presence of radioactive material well before members of
the public could be exposed via this pathway. It is concluded that there is a negligible probability of significant failure of the leachate collection system.

_Aerosol generation from leachate_

12.21 There is minimal potential during leachate management and treatment for aerosols to be generated that could be inhaled by workers or members of the public near the off-site treatment facility. Any exposure to aerosols in leachate resulting from LLW deposited at the landfill site will be abnormal and short-lived. A risk assessment has been carried out of the dose which would result from routine, off-site leachate management. In the conservative risk assessments it is concluded that the doses of radiation in aerosols formed from leachate to which the workers and members of the public would be exposed are below the relevant assessment criteria.

_Impact from an aircraft crash_

12.22 There is a low potential for an accident such as an aircraft crash at the site that may result in the release of radioactively contaminated material into the air. Due to the proximity of RAF Wittering the risk presented by this unlikely event has been assessed. In the risk assessment it is assumed that 300 m$^3$ of LLW is displaced as a result in the impact from a crashed military plane. The present of a 1.5 m capping layer of the waste is ignored in the risk assessment. It is assumed that the duration of the event in which the displaced material can be inhaled is 30 minutes and that the displacement takes place 200 m from the public. Still, worst case weather conditions are assumed in the risk assessment. The risk assessment demonstrates that as a result of this unlikely event the exposure of workers and members of the public will be below the relevant assessment criteria. Exposure to radioactivity as a result of fire is not assessed in this scenario as although an aircraft crash could lead to a fire, the fire would consume the aircraft fuel and wreckage and not the waste.
Monitoring

12.23 An environmental radioactivity monitoring scheme for the site will be prepared and approved as part of the Authorisation for the proposed development. The monitoring will include continuous monitoring of individual workers, workplace monitoring of areas such as the wheel wash, the site access, traffic routes and the surface of the landfill site. Together with routine chemical analyses as specified in the current Environmental Permit radiochemical monitoring will be carried out of the site leachate, gas, groundwater, surface water and dust collected in the dust monitoring gauges. The monitoring will provide reassurance that the site is being operated in accordance with the design and the predictive risk assessments and provide early warning in the event that improvements are necessary well before any unacceptable levels of exposure are reached. The results of the monitoring will be submitted to the Environment Agency and will be publicly available.

Exposures of workers and members of the public during the post closure period – expected events

12.24 Management controls will be in place at the site for a minimum of 60 years after the closure of the site therefore the risk assessments which have been carried out for the operational period remain valid. A number of the risk assessment scenarios such as direct radiation from delivered waste, the dropped or spilled container and the wound contamination scenarios no longer will exist following the closure of the site. A risk assessment has been carried out of exposure levels at the restored surface of the site. Exposure levels will be well below the relevant dose criteria for members of the public who walk over the site surface.

Monitoring

12.25 Environmental radiochemical monitoring will continue to be carried out to provide reassurance that the site is being operated in accordance with the design and the predictive risk assessments and provide early warning in the event that
improvements that are necessary well before any unacceptable levels of exposure are reached.

**Exposures of workers and members of the public during the post closure period – unexpected events**

12.26 For the purpose of the risk assessments it is assumed conservatively that following closure of the landfill site management measures will be in place at the site for a period of only 60 years which is consistent with the current financial provision in place in accordance with the Environmental Permit. In practice the period of aftercare will almost certainly be considerably longer than 60 years. A number of the risk assessments which have been carried out for unexpected events during the operational period of the landfill are relevant also to the post closure period.

12.27 The additional scenario which has been assessed is the unlikely situation where it has been forgotten that radioactive waste has been deposited in the site and people may penetrate into the landfill in a way that results in continuous exposure to the LLW without realisation of the radiological hazards present. The scenario is extremely unlikely give the presence in the site of hazardous waste and asbestos which would indicate that the site has been used for the disposal of waste. In the risk assessment it is assumed that the engineering barrier will degrade with the potential for gas and liquid releases and direct irradiation through the cover materials. It is assumed in the risk assessment that the material in the site is disturbed and radioactive material is incorporated into the surface soil in which crops are grown and animals are grazed.

12.28 Risk assessments have been carried out based on the assumption that a house is constructed on top of the landfill cap immediately after closure and members of the public are living there. Irradiation doses are calculated for a resident spending 75% of the time indoors and 25% outdoors. Doses from gas inhalation are calculated for indoor exposure of the house resident to gas accumulating in the dwelling.
12.29 For the purpose of the assessment it is assumed that there will be loss of control over the site 60 years after closure. To illustrate the sensitivity to this assumption alternative cases in which it is assumed that control over the site will be lost 20 years and 100 years after closure have also been considered in the risk assessments. In the conservative risk assessments it is concluded that the doses of radiation to which members of the public living on the site following loss of management control would be exposed are below the relevant assessment criteria.

12.30 The risk assessments submitted as part of the Authorisation application will be scrutinised robustly by the Environment Agency and the other regulators during the Authorisation application process. An Authorisation for the site will be issued only if the agencies are satisfied that the site can be operated in the short, medium and long term without an unacceptable impact on human health and the environment.

Assessment of socio-economic effects

12.31 In the Strategic Environmental Assessment of the NDA Strategy\(^{20}\) the potential for concerns regarding the impacts on the economy and society arising from the management of radioactive waste at sites away from existing nuclear sites, for example due to negative impact on property prices or inward investment is noted. The assessment did not find evidence that adverse impacts on local economies are likely to be significant but noted that such considerations can only be fully considered in the context of specific local circumstances. The NDA Strategy\(^{21}\) states:

- Any impact on property prices of radioactive waste facilities is expected to be equivalent to those observed near non radioactive waste facilities and are expected to be both small and very localised.


• The Strategic Environmental Assessment did not identify conclusive evidence of significant negative impacts on local economies near major nuclear sites. As a result significant negative impacts have not been demonstrated on local economies and indeed, where new waste management facilities are required modest positive impacts are expected as a result of job creation.

12.32 The proposed development will help secure the employment of the 22 full time staff who currently work at the East Northants RMF.

12.33 The need for the proposed development is set out in the Planning Application document which accompanies this Environmental Statement. It is concluded in the assessment of need that there will be a shortfall in disposal capacity for LLW from the major LLW waste producers for the period 2010 to 2014 which is the operational life of East Northants RMF. It is concluded that there is a significant and urgent national need for additional disposal capacity for LLW. The East Northants RMF will provide a new, fit-for-purpose alternative site for the disposal of LLW from both the nuclear and non-nuclear industries that will contribute to the national need for capacity to address the identified shortfall.

12.34 In the consultation draft of the NDA strategy for LLW it is stated that while widespread significant negative impacts on local communities are not envisaged, like other waste management infrastructure, the development of new radioactive waste management facilities is potentially contentious and will need effective and proactive engagement with local communities. The proposed development at the site has been the subject of extensive engagement with the public and other stakeholders. The details of the engagement activities are set out in the Statement of Local Engagement which accompanies the planning application.

12.35 Augean has sought to engage actively, meaningfully and continuously with all the key stakeholders particularly the local community. The engagement activities have included a public exhibition and surgery held in Kings Cliffe. Representatives from
Augean, the Environment Agency, the Health Protection Agency and Research Sites Restoration Ltd, a subsidiary of the United Kingdom Atomic Energy Authority (UKAEA) were present. 220 members of the public attended the exhibition.

12.36 A number of other measures were used to inform the local community, elected representatives and others about the proposed development. A public information leaflet was distributed to over 560 houses and businesses in Duddington and Kings Cliffe. The leaflet was also mailed to elected representatives at every level including MEPs, MPs, Northamptonshire County, East Northamptonshire District and Peterborough City Councillors and Kings Cliffe, Duddington with Fineshade, Collyweston, Easton-on-the-Hill, Thurnhaugh and Wansford Parish Councillors. Meetings were held with Councillors from Northamptonshire County Council, East Northamptonshire District Council and Kings Cliffe Parish Council. Particular attention was paid to providing information to the Primary Care Trust and local doctors’ surgeries and Kings Cliffe Middle School.

12.37 An information pack was created containing the public information leaflet, site map, news release, key facts about the proposals, key fact about the site, frequently asked questions (FAQs) and a fact sheet on the sources of radiation and comparative doses. The information pack was sent to journalists from the local press.

12.38 Presentations of the proposals were given to the Lead Member for Environmental Services and the Leader of the Council of East Northamptonshire Council. Officers and the Heads of Planning Services and Environmental Services, Kings Cliffe Local Liaison Group and Kings Cliffe Parish Council. The Chair of Collyweston Parish Council and Northamptonshire County Council and East Northamptonshire District Council officers were also present. Augean has given presentations on the proposals to the Parish Councils of Duddington with Fineshade, Collyweston and Easton-on-the-Hill to which members of the public were invited. A presentation was also made to the Councillors of the neighbouring Peterborough City Council ward of

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Glinton and Wittering, together with the City Council interim Head of Planning and the portfolio members for planning and strategic planning.

12.39 A further newsletter will be distributed to local residents and businesses in the local area and widely elsewhere to coincide with the submission of the planning application. Together with a full list of questions and answers on the Augean website the newsletter will address the questions raised by local residents at the public exhibition and subsequently and by elected representatives. Augean will continue to engage with all those with an interest in the proposals.
13. Ecology

Baseline

13.1 The ecological setting of the site has been established as a result of the development of the current waste management activities at the site. No significant habitats were identified in the area of the proposed development. There is no change to the footprint of the landfill site as a result of the proposed development and the landfill area into which LLW will be deposited comprises engineered landfill cells and disturbed ground which is awaiting engineering works.

13.2 No protected species have been recorded in the proposed development area. In the vicinity of the landfill site badgers, great crested newts and reptiles have been identified and the northern boundary of the landfill site bounds the ancient woodland of Collyweston Great Wood. Parts of the Collyweston Great Wood and Eason Hornstocks are designated a Site of Special Scientific Interest (SSSI) and a National Nature Reserve. Based on a 2006 survey two active badger setts are located to the north of the landfill site and one active sett is located to the south of the landfill site. Based on a 2007 great crested newt survey great crested newts are present in ponds to the west of the active landfill.

Assessment of effects

13.3 The footprint of the landfill will not change as a consequence of the proposed development. The mitigation schemes for the protected species identified in the vicinity of the proposed development site are agreed and are in place. The only potential impacts as a result of the proposed development that it is necessary to assess are the potential impacts on non-human flora and fauna due to the disposal and presence of LLW.

13.4 The potential radiological effects of the disposal of LLW at the site on non-human species has been assessed as part of the risk assessments carried out for the Authorisation application. Although there is no specific evidence that there might be
a threat to populations of non-human species from the release of radioactive substances if people are protected adequately damage to biodiversity might occur to habitats that are not exploited extensively by people. There are currently no internationally established criteria for determining radiological protection of the ecological environment. However, a number of research studies and regulatory guidance documents²³ have proposed dose rate values as a screening criterion. Estimated dose rates greater than the screening criterion would warrant more detailed assessments.

13.5 An assessment tool²³ developed as part of the ERICA project (Environmental Risk from Ionising Contaminants: Assessment and Management) has been used to calculate potential dose rate values. In the risk assessment both terrestrial and freshwater ecosystems are considered. The range of organisms and wildlife groups considered in the risk assessment for the terrestrial and freshwater ecosystems are set out in Table 4.

13.6 In the risk assessment estimated environmental concentrations for individual radionuclides calculated using generic assumptions regarding the ecosystems are compared with limiting concentrations. It is assumed that all of the organisms and groups listed in Table 4 are present so that the limiting concentration is that calculated for any organism.

13.7 For the purposes of the wildlife assessment radionuclide concentrations are estimated in a hypothetical stream close to the site boundary. It is assumed that this stream receives baseflow from groundwater. For the terrestrial ecosystem it is assumed that this stream floods periodically onto an adjacent area of land resulting in the presence of radionuclides in soil.

13.8 Based on the conservative risk assessment it is demonstrated that the risk to the wildlife and biodiversity at and in the vicinity of the site is not significant as the

²³ http://www.ceh.ac.uk/protect/ERICAdeliverables.html
estimated radiation dose to wildlife is significantly below the screening criterion at which the need for more detailed assessment should be considered.

13.9 The risk assessments submitted as part of the Authorisation application will be scrutinised robustly by the Environment Agency and the other regulators during the Authorisation application process. An Authorisation for the site will be issued only if the agencies are satisfied that the site can be operated in the short, medium and long term without an unacceptable impact on the environment including wildlife.
14. Water resources

Baseline

14.1 The baseline geology, hydrology and hydrogeology has been established at the site as part of the assessments carried out for the current waste management activities at the site.

Geology

14.2 The former clay pit which now comprises the landfill site was excavated to the base of the Jurassic Upper Estuarine Series of the Great Oolite Group which overlies the Jurassic Inferior Oolite Group. The Upper Estuarine Series comprises silty mudstones and is approximately 4m thick in the vicinity of the site. The Inferior Oolite Group comprises the limestones and sandy limestones of the Lincolnshire Limestone, the sands, slits, silty clays and mudstones of the Grantham Formation and the sandstones with subordinate limestones of the Northampton Sand. The Grantham Formation is discontinuous locally and often the Lincolnshire Limestone is in direct contact with the Northampton Sand.

Hydrogeology

14.3 The mudstones of the Upper Estuarine Series have a low hydraulic conductivity. The limestones and sandstones of the Lincolnshire Limestone and the Northampton Sand are water bearing. Groundwater levels in the Lincolnshire Limestone in the vicinity of the site vary seasonally between approximately 8 metres below ground level (mbgl) and 16mbgl. It is reported that groundwater levels in the vicinity of the site rise rapidly in response to rainfall events. The Lincolnshire Limestone has a high hydraulic conductivity due to the presence of fissures and fractures. Karst features for example swallow holes have been recorded in the immediate vicinity of the site. There are no records of swallow holes at the development site. The regional direction of groundwater flow in the Lincolnshire Limestone in the vicinity of the site is reported to be towards the east. Locally the direction of groundwater flow in the Lincolnshire Limestone is to the south and south east.
14.4 The Upper Estuarine Series is designated a Non Aquifer by the Environment Agency. The Lincolnshire Limestone is designated a Major Aquifer by the Environment Agency. The Northampton Sand is designated a Minor Aquifer by the Environment Agency. There are eight licensed groundwater abstraction points within a 3km radius of the site which are for agricultural or industrial use. The active abstraction closest to and potentially down hydraulic gradient of the site is approximately 1490m south east of the site at Law’s Lawn which is licensed for agricultural use.

14.5 It is considered that the site is in a sensitive location with respect to groundwater. It is considered that the site is not in a sensitive location with respect to groundwater abstractions.

14.6 Samples of leachate and groundwater at and in the vicinity of the site have been analysed for radioactivity. The baseline sampling showed there is no enhancement of radioactivity in the groundwater samples compared with typical background levels derived from UK wide groundwater monitoring programmes. The leachate samples showed a slight enhancement of tritium ($^3$H) concentrations compared with typical leachate levels derived from UK wide monitoring programmes. Tritium is found commonly in leachate from landfills across the UK in which ordinary waste including domestic and commercial waste is deposited.

Hydrology

14.7 The site is located in an area between two adjacent streams flowing in the same general direction of the catchment of the River Nene which flows generally to the west approximately 6.5km south east of the site and the River Welland which flows generally from south to north approximately 2.5km west of the site. A surface water ditch flows from east to west adjacent to the northern boundary of the landfill site. Water draining from the northern part of the landfill site is collected in a sump then

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24 http://www.food.gov.uk/science/surveillance/radiosurv/rife11

pumped to holding areas on site for use in dust suppression, wheel washing or discharge from the site. Drainage from the proposed development area currently drains to ground. The site is not located in an area of significant flood risk as designated by the Environment Agency. The surface water run off from the landfill site is managed in accordance with the surface water management plan for the site which is prepared and implemented in accordance with the Environmental Permit for the site.

14.8 There is one surface water abstraction reported within a 3km radius of the site which is at Woodthorpe Nurseries approximately 2km to the east of the site. It is reported that the abstraction is downstream of the site.

14.9 It is considered that the site is in a sensitive location with respect to surface water. It is considered that the site is not in a sensitive location with respect to surface water abstractions.

Assessment of environmental effects

Flood Risk Statement

14.10 The proposed development is for a change of waste types only and will not change the footprint of the site, the permitted restoration profile, the nature of the site surface or the agreed operational or restoration surface water management scheme. The proposed development will not affect surface water run off and management therefore no further flood risk assessment is necessary.

Contaminant impact assessment

14.11 The engineered containment and the leachate management infrastructure of the landfill site will not change as a result of the acceptance of LLW and the phasing of the landfilling activities will remain the same. The pathways for the migration of contaminants in the landfill to surface water and groundwater will not alter due to the proposed development. The potential impacts with respect to potential
contamination by radioactive material on groundwater and surface water quality and the subsequent use of the water resources by people have been assessed quantitatively in the risk assessments which are submitted to the Environment Agency as part of the Authorisation application. A number of different exposure scenarios have been assessed as shown in Table 2.

14.12 Even with the presence of the engineered containment system at the site and the leachate collection systems a limited amount of leachate will migrate over time through the engineered seal to the underlying groundwater. Groundwater can be used directly from abstraction wells or can contribute through springs or base discharge to surface water resources which in turn are used. In the risk assessments that have been carried out it is assumed that the water is used directly for drinking and that it is used to irrigate food crops and the soil used for farming or is used for stock watering. It is assumed that livestock and their associated products such as milk are consumed. It is assumed that surface water also is used for fishing and that the fish inhabiting the water are consumed. It is assumed that the soil which has been irrigated by the water generates dust which is inhaled and inadvertently ingested.

14.13 Even though the closest active licensed groundwater abstraction point is located approximately 1500m south east of the site risk assessments are carried out based on the conservative assumption that groundwater is abstracted from the current nearest downgradient abstraction well approximately 1500m from the site boundary as well as from a hypothetical borehole at the site boundary.

14.14 A risk assessment has been carried out of the effect of a leak or spillage of leachate which could result in potential impacts through several possible exposure pathways. Spillage could result at the site as a result of a leak in the leachate storage tank or a spill as leachate is being discharged to a road tanker for transportation off site. A road accident involving the leachate tanker may result in spillage of the entire tanker load. A risk assessment is carried out of the effect of the spillage of the tanker of leachate as this is regarded as the worst case. It is assumed conservatively in the risk assessment that a tanker contains 30m$^3$ of leachate and
that the leachate reaches a small reservoir that is used for drinking water, irrigation and fishing. Exposures are calculated for human exposure through consumption of drinking water, fish, crops, livestock and associated products and inadvertent consumption of soil.

14.15 Based on the conservative risk assessments it is concluded that the doses of radiation to which members of the public may be exposed as a result of contamination via the groundwater and/or surface water pathways are below the relevant assessment criteria.

Assessment of the effects that may result from climate change

14.16 It is known that as a result of climate change the weather patterns in the UK will change. The site is located approximately 35 miles south west of the nearest coast at the Wash and is approximately 80m above mean sea level and therefore is highly unlikely to be affected by the predicted sea level rise of up to 53 cm by 2095 in a worst case scenario\textsuperscript{26}. The site is not located in an area which is identified by the Environment Agency as sensitive to flooding from rivers or the sea taking into account the predicted effects of climate change. No changes will be made to the approved surface water management schemes as a result of the proposed development. Where necessary surface water management schemes prepared in accordance with Environmental Permit take into account the changes in rainfall volumes and intensity that are anticipated as a result of climate change.

\textsuperscript{26} http://ukclimateprojections.defra.gov.uk/content/view/2145/9/index.html
15. Air quality

Baseline

15.1 The baseline air quality at the site is established as part of the current site waste management activities. A dust monitoring programme is operated currently at the site and will continue in accordance with the current planning permission. The dust monitors and deposition gauges are located along the eastern, southern and western boundaries of the hazardous waste landfill site. Odour generation is controlled in accordance with established procedures that are implemented as part of the Environmental Permit.

15.2 The emissions from the landfill gas flare stack are controlled and monitored and gas concentrations in the monitoring boreholes surrounding the site are monitored based on schemes prepared in accordance with the Environmental Permit. The quantity and chemical quality of carbon based landfill gases generated at the site will not change as a consequence of the proposed development as LLW contains minimal biodegradable material. The only assessment of effects that it is necessary to undertake is with respect to the presence of radioactive components in the gas generated at the site.

Assessment of effects

15.3 The risk assessment is based on the assumption that although carbon based gases such as methane and carbon dioxide may be generated by the negligible proportion of biodegradable wastes deposited with the hazardous wastes at the site it is highly unlikely that carbon based gases will be generated from the LLW deposited at the site. Accordingly the risk assessment is based on the potential for exposure to the radionuclides tritium ($^3$H) and radon ($^{226}$Ra) rather than $^{14}$C. The risk assessment is based on exposure to gas emitted through the surface of the site and from the flare stack.
15.4 In the conservative risk assessments it is concluded that the doses of radiation to which the workers and members of the public will be exposed as a result of gas emissions from the site are below the relevant assessment criteria.
16. Transport

Baseline

16.1 Access to the site is from Stamford Road which runs from north to south adjacent to the eastern boundary of the wider site. The A47 is approximately 1km north of the access. Condition 5 of planning permission reference EN/05/1246C states that the total amount of waste materials imported to the site per annum shall not exceed 249,999 tonnes.

Assessment of effects

16.2 The total amount of waste materials imported to the site per annum will not change as a consequence of the proposed development hence the numbers of vehicles delivering waste to the site will not change as a result of the proposed development. All vehicles other than the very small number delivering wastes from very local arisings will continue to deliver waste via the A47 to the north. Accordingly there are no effects on transport which result from the proposed development.

16.3 The transportation of LLW is the subject of The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2007 and is regulated by the Department for Transport. The emphasis of the regulations is for the package design to provide the main element of safety in normal and accident conditions. It is the responsibility of the consignor and carrier of the waste from the source site to ensure that the material is transported in accordance with the relevant transport regulations.

16.4 Notwithstanding that the transportation of LLW is the subject of regulation by the Department for Transport rather than the planning authority the risk assessments carried out as part of the application to the Environment Agency for the Authorisation include an assessment of the potential exposure to LLW following a vehicle accident.
Vehicle accident resulting in spillage of LLW

16.5 Following a vehicle accident there is the potential for the waste packaging to be split. Contaminated material could then be released from the open packaging with a consequent potential for exposure to members of the public through inhalation.

16.6 The risk assessment for a spillage of LLW following a vehicle accident is the same as that carried out for a spillage of LLW following a dropped container during unloading or placement as described in section 12.

16.7 In the conservative risk assessments it is concluded that the doses of radiation to which the transport workers and members of the public would be exposed as a result of a dropped or spilled container of LLW are below the relevant assessment criteria.

Vehicle accident resulting in the spillage of leachate

16.8 Excess leachate from the site is removed by tankers and transported to a water treatment plant. Road accidents involving tankers may result in the spillage of the entire tanker load. The risk assessment for the spillage of leachate is the same as that at described in section 14. It is assumed conservatively in the risk assessment that a tanker contains 30m³ of leachate and that the leachate reaches a small reservoir that is used for drinking water, irrigation and fishing. It is assumed that the resulting radioactive contamination remains constant for one year. Exposures are calculated for human exposure through consumption of drinking water, fish, crops, livestock and associated products and inadvertent consumption of soil.

16.9 Based on the conservative risk assessments it is concluded that the doses of radiation to which members of the public may be exposed as a result of contamination via the groundwater and/or surface water pathways are below the relevant assessment criteria.
16.10 Small volumes of LLW which are delivered to the site will arise from local sources such as hospitals and manufacturing facilities. The majority of the LLW will arise as a result of the decommissioning of nuclear power plants. The locations of the major arisings of LLW are shown on Figure 4. East Northants RMF is located centrally for the southern centres of waste arising and may receive wastes from any of the arising locations subject to an assessment by the waste producer of the most appropriate disposal location for their waste. Government policy\textsuperscript{27} recognises that the desire to avoid excessive transportation of LLW is an important consideration but state that it must be balanced with all other relevant factors on a case-by-case basis.

16.11 The Strategic Environmental Assessment of the NDA LLW Strategy\textsuperscript{28} states that despite transport being an important consideration in determining the route for the disposal of solid LLW, when the environmental impact of transportation is considered on a national level the effects are small and it is not a strong differentiator between waste management options. It is stated in the consultation draft of the NDA LLW Strategy\textsuperscript{29} that:

‘Transport of LLW to more distant waste management facilities does result in increased carbon emissions compared with management closer to the site where wastes arise. However, such emissions are relatively small on a national scale when compared with UK transport related emissions and such emissions are also not a significant contributor to the carbon emissions of the nuclear sector’

16.12 The number of vehicles delivering waste to the site as a result of the proposed development will not change. The transportation of LLW is the subject of regulation

\textsuperscript{28} UK Strategy for the management of low level radioactive waste from the nuclear industry. Strategic Environmental Assessment. Environment and Sustainability Report. June 2009. NDA
\textsuperscript{29} UK Strategy for the management of low level radioactive waste from the nuclear industry. Consultation Document. June 2009. NDA
by the Department of Transport. Risk assessments carried out as part of the Authorisation application demonstrate that in the event of an accident while LLW is being transported the risks to transport workers and members of the public are below the relevant acceptance criteria.

16.13 The East Northants RMF is located centrally to the southern centres of arisings of decommissioning wastes. The waste producers are obliged to assess and determine the most appropriate location for the disposal of the LLW produced at their facilities taking into account a number of issues including distance to the disposal location. It is concluded in the Strategic Environmental Assessment of the NDA LLW Strategy that the environmental impacts of transportation of solid LLW are small.
17. **Cumulative effects**

17.1 The site is operated currently as a hazardous waste treatment and landfill facility. The proposed disposal of solid LLW in the site will be carried out alongside the disposal of the hazardous waste. The total volume of waste deposited in the site will not change. The LLW will comprise predominantly construction and demolition waste such as rubble, soils, crushed concrete and metals from the decommissioning of nuclear powered electricity generating stations. With the exception of the radioactivity of the waste the LLW will similar in nature to inert, non-hazardous or hazardous waste and will not be more chemically hazardous than waste deposited currently. Accordingly the potential for adverse chemical reactions between the LLW and the hazardous waste that is deposited at the site is negligible. As the waste deposited at the site currently does not comprise radioactive waste there is no cumulative effect with respect to radiation doses at the site.

17.2 Research has not identified any nearby storage or use of radioactive materials other than the natural radiation that is present in the ground in the immediate vicinity of the site. In accordance with international protocols the risk assessments of radiation exposure that have been carried out take into account the cumulative effect of radiation exposure from radiation doses of different sizes, delivered at different rates to different parts of the body, by different pathways from different radionuclides.

17.3 The current UK public dose limit is 1mSv/yr which is additional to background or other sources. In the risk assessments carried out for the Authorisation application exposures which persons may be receive under a wide variety of different normal and accident scenarios are estimated and summed hence comprise an assessment of cumulative effects. The most restrictive of the scenarios is then used to set the radiological capacity of the landfill such that the annual exposure to persons is predicted to be below relevant dose criteria.
18. Conclusions

18.1 The proposed development comprises the disposal of LLW at East Northants RMF in addition to the hazardous waste already permitted for disposal at the site. The proposed development will not change the rate or volume of waste deposited at the site or the physical features that were assessed during the decision process that resulted in the granting of the current planning permission for the site. There will be no change to the permitted vehicle movements or noise generating activities associated with the importation or landfilling of LLW at the site. The site will be capped and restored progressively in accordance with the conditions of the current planning permission and the current Environmental Permit. There will be no change to the operational lifetime of the site and no change to the restoration and aftercare proposals for the site. It is concluded that the impact assessments that are relevant to the proposed development are those which relate to the effect of the radioactivity of the waste which will be deposited in the site.

18.2 To permit the disposal of LLW the site must be the subject of an Authorisation under the Radioactive Substances Act 1993 for which the regulator is the Environment Agency. An application for an Authorisation is being submitted to the Environment Agency in parallel with the submission of this planning application to Northamptonshire County Council.

18.3 As part of the Authorisation application quantitative risk assessments have been carried out for a number of scenarios which cover the operational and post operational period of the site together with the long term when management of the site may no longer be in place. The scenarios which are assessed include expected events as well as events and accidents which it is considered are unlikely to occur. The risk assessments will be scrutinised robustly by the Environment Agency and the other regulators during the Authorisation application process. An Authorisation for the site will be issued only if the agencies are satisfied that the site can be operated in the short, medium and long term without an unacceptable impact on human health and the environment.
Population

18.4 As part of the Authorisation application risk assessments have been undertaken for site workers, members of the public exposed directly to solid LLW, members of the public using potentially contaminated groundwater or surface water resources, members of the public living on the site after closure and after the withdrawal of controls. Risk assessments have also been undertaken for workers at the leachate treatment facility and the public living near the leachate treatment facility together with the workers and public at the facility where the sludge from the leachate treatment plant will be disposed of.

18.5 In the risk assessments exposure that may result from the following pathways are assessed:

- Direct exposure
- Gas emissions
- Leachate treatment at a wastewater treatment works
- Drilling through the emplaced waste in order to install new leachate extraction wells or monitoring boreholes
- Dropped waste container resulting in spillage of LLW
- Contamination as a result of LLW entering an open wound
- Failure of the engineered containment barrier
- Site remediation activities
- Fire at the site
- Failure of the leachate collection system
- Aerosol generation from leachate
- Impact from an aircraft crash
• Inadvertent excavation and dispersion of the LLW and the construction of houses directly on the exposed material.

18.6 It is concluded that based on the conservative risk assessments for each exposure scenario that the doses of radiation to which the workers and members of the public may be exposed are below the relevant assessment criteria.

18.7 It is concluded that there is no evidence that there will be significant adverse effects on local economies or local communities as a result of the proposed development. The provision of new, fit for purpose disposal capacity for LLW will provide a significant positive effect in the contribution it will make to the safe decommissioning of the national legacy of nuclear power generation.

18.8 It is demonstrated that the proposed development has been the subject of extensive engagement with the public and other stakeholders. It is concluded that the public engagement programme has been effective in providing extensive information and discussion opportunities regarding the proposals that has addressed possible previous mis-perceptions regarding the effects of the proposed development on people and the environment.

Ecology

18.9 The potential radiological effects of the disposal of LLW at the site on non-human species have been assessed for both terrestrial and freshwater ecosystems. A range of organisms and wildlife groups were considered. Based on the conservative risk assessment it is concluded that the risk to the wildlife and biodiversity at and in the vicinity of the site is not significant as the estimated radiation dose to wildlife is significantly below the screening criterion at which the need for more detailed assessment should be considered.
18.10 The potential impacts with respect to potential contamination by radioactive material on groundwater and surface water quality and the subsequent use of the water resources by people have been assessed quantitatively. Based on the conservative risk assessments it is concluded that the doses of radiation to which members of the public may be exposed as a result of contamination via the groundwater and/or surface water pathways are below the relevant assessment criteria.

18.11 The site is not located in an area which is identified by the Environment Agency as sensitive to flooding from rivers or the sea taking into account the predicted effects of climate change. It is concluded that it is highly unlikely that the proposed development at the East Northants RMF will be affected by the predicted effects of climate change.

Air quality

18.12 A risk assessment was carried out for exposure of workers and members of the public to radioactive components in the gas generated at the site. In the conservative risk assessment it is concluded that the doses of radiation to which the workers and members of the public will be exposed as a result of gas emissions from the site are below the appropriate assessment criteria.

Transport

18.13 Notwithstanding that the transportation of LLW is regulated by the Department of Transport a risk assessment of the potential exposure to LLW and leachate following a vehicle accident was carried out as part of the Authorisation application. In the conservative risk assessments it is concluded that the doses of radiation to which the transport workers and members of the public would be exposed as a result of a transport accident are below the appropriate assessment criteria.
18.14 The East Northants RMF is located centrally to the southern centres of arisings of decommissioning wastes. The waste producers are obliged to assess and determine the most appropriate location for the disposal of the LLW produced at their facilities taking into account a number of issues including distance to the disposal location. It is concluded in the Strategic Environmental Assessment of the NDA LLW Strategy that the environmental impacts of transportation of solid LLW are small.

Cumulative effects

18.15 It is concluded that the cumulative effects of the proposed development have been taken into account in the assessment of environmental effects.

Conclusions

18.16 It is concluded that the proposed development can be undertaken without significant adverse impacts on workers, local residents and the environment.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstraction</td>
<td>The removal of water or gas from any source either permanently or temporarily.</td>
</tr>
<tr>
<td>Aftercare</td>
<td>The steps necessary to bring land to the specified condition for the afteruse.</td>
</tr>
<tr>
<td>Aquifer</td>
<td>A geological stratum that is capable of storing and transmitting water.</td>
</tr>
<tr>
<td>Biodegradable</td>
<td>Materials which will be broken down by bacteria or other biological means.</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>Range of variation in living organisms including genetic variation and ecosystem variation.</td>
</tr>
<tr>
<td>Bq/g</td>
<td>A Becquerel (abbreviated as Bq) is the unit for the activity of radioactive material. A Gram (abbreviated as g) is a unit of mass. A Becquerel per Gram (Bq/g) is therefore a measure of the concentration of radioactivity in a material.</td>
</tr>
<tr>
<td>Bund</td>
<td>A low bank or wall of material used to store soils or to provide a visual screen.</td>
</tr>
<tr>
<td>Cumulative impact</td>
<td>The combined positive and negative impacts on a specific receptor or medium.</td>
</tr>
<tr>
<td>Disposal</td>
<td>Emplacement of waste in an appropriate facility without the intention of retrieval.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Dose</td>
<td>General term for a measure of the energy deposited by radiation in a target.</td>
</tr>
<tr>
<td>Environmental Impact</td>
<td>A process to assess the environmental implications of proposals.</td>
</tr>
<tr>
<td>Environmental Statement</td>
<td>The document that reports the findings of an Environmental Impact Assessment.</td>
</tr>
<tr>
<td>Exposure</td>
<td>The act or condition of being subject to irradiation. Exposure can be either external exposure to sources outside the body or internal exposure due to sources inside the body.</td>
</tr>
<tr>
<td>Groundwater</td>
<td>Refers to all subsurface water as distinct from surface water. It is considered generally that groundwater is water which is in the zone of saturation and contained in porous soil or rock stratum (aquifer).</td>
</tr>
<tr>
<td>Hazardous waste</td>
<td>Waste which had properties which may make it harmful to human health or the environment.</td>
</tr>
<tr>
<td>Hydrogeology</td>
<td>The quality, quantity, storage and movement of water in rock and the interaction with geology.</td>
</tr>
<tr>
<td>Hydrology</td>
<td>The surface water system and its operation.</td>
</tr>
<tr>
<td>Hydraulic gradient</td>
<td>The change in total hydraulic head per unit distance of flow in a given direction.</td>
</tr>
<tr>
<td>Inert</td>
<td>Materials that will not dissolve, burn or react physically or chemically or undergo biodegradation.</td>
</tr>
<tr>
<td>Irradiation</td>
<td>The act of being exposed to radiation.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Landfill gas</td>
<td>An end product of the degradation of biodegradable wastes in a landfill site.</td>
</tr>
<tr>
<td>Leachate</td>
<td>Liquid which seeps through waste in a landfill and becomes contaminated by the deposited waste.</td>
</tr>
<tr>
<td>LLW</td>
<td>Low Level Radioactive Waste. With certain specific exceptions LLW is defined as waste which has an activity concentration in the range 0.4 – 4,000 Bq/g for alpha emitters and 12,000 Bq/g for beta-gamma emitters.</td>
</tr>
<tr>
<td>mSv</td>
<td>milli sieverts. One thousandth of a sievert.</td>
</tr>
<tr>
<td>Permeability</td>
<td>A measure of the rate at which a fluid will pass through a medium.</td>
</tr>
<tr>
<td>Radiation</td>
<td>Energy in the form of waves or particles propagated through space.</td>
</tr>
<tr>
<td>Radioactivity</td>
<td>The phenomenon whereby atoms undergo spontaneous random disintegration, usually accompanied by the emission of radiation.</td>
</tr>
<tr>
<td>Radionuclide</td>
<td>A nucleus (of an atom) that possesses properties of spontaneous disintegration (radioactivity).</td>
</tr>
<tr>
<td>Sievert</td>
<td>Symbol Sv. The unit of effective dose and equivalent dose.</td>
</tr>
<tr>
<td>Surface water</td>
<td>Whole or part of any river, stream, other watercourse natural or artificial, lake, pond, creek, estuary or arm of the sea except for</td>
</tr>
</tbody>
</table>
certain sewers and water mains. In effect all waters that are not groundwater.

**Sustainable Development** Development which meets the need of current generations without compromising the ability of future generations to meet their own needs.

**VLLW** Very Low Level Waste. Radioactive waste considered suitable by the regulatory body for authorized disposal, subject to specified conditions, with ordinary waste in facilities not specifically designed for radioactive waste disposal.

A comprehensive glossary with respect to radiological terminology is presented in the Authorisation application which is included at Appendix C to the Environmental Statement.
Table 1

A summary of the planning issues raised in the responses to the Scoping Report together with a reference to the section in the Environmental Statement in which the issues are addressed.

References in [brackets] refer to the scoping responses
NCC – Northamptonshire County Council
ENC – East Northants Council
PCC – Peterborough City Council
ENCPLAN – East Northants Council Planning Dept
MER- Comments from Dr Andy Mercer submitted with the response from East Northants Council
NE – Natural England
EA – Environment Agency
EASTPC – Easton on the Hill Parish Council
COLLPC – Collyweston Parish Council
DUDD – Duddington & Finshade Parish Council
JON – Questions from Mr. Phillip Jones, Wansford.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Specific issues raised and comments made</th>
<th>Comments and / or the location in the Environmental Statement or Planning Application in which the issues are addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>Provide information to enable the public to understand the impacts on human health [NCC]</td>
<td>Section 11 Introduction to the assessment of environmental effects Section 12 Population</td>
</tr>
<tr>
<td></td>
<td>Human health risk assessment [ENC]</td>
<td>Section 12 Population</td>
</tr>
<tr>
<td></td>
<td>Perception of risk for those in the immediate proximity and in wider area during operations and in the longer term[PCC]</td>
<td>Volume 1 Planning Application Statement of Local Engagement</td>
</tr>
<tr>
<td></td>
<td>Radiological impact assessment required[EA]</td>
<td>Section 12 Population</td>
</tr>
<tr>
<td></td>
<td>Maximum exposure to public – comparison with existing background levels [DUDD]</td>
<td>Section 12 Population Table 3 Radioactivity exposure limits compared with natural radiation and</td>
</tr>
<tr>
<td>Subject</td>
<td>Specific issues raised and comments made</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>---------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Ecology</td>
<td>Assessment methodology for non-human biota (ENCPLAN). Consideration of updated species and habitat surveys (ENCPLAN). Impacts on designated nature conservation sites, habitats, species subject to UK and EU legislation, UK and local BAP importance to be properly addressed. From mitigation measures (ENC) to enhance biodiversity and green infrastructure should be sought. Nature conservation enhancements should be distinguished. Ways to enhance biodiversity and green infrastructure should be sought.</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>Surface and groundwater risk assessment (ENCPLAN) (ENC). Leaching effects over the long term (ENC). Flood risk assessment (ENC) (ENC). What work has been done of the hydrology and hydrogeology and suitability of the site? [JON]. What will you do about gravel in the local geology and streams around the site? [JON].</td>
<td></td>
</tr>
<tr>
<td>Air</td>
<td>Air quality and stack emissions monitoring (ENC). Gas venting mechanism (ENC).</td>
<td></td>
</tr>
<tr>
<td>Subject</td>
<td>Specific issues raised and comments made</td>
<td>Comments and / or the location in the Environmental Statement or Planning Application in which the issues are addressed</td>
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</tr>
<tr>
<td>Transport</td>
<td>Hydrogen concentrations [MER]</td>
<td>Section 15 Air Quality</td>
</tr>
<tr>
<td></td>
<td>What is the accident record on road past the site and A47 junction? [EASTPC]</td>
<td>There are no changes to the traffic movements associated with the site as a result of the proposed development</td>
</tr>
<tr>
<td></td>
<td>Who monitors lorries for content and radiation? [ENC]</td>
<td>Section 16 Transport</td>
</tr>
<tr>
<td></td>
<td>Why is LLW being transported over long distances? [ENC]</td>
<td>Volume 1 Planning Application section 8 Assessment of the need for the proposed development</td>
</tr>
<tr>
<td></td>
<td>Assess health risks if a vehicle is in an accident and LLW is split [COLLYPC][NCC]</td>
<td>Section 16 Transport</td>
</tr>
<tr>
<td></td>
<td>Transport of LLW – Routes, accidents, emergency plan, responsibilities, lorry type [DUDD]</td>
<td>Section 16 Transport</td>
</tr>
<tr>
<td></td>
<td>Quality of the Stamford Road into site? [DUDD]</td>
<td>Volume 1 Planning Application section 8 Assessment of the need for the proposed development</td>
</tr>
<tr>
<td></td>
<td>Vehicle numbers [DUDD]</td>
<td>There are no changes to the traffic movements or traffic management procedures associated with the site as a result of the proposed development.</td>
</tr>
<tr>
<td></td>
<td>From how far around the country will the waste be transported? [JON]</td>
<td>Section 16 Transport</td>
</tr>
<tr>
<td></td>
<td>What arrangements will be in place to protect the waste during transport? [JON]</td>
<td>Section 16 Transport</td>
</tr>
<tr>
<td>Planning</td>
<td>Reference to national, regional and local planning context and nature conservation [NE]</td>
<td>Volume 1 Planning Application section 6 Review of national policy for the management of low level radioactive waste Section 7 Review of the relevant environmental planning polices</td>
</tr>
<tr>
<td>Subject</td>
<td>Specific issues raised and comments made</td>
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<tr>
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</tr>
<tr>
<td>Nature of LLW</td>
<td>Radioactive waste handling [ENC]</td>
<td>Section 8 Proposed operations</td>
</tr>
<tr>
<td></td>
<td>Packaging – If double bagged need to state no need to assess dust or odour [PCC]</td>
<td>Section 8 Proposed operations</td>
</tr>
<tr>
<td></td>
<td>Packaging – vulnerability to wear or tearing [PCC]</td>
<td>Section 8 Proposed operations</td>
</tr>
<tr>
<td></td>
<td>Packaging – Possibility of LLW escape [PCC]</td>
<td>Section 8 Proposed operations</td>
</tr>
<tr>
<td></td>
<td>Mixing of waste products [MER]</td>
<td>Section 8 Proposed operations</td>
</tr>
<tr>
<td></td>
<td>Volume of waste [EA][NCC]</td>
<td>Section 6 Principles of the development</td>
</tr>
<tr>
<td></td>
<td>Can LLW be co-located with Hazardous? [ENC]</td>
<td>Section 8 Proposed operations</td>
</tr>
<tr>
<td></td>
<td>Does LLW have a higher fire risk? [ENC]</td>
<td>Section 12 Population</td>
</tr>
<tr>
<td></td>
<td>What is the half life of the waste? [ENC]</td>
<td>Section 12 Population</td>
</tr>
<tr>
<td></td>
<td>Is LLW replacing currently permitted hazardous waste? [COLLYPC]</td>
<td>Section 6 Principles of the development</td>
</tr>
<tr>
<td></td>
<td>Are the two wastes stored separately [COLLYPC]</td>
<td>Section 8 Proposed operations</td>
</tr>
<tr>
<td></td>
<td>How long do the containers last before decomposing? [COLLYPC]</td>
<td>Section 12 Population</td>
</tr>
<tr>
<td></td>
<td>Waste less toxic than already taken at site? [DUDD]</td>
<td>Section 17 Cumulative</td>
</tr>
<tr>
<td></td>
<td>Classification of waste for the site? [JON]</td>
<td>Section 6 Principles of the development</td>
</tr>
<tr>
<td></td>
<td>Alpha and gamma radiation stored on site? [JON]</td>
<td>Section 6 Principles of the development</td>
</tr>
<tr>
<td></td>
<td>What isotopes with what half life expected on site? [JON]</td>
<td>Section 12 Population</td>
</tr>
<tr>
<td></td>
<td>Sources of LLW [JON]</td>
<td>Volume 1 Planning Application section 8 Assessment of the need for the proposed development</td>
</tr>
<tr>
<td></td>
<td>Non-nuclear and nuclear sources? [JON]</td>
<td>Volume 1 Planning Application section 8 Assessment of the need for the proposed development</td>
</tr>
<tr>
<td>Subject</td>
<td>Specific issues raised and comments made</td>
<td>Comments and / or the location in the Environmental Statement or Planning Application in which the issues are addressed</td>
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<tr>
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<tr>
<td></td>
<td>How will waste be packaged to ensure it is not dispersed [JON]</td>
<td>Section 8 Proposed operations</td>
</tr>
<tr>
<td></td>
<td>How will packaging be protected from the elements? [JON]</td>
<td>Section 8 Proposed operations</td>
</tr>
<tr>
<td>General EIA</td>
<td>Include a radiation/environmental monitoring regime [ENC][NCC][JON][ENCPLAN][ENC][JON]</td>
<td>Section 8 Proposed operations</td>
</tr>
<tr>
<td></td>
<td>Emergency procedures [ENC]</td>
<td>Section 8 Proposed operations</td>
</tr>
<tr>
<td></td>
<td>Restoration and aftercare [ENC]</td>
<td>Section 9 Restoration</td>
</tr>
<tr>
<td></td>
<td>Accident assessment methodology and key considerations [ENCPLAN]</td>
<td>Section 12 Population</td>
</tr>
<tr>
<td></td>
<td>Regulation/ control legislation for each impact [EA][NCC]</td>
<td>Section 11 Introduction to the assessment of environmental effects</td>
</tr>
<tr>
<td></td>
<td>Monitoring procedures when LLW arrives at site? [DUDD]</td>
<td>Section 8 Proposed operations</td>
</tr>
<tr>
<td></td>
<td>Plans for capping and landscaping after disposal [JON]</td>
<td>Section 9 Restoration</td>
</tr>
<tr>
<td></td>
<td>Disposing of LLW at the site could have a detrimental effect on house prices in the area</td>
<td>Section 12 Population</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>What volume of waste is planned for disposal? Expressed as Half height International standard containers [JON]</td>
<td>Section 6 Principles of the development Section 11 Introduction to the assessment of environmental effects</td>
</tr>
<tr>
<td></td>
<td>Does the capacity exist? [COLLYPC]</td>
<td>Section 7 Current operations at the site</td>
</tr>
<tr>
<td></td>
<td>Why not store waste at source [ENC]</td>
<td>Volume 1 Planning Application section 8 Assessment of the need for the proposed development</td>
</tr>
</tbody>
</table>
Table 2
The potential exposure pathways that are assessed

<table>
<thead>
<tr>
<th>Phase</th>
<th>Scenario</th>
<th>Exposure pathways considered</th>
<th>Dose criteria applied in the Authorisation application</th>
<th>Section of the Environmental Statement in which the effect is assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational phase of the landfill (up to capping and closure)</td>
<td>Normally expected to occur</td>
<td>Direct exposure to waste</td>
<td>Workers 1 mSv/yr&lt;br&gt;Public 0.02 mSv/yr</td>
<td>Section 12 – Population</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas emissions</td>
<td>Workers 1 mSv/yr&lt;br&gt;Public 0.02 mSv/yr</td>
<td>Section 12 – Population</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Leachate treatment at a wastewater treatment works</td>
<td>Workers 1 mSv/yr&lt;br&gt;Public 0.02 mSv/yr</td>
<td>Section 12 – Population</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Drilling through the emplaced waste in order to install new leachate</td>
<td>Qualitative assessment</td>
<td>Section 12 – Population</td>
</tr>
<tr>
<td></td>
<td></td>
<td>extraction wells or monitoring boreholes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unlikely to occur</td>
<td>Dropped waste container resulting in spillage of LLW</td>
<td></td>
<td>Workers 1 mSv/yr&lt;br&gt;Public 0.02 mSv/yr</td>
<td>Section 12 – Population</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contamination as a result of LLW entering an open wound.</td>
<td>Workers 1 mSv/yr</td>
<td>Section 12 – Population</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Failure of the engineered containment barrier</td>
<td>Qualitative assessment</td>
<td>Section 12 – Population</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Site remediation activities</td>
<td>Qualitative assessment</td>
<td>Section 12 – Population</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fire at the site</td>
<td>Qualitative assessment</td>
<td>Section 12 – Population</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Failure of the leachate collection system</td>
<td>Qualitative assessment</td>
<td>Section 12 – Population</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aerosol generation from leachate at the off site treatment facility</td>
<td>Workers 1 mSv/yr&lt;br&gt;Public 0.02 mSv/yr</td>
<td>Section 12 – Population</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Impact from an aircraft crash</td>
<td>3 mSv/yr</td>
<td>Section 12 – Population</td>
</tr>
<tr>
<td>Phase</td>
<td>Scenario</td>
<td>Exposure pathways considered</td>
<td>Dose criteria applied in the Authorisation application</td>
<td>Section of the Environmental Statement in which the effect is assessed</td>
</tr>
<tr>
<td>--------------------------------------------</td>
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<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Post closure of the landfill site when management controls still are in place</td>
<td>Normally expected to occur</td>
<td>Exposure of wildlife</td>
<td>10 μGy/hr (micro Gray per hour)</td>
<td>Section 13 - Wildlife</td>
</tr>
<tr>
<td></td>
<td>Direct exposure through cover materials</td>
<td></td>
<td>0.02 mSv/yr</td>
<td>Section 12 - Population</td>
</tr>
<tr>
<td></td>
<td>Gas emissions</td>
<td></td>
<td>0.02 mSv/yr</td>
<td>Section 12 - Population</td>
</tr>
<tr>
<td></td>
<td>Leachate treatment at a wastewater treatment works</td>
<td></td>
<td>0.02 mSv/yr</td>
<td>Section 12 - Population</td>
</tr>
<tr>
<td></td>
<td>Use of groundwater at nearest abstraction point</td>
<td></td>
<td>0.02 mSv/yr</td>
<td>Section 14 - Water resources</td>
</tr>
<tr>
<td></td>
<td>Unlikely to occur</td>
<td>Failure of the engineered containment barrier</td>
<td>Qualitative assessment</td>
<td>Section 12 - Population</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inadvertent excavation</td>
<td>3 mSv/yr</td>
<td>Section 12 - Population</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Exposure of people as a result of houses built directly on the site,</td>
<td>3 mSv/yr</td>
<td>Section 12 - Population</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use of groundwater from a borehole installed at the site boundary</td>
<td>3 mSv/yr</td>
<td>Section 14 - Water resources</td>
</tr>
<tr>
<td>Transportation of waste to the site</td>
<td>Normally expected to occur</td>
<td>Controlled by transportation regulations</td>
<td>External limit on packages of 10 μSv/hr at 1m distance</td>
<td>Section 16 - Transport</td>
</tr>
<tr>
<td></td>
<td>Unlikely to occur</td>
<td>Spillage of LLW during transportation to the site</td>
<td>1 mSv/yr</td>
<td>Section 16 - Transport</td>
</tr>
</tbody>
</table>
Table 2

The potential exposure pathways that are assessed

<table>
<thead>
<tr>
<th>Phase</th>
<th>Scenario</th>
<th>Exposure pathways considered</th>
<th>Dose criteria applied in the Authorisation application</th>
<th>Section of the Environmental Statement in which the effect is assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Spillage of leachate during transportation from the site</td>
<td>1 mSv/yr</td>
<td>Section 16 - Transport</td>
</tr>
</tbody>
</table>

Note: Dose criteria are set based on the likelihood of occurrence so that design scenarios which are expected to occur are set lower dose criteria and accidents or events unlikely to occur are set higher dose criteria which take into account their low probability of occurrence.
### Table 3

Radioactivity exposure limits compared with natural radiation and more familiar exposure routes

<table>
<thead>
<tr>
<th>Item</th>
<th>Radioactivity Average annual or event dose</th>
<th>Source document.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EXPOSURE LIMITS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legal dose limit for workers (UK)</td>
<td>20 mSv/yr</td>
<td>The Ionising Radiations Regulations 1999 (Statutory Instrument 1999 No. 3232)</td>
</tr>
<tr>
<td>Legal dose limit for the public (UK)</td>
<td>1 mSv/yr</td>
<td>The Ionising Radiations Regulations 1999 (Statutory Instrument 1999 No. 3232)</td>
</tr>
<tr>
<td>Dose criterion for workers for this application</td>
<td>&lt;1 mSv/yr</td>
<td>Design dose criteria for the site</td>
</tr>
<tr>
<td>Item</td>
<td>Radioactivity</td>
<td>Source document.</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>-------------------------------------</td>
<td>-------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Average annual or event dose</td>
<td>Environment Agency.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Radiological Protection Objectives</td>
</tr>
<tr>
<td></td>
<td></td>
<td>for the land based disposal of solid</td>
</tr>
<tr>
<td></td>
<td></td>
<td>radioactive wastes.</td>
</tr>
<tr>
<td>Design dose criterion for the public for this application</td>
<td>&lt;0.02 mSv/yr</td>
<td>Design dose criteria for the site</td>
</tr>
<tr>
<td><strong>NATURAL RADIATION</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average annual exposure of UK population from natural sources</td>
<td>2.2 mSv/yr</td>
<td>Ionising Radiation Exposure of the UK Population:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2005 review Health Protection Agency (HPA RPD 001)</td>
</tr>
<tr>
<td>Average annual exposure in the site area from natural sources</td>
<td>3.6 mSv/yr</td>
<td>Ionising Radiation Exposure of the UK Population:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2005 review Health Protection Agency (HPA RPD 001)</td>
</tr>
<tr>
<td>Average annual exposure in Cornwall from natural sources</td>
<td>7.4 mSv/yr</td>
<td>Ionising Radiation Exposure of the UK Population:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2005 review Health Protection Agency (HPA RPD 001)</td>
</tr>
<tr>
<td><strong>COMPARATIVE DOSES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drinking bottled water (2l/day)</td>
<td>0.002 – 0.484 mSv/yr</td>
<td>Ionising Radiation Exposure of the UK Population:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2005 review Health Protection Agency (HPA RPD 001)</td>
</tr>
<tr>
<td>Food; for example 100g of Brazil nuts</td>
<td>0.004 mSv</td>
<td>Ionising Radiation Exposure of the UK Population:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2005 review Health Protection Agency (HPA RPD 001)</td>
</tr>
<tr>
<td>Dental x-ray</td>
<td>0.005 mSv</td>
<td>Ionising Radiation Exposure of the UK Population:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2005 review Health Protection Agency (HPA RPD 001)</td>
</tr>
<tr>
<td>Chest x-ray</td>
<td>0.02 mSv</td>
<td>Ionising Radiation Exposure of the UK Population:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2005 review Health Protection Agency (HPA RPD 001)</td>
</tr>
<tr>
<td>London to Los Angeles return flight</td>
<td>0.16 mSv</td>
<td>Ionising Radiation Exposure of the UK Population:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2005 review Health Protection Agency (HPA RPD 001)</td>
</tr>
<tr>
<td>Medical Abdominal CT Examination</td>
<td>10 mSv</td>
<td>Ionising Radiation Exposure of the UK Population:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2005 review Health Protection Agency (HPA RPD 001)</td>
</tr>
<tr>
<td>UK action level for Radon in homes</td>
<td>200Bqm(^3) (equivalent to 10mSv/yr)</td>
<td>National Radiological Protection Board 1990. Limitation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>of human exposure to radon in homes. Doc NRPB, 1(1),</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15-16</td>
</tr>
</tbody>
</table>
Table 4

Organisms and wildlife groups included in the terrestrial and freshwater ecosystems considered in the assessment of impacts on wildlife

<table>
<thead>
<tr>
<th>Terrestrial ecosystem</th>
<th>Freshwater ecosystem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bird</td>
<td>Amphibian</td>
</tr>
<tr>
<td>Bird egg</td>
<td>Benthic fish</td>
</tr>
<tr>
<td>Detritivorous invertebrate</td>
<td>Bird</td>
</tr>
<tr>
<td>Flying insects</td>
<td>Bivalve mollusc</td>
</tr>
<tr>
<td>Gastropod</td>
<td>Crustacean</td>
</tr>
<tr>
<td>Grasses and Herbs</td>
<td>Gastropod</td>
</tr>
<tr>
<td>Lichen and Bryophytes</td>
<td>Insect larvae</td>
</tr>
<tr>
<td>Mammal (Deer)</td>
<td>Mammal</td>
</tr>
<tr>
<td>Mammal (Rat)</td>
<td>Pelagic fish</td>
</tr>
<tr>
<td>Reptile</td>
<td>Phytoplankton</td>
</tr>
<tr>
<td>Shrub</td>
<td>Vascular plant</td>
</tr>
<tr>
<td>Soil Invertebrate (worm)</td>
<td>Zooplankton</td>
</tr>
<tr>
<td>Tree</td>
<td></td>
</tr>
</tbody>
</table>
There are 36 major waste producing sites. There are no major waste producing sites in Northern Ireland.

- **Spent fuel reprocessing**
- **Nuclear power reactors**
- **Nuclear energy research and development**
- **Defence**
- **Fuel fabrication and uranium enrichment**
- **Medical and Industrial facilities**

Note: The national LLW disposal facility (the LLWR near Drigg) is located four miles south of Sellafield.

**Sites which are being decommissioned**

**EAST NORTHANTS RESOURCE MANAGEMENT FACILITY**

The approximate locations of the facilities at which the majority of the LLW is produced.