Port Clarence Landfills radioactive substances permit application: Summary of consultation responses

13 October 2020

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We improve the quality of our water, land and air by tackling pollution. We work with businesses to help them comply with environmental regulations. A healthy and diverse environment enhances people's lives and contributes to economic growth.

We can't do this alone. We work as part of the Defra group (Department for Environment, Food & Rural Affairs), with the rest of government, local councils, businesses, civil society groups and local communities to create a better place for people and wildlife.

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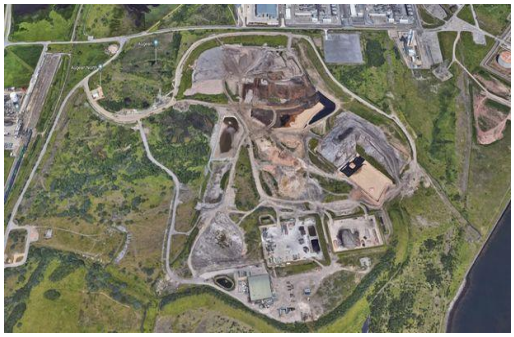

The Environment Agency received an application, in August 2019, from Augean North Ltd for an Environmental Permit to accept low level radioactive waste (LLW) at Port Clarence Landfill sites for disposal by burial. The landfills have been operating since the 2000's and currently accept both hazardous and non-hazardous waste for treatment and disposal.

For the last three years the landfill has also accepted naturally occurring radioactive material (NORM), which are very low level radioactive wastes, under a legal exemption. The waste deposited to date has consisted largely of chemical manufacturing wastes from the processing of waste ores on Teesside.

There are currently four other landfill sites in England that have been permitted to dispose of LLW. These are East Northants Resource Management Facility (ENRMF) in Northamptonshire, Clifton Marsh in Lancashire, Lillyhall in Cumbria and Calder Landfill Extension Segregated Area (CLESA) on the Sellafield site in Cumbria which only accepts waste from Sellafield and Lillyhall in Cumbria which is permitted to accept high volume very low level waste (HV-VLLW).

The application for an environmental permit is supported by an environmental safety case (ESC), which considers the radiological risks from the site, and a hydrogeological risk assessment (HRA) which considers the impact of the site on the groundwater. We are currently reviewing these as part of our determination process.

Our determination of this application is expected to be complete by late 2020 to early 2021. We will consult again on our draft decision and then make our final decision on issuing a permit. We expect the draft decision will be produced and the consultation to take place in 2021. We cannot be specific on timescales as these are dependent on the time it takes for the applicant to respond to our questions, the number of comments we receive during the consultation and any subsequent technical work that may be required.

2. How we ran the consultation

We consulted on the application from September 2019 to January 2020 on Citizen Space. The consultation was scheduled to be open for 12 weeks, but due to the general election on 12 December 2019 we decided to extend the consultation period to the end of January 2020. This was to ensure elected officials had sufficient time to submit their responses.

We informed the following government bodies, local authorities, interest groups and other interested parties of the consultation via email and/or letter:

Government bodies

Department for Business, Energy & Industry Strategy (BEIS)

Office for Nuclear Regulation (ONR)

Committee on Medical Aspects of Radiation in the Environment (COMARE)

Public Health England (PHE)

Food Standards Agency (FSA)

Natural England (NE)

Local authorities

Stockton Borough Council (Environmental Health and Planning)

Middlesbrough Council (border)

Redcar and Cleveland County Council (border)

Billingham Town Council

Hartlepool Borough Council (border)

NGOs and interest groups

Saltholme Nature Reserve (RSPB)

Communities

High Clarence

Billingham

Companies

Hartlepool Nuclear Power Station

Scott Brothers

Northumbrian Water Group

MPs

Alex Cunningham MP

Jacob Young/Anna Turley MP (border MP)

Andy McDonald MP (border MP)

Matt Vickers/Dr Paul Williams MP (border MP)

Mike Hill MP (border MP)

Elected Representative

Ben Houchen, Tees Valley Mayor

Parish Councils

Greatham Parish Council

Councillors

All Stockton Borough Councillors

Middlesbrough/Redcar and Cleveland/Hartlepool Council Ward Clerks

We also attended two stakeholder events in November 2019 in Billingham and High Clarence. We also met with the Mayor of Teesside, Alex Cunningham MP, Stockton Borough Council Planning Committee, the Councillors of Middlesbrough and Redcar and Cleveland Councils between December 2019 and January 2020.

During the initial consultation we were neutral in our communications surrounding our role in the application process. Our main role was to host the consultation documents on Citizen Space to enable people to voice their opinions about the application.

We were reactive to any media enquiries generated during the consultation period due to the local public consultation events being held during the pre-election period. We

responded to enquiries from various media outlets including television, radio, newspaper and social media; namely BBC Tees and ITV Tyne Tees & Border.

We will continue to monitor the media interest surrounding the Port Clarence Landfill Sites application.

We received 2329 consultation responses on Citizen Space. The majority of the responses were from members of the public. We also received responses from local authorities, Public Health England, COMARE, Natural England and various businesses in the area. The Office for Nuclear Regulation (ONR) advised us that no response or comment was required from them as the site falls outside their enforcing authority remit.

3. Consultation responses and our responses to these

We did not set specific questions for consultees to respond to. Instead, we asked for feedback in a free text format. We have summarised below the consultation responses which will be included in our final decision document along with our response to the comments.

Due to the large volume of responses we have received and the similarity in the type of issues raised, we have categorised them into areas of concern wherever possible. Where applicants have asked specific questions or raised specific or unique comments we have addressed them individually. The responses varied from being technical in nature, for example asking specific questions relating to the activity limits and management of the site, to quite general comments on the location of the site and the local area. Some of the responses were very detailed, seeking further clarification on points made in the ESC. Where appropriate, we have requested further information from the applicant in response to these comments. Some comments were either not relevant (outside of our regulatory remit) or did not require further information or a response.

We have tried to answer each question or group of questions as fully as possible. However, due to the broad nature of some of the questions and comments and the complexity of some of the issues, we recommend that readers review the responses to all questions, as other related aspects may be addressed elsewhere in this document.

Comment Summary	Environment Agency consideration of the issues
Topic: Matters outside the Environment Agency's regulatory remit	
We received 2329 responses from members of the public and various organisations. Only 13 responses were in favour of the application. The majority of the comments objected to the permit application and these were grouped together due to the similarity of the comment:	We do not influence or regulate site selection. This decision is made by the applicant in consultation with the local planning authority, in this case Stockton Borough Council. We can only take account of issues within the relevant environmental regulations or inside the remit of the Environmental Permitting Regulations 2016. The local planning authority is responsible for granting permission for change of use under

Oppose, no more waste **Dump the waste elsewhere, not in this area (Teesside).** **Sets a precedent to allow further types of hazardous and radioactive wastes**	planning law. The National Planning Policy Framework published in 2019 (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/810197/NPPF_Feb_2019_revised.pdf) confirms that the planning system should not duplicate controls that exist under pollution control regimes and, where a planning decision has been made, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities, such as the Environmental Permitting regime administered by the Environment Agency. We consider each application on its own merits within the context of the Environmental Permitting regime.
Members of the public Stockton on Tees Borough Council and Redcar and Cleveland Borough Council commented on the socio-economic impact and the general impact on the area: **Impact on house prices** **Potentially impact future regeneration / investment**	We do not influence or regulate site selection. This decision is made by the applicant in consultation with the local planning authority. We can only take account of issues within the relevant environmental regulations or inside the remit of the Environmental Permitting Regulations 2016. We do take account of amenity issues and the potential impact this could have on an area. The EPR landfill permits have conditions in place that require an operator to control emissions that may have an impact on amenity. The applicant, who is the operator of Port Clarence landfill sites, has a fugitive emissions control procedure in place to ensure issues such as noise, odour and litter are appropriately managed at the landfill site. Although fugitive emission controls are not specifically required in radioactive substances permits the radioactive waste will be co-disposed with the hazardous and non-hazardous waste and therefore the fugitive controls procedure will also ensure the management of radioactive waste is also controlled. The potential effect on future investment in the area and house prices is not in the Environment Agency's remit and we cannot comment on this.
A member of the public asked if the operator will make a financial donation to the area.	This is a matter for the applicant to discuss with the local community and is not within our regulatory remit.
Members of the public expressed concerns over issues associated with	The Office for Nuclear Regulation (ONR) regulates the transport of radioactive wastes from nuclear sites along with the planning authority under the

transporting radioactive waste, accidents and the volume of traffic in the area. **Stockton Borough Council asked for 'Clarification over who is responsible for the potential movement of radioactive materials is required. This Council would wish to understand what protection measures will be in place and who is responsible for any incidents, particularly as the transit route will potentially pass residential properties. In the event of a road traffic accident the potential exposure to radioactive material (including Alpha emitting particles) to the general public is most concerning. '**	planning regime. We can only take account of issues within the relevant environmental regulations or within the remit of the Environmental Permitting Regulations 2016.
Redcar and Cleveland Borough Council members offered the view that the transport of waste by methods other than road should be examined, particularly rail.	This is a matter for the applicant to consider in consultation with the consignors and the relevant authorities.
North Billingham Residents Association commented: **Whilst the restoration of the landfill site is intended following the phased waste disposal operations, it is likely that public awareness will result in reluctance for any kind of future site use, given the nature of the proposed disposal use.**	This is a matter for the planning authority to consider. It is worth noting that the applicant has considered future use of the landfill sites after operations have ceased. Radiological risk assessments have been carried out for potential future uses such as recreational users, wildlife and excavations for housing and small holders. We will review the radiological risks associated with such future uses as part of our assessment.
Topic: Impacts on the area and people	
Members of the public generally expressed concerns over the health effects of this waste being disposed of to Port Clarence landfill site.	Public Health England (PHE) provides health advice and have commented on this application. We review these comments under the relevant topics below.

	We will review the ESC against the principles and requirements of our guidance on requirements for authorisation of near-surface disposal facilities on land for solid radioactive wastes - also referred to as the GRA. (https://www.gov.uk/government/publications/near-surface-disposal-facilities-on-land-for-solid-radioactive-wastes). This guidance requires the applicant to consider the radiological impacts on members of the public and the environment, during landfill operations, after the landfill has closed and potential human intrusion into the landfill. The applicant has produced various radiological risk assessments to show the impact from disposals is within the dose and risk criteria. We will review these assessments to ensure people are protected now and into the future. The dose and risk criteria in this guidance are consistent with PHE guidance. We will not issue a permit if the criteria is not met.
Members of the public and Stockton on Tees Borough Council commented on the general impact on the area: **Too close to residential / urban areas** **Impact on family, children / future generations**	We can only take account of issues within the relevant environmental regulations or inside the remit of the Environmental Permitting Regulations 2016 (EPR). We also take account of amenity issues. The EPR landfill permits have conditions in place that require the operator to control emissions that may have an impact on amenity. There is a fugitive emissions control procedure in place to ensure issues such as noise, odour and litter are appropriately managed at the Port Clarence landfill sites. Although fugitive emission controls are not specifically required in radioactive substances permits the radioactive waste will be co-disposed with the hazardous and non-hazardous waste and therefore the fugitive controls procedure will also ensure the management of radioactive waste is controlled. We require the applicant to consider the radiological impacts on members of the public and the environment, during landfill operations, after the landfill has closed and potential human intrusion into the landfill. We will assess these impacts to ensure they are within the dose and risk criteria set out in our guidance. We will not issue a permit unless the applicant demonstrates the disposals will be safe to people and the environment. To put this in to context the annual average dose received by a member of the public is 2.7

	millisievert (mSv) /year (y) compared with the dose constraint during landfill operations of 0.3 mSv/y.
Topic: Site restoration and legacy concerns	
Members of the public, Stockton Borough Council and Redcar and Cleveland Borough Council were concerned about the legacy the site will leave and financial provision to ensure the site is managed after closure. Specific concerns are listed below: **1. Company plans are to remediate the site in the future and what ring-fenced funds are being set aside to enable the site to be remediated should the company cease trading.** **2. Clean up/legacy concerns** **3. Stockton Borough Council: At what point would, given the half-life decay of the radioactive material proposed to be taken to landfill, this site ever be fit for redevelopment or to be brought back into an alternative form of use. The timeframe for a 40 year site life with 60 years aftercare seems inadequate. Full assurances need to be given and secured to ensure that the proposed site is tied to its proposed Environmental Permits and ensure adequate future finances for the management of the site. The alternative is that this could otherwise fall to the local authority to address under Part 2A of the Environmental Protection Act 1990 with all associated costs.**	Restoration and land use planning: Planning decisions associated with the use of a site for waste or radioactive waste disposal are not within our regulatory remit. Similarly, reuse of the site or change of use would be matters for that authority, although while our permits remain in force we would continue our regulation of the site. Site restoration is within our regulatory remit where that involves the use of waste but the planning permission will normally control what the final state of the site should be. In accordance with the planning permission, the landfill site will be restored to rough grassland, scrub and woodland and the surrounding areas will be restored to areas of open water, aquatic marginal vegetation, scrub, wet meadow and ruderal grassland with small hollows, banks and ridges suitable for nature conservation use. This will ensure industrial waste land is reclaimed, provide a range of habitats and provide beneficial after use to both the environment and the community. Remediation of landfills: Landfills must be completed to an agreed standard as laid out in a detailed plan concerning the proposed closure, restoration and aftercare activities. We must agree that this plan is suitable before we will accept closure. Following closure the applicant must maintain and monitor the site during the aftercare period to minimise or prevent pollution as required by the permit. Our regulation of landfill sites normally continues until the surrender tests are met. If development is proposed for that land at a future date, the need for remediation to enable that development would be determined by the planning authority. Financial Provision: Having financial provision is a legal requirement for all landfills that accept Waste Framework Directive (non-radioactive) waste. There is no legal requirement for financial provision for radioactive waste. Waste Framework Directive landfill sites are required to have financial provision in place for as long as the site poses a hazard to the environment and in particular to maintain and monitor the site in

	the aftercare phase. The estimated costs are based on a period of 60 years after the site has definitely closed. However, an additional contingency sum must also be available to ensure funds will still be available for ongoing management, if it is required beyond 60 years. Aftercare costs are for things like: • environmental monitoring – on or off-site monitoring of landfill gas and groundwater quality; • capping and cap maintenance; • leachate, landfill gas and surface water management • site security; • producing site reports – performance report, surrender report and topographical surveys • specified events Financial provision is required to cover routine costs for maintenance and monitoring during the aftercare phase. It is unlikely to be available for remediation should an operator cease trading. Where that happens and the permit is disclaimed, the site would normally fall to EPA 1990, Part 2A. Also see 'site abandonment' below. Permitting radioactive waste disposal – operator competence: Before we issue a radioactive substances activity (and any other) permit we must be satisfied that the applicant is a competent operator. One part of being a competent operator is that they must have financial competence i.e. that they have the finances to carry out their operations and meet the permit conditions. If we are not satisfied that this is the case then we would refuse to issue the permit. This is one of the many aspects we are still considering as part of our determination process. Permitting radioactive waste disposal – principles and requirements: We permit the disposal of radioactive waste by reference to the principles and requirements in the GRA. These principles and requirements address both the period of authorisation and the indefinite period after regulation of the waste disposal ceases. This means that at the time of application, the operator must be able to satisfy us that the waste disposal facility will be safe for people and the environment after all controls exercised by people have come to an end.

	To demonstrate that the principles and requirements in the GRA can be met, as part of the application for a radioactive substances permit, we require the operator to produce an ESC. This must show that the radiological risks to individual members of the public and the population as a whole are as low as reasonably achievable (ALARA) and less than relevant dose constraints during the entire period of authorisation. This includes the operational period, for this site, which is assumed to last until 2070 and an aftercare period of at least (but possibly much longer than) 60 years. During the aftercare period active management controls and regulation will continue until it can be confirmed that the site no longer represents a risk in terms of environmental pollution or harm to human health During the active management period, which for the purpose of the ESC is assumed to last from 2070 to 2130, leachate and gas would continue to be managed, monitoring would continue and access to the site would be controlled. In practice the active management period is likely to be considerably longer than 60 years. Radiological risk assessments must be produced to show the disposals of the waste meet the GRA standards for protection of people and the environment. The standards are for: • Protection of people during the period of authorisation (the same standards for any RSR facility; well below the public dose limit) • Protection of people after the end of regulation from any radioactivity in the environment as a result of natural processes acting on the waste (based on a risk of one in a million) • Protection of people after the end of regulation from exposure to radioactivity as a result of inadvertent intrusion in to the waste • Protection of wildlife from radioactivity dispersing in the environment during and after regulation. The operator will be required to periodically update and refine their ESC, including when waste emplacement ends and before the permit is surrendered. The final ESC must show that the requirements in our GRA that apply to the period after the end of regulation have all been met, as well as the surrender tests (as explained below). Permit surrender: The landfill site will remain under regulatory control until the relevant permits are

	surrendered. In this case it means both the landfill and radioactive substances permits. In order to accept an application to surrender a permit we must be satisfied that the necessary measures have been taken— (a) to avoid a pollution risk resulting from the operation of the regulated facility and (b) to return the site of the regulated facility to a satisfactory state, having regard to the state of the site before the facility was put into operation. The environment agencies will only agree to release a site from radioactive substances regulation if we are satisfied that radioactive waste disposal has ended and that the site is in a state that will ensure people and the environment are protected. In order to accept an application to surrender a landfill permit we must be satisfied that: • the site has ceased accepting waste • relevant closure procedures have been complied with • an appropriate period of aftercare has passed to allow the waste to stabilise and to gather evidence to demonstrate that the pollution control measures are no longer necessary • the deposits of waste are in a satisfactory state that, if left undisturbed, will not cause pollution of the environment We have issued guidance on surrendering permits in general (RGN9 guidance note on surrender and H5 on site condition reports) and detailed guidance on surrendering landfill permits. We would not allow the surrender of a permit until we were satisfied the site did not pose a risk to members of the public or the environment. Site abandonment: We recognise that permitted sites may be abandoned. For example, if a permit holder passes away or the company holding the permit becomes insolvent. In cases of insolvency the permit may be disclaimed as onerous property by the liquidator or bankruptcy trustee. If this happens or if the permit holder dies, the permit ceases to exist along with our responsibility to regulate against it. We might not be able to gain access to any Financial Provision that might have existed before abandonment. Where we can, we are limited in how we spend that money by EPR

	2016, Regulation 57, i.e. we only have powers to remove the risk of serious pollution.
A member of the public asked: **'Would the placement of this material stop further development of the site post completion of the landfill?'**	The application assumes that the site will be managed, and regulated under the terms of its environmental permit, until 2130. We will only allow an operator to surrender the permit if we are satisfied that future doses and risks to people will be below our regulatory guidance levels at the time of surrender and at all times in the future without active management. The development of the site following surrender of the permit is a matter for the planning authority. The current restoration plan for the site is for it to be restored to rough grassland, scrub and woodland and the surrounding areas will be restored to areas of open water, aquatic marginal vegetation, scrub, wet meadow and ruderal grassland with small hollows, banks and ridges suitable for nature conservation use.
Topic: Radiological Risks and Assessments	
Members of the public asked: **What are the risks of the waste?**	The LLW proposed to be disposed of contains low levels of radioactivity. If released into the environment radioactivity can cause harm to health and the wider environment. However, as with all forms of waste, if properly handled and contained this risk of harm can be reduced to acceptably low levels. We require the applicant to demonstrate that the waste will be appropriately managed and contained both in the short and long term. We require them to do this through production of an ESC. In addition, LLW may also contain other non-radioactive materials that require safe management and control, similar to other more conventional wastes disposed of at many landfills across the UK. We similarly expect adequate controls to be in place for these materials. In producing an ESC the applicant should follow our guidance on requirements for authorisation of near-surface disposal facilities for solid radioactive waste, which sets out specific dose and risk criteria that the landfill must be demonstrated to meet. These include: • During the period of permitting, the maximum dose to a representative member of the critical group (i.e. a member of the public) should not exceed a source-related dose constraint of 0.3 mSv /y.

	• After surrender of the permit, the radiological risk to a person representative of those at greatest risk should be consistent with a risk guidance level of 1 in a million per year. This is approximately equivalent to an annual dose of 0.02 mSv in the situation where there is a probability of 1 of the dose being received. • Also, after surrender of the permit, the effective dose to any person following inadvertent human intrusion into the landfill should not exceed a dose guidance level in the range of 3 to 20 mSv/year. Values towards the lower end of this range are applicable to assessed exposures continuing over a period of years while values towards the upper end of the range are applicable to assessed doses that are only short-term. In comparison, PHE has estimated that the average annual dose to people in the UK is about 2.7 mSv, with the largest exposures from naturally occurring radiation in homes and workplaces. The applicant has carried out a series of dose and risk assessments, as described in Appendix E of the ESC, which it uses to demonstrate how it will make sure that impacts from disposed waste will meet the Environment Agency's relevant dose criteria and risk guidance levels. As part of our determination of this application we are completing a review of these assessments.
Members of the public asked: **How safe is it?**	The use of landfill sites is an established route for the disposal of LLW. There are four landfill sites in England which are permitted to accept LLW. These are Clifton Marsh, in Lancashire; the ENMRF in Northamptonshire; Lillyhall in Cumbria; and Sellafield which has a dedicated landfill for the disposal of LLW. The applicant is required to submit an ESC as part of their application to dispose of LLW to landfill. The ESC assesses the radiological risks of the disposal of LLW to the environment and members of the public and sets out how these will be managed. The ESC must meet the principles and requirements of our guidance on requirements for authorisation of near-surface disposal facilities for solid radioactive waste. We will review this ESC in detail and assess the risks against the relevant dose and risk criteria specified in this guidance. Environmental monitoring throughout the time that the site is permitted will provide a check on the integrity of barriers and safety plans, helping to

	confirm the system is operating as expected. Environmental permits would require the monitoring results to be reported to the Environment Agency. A permit and any reporting requirements would remain in force until an application for surrender is submitted by an operator. We would only allow surrender of a permit if we were satisfied the landfill sites will not cause an unacceptable risk of pollution or harm to human health or the environment. Our assessment of the permit application will consider the safety of current operations for people and the environment and also the longer term future impacts. If we consider the risks to be unacceptable or insufficient information is provided to demonstrate adequate safety to people and the environment we will not issue a permit.
A member of the public commented: **'I would like a full independent review of the risks associated and for this to be available to the public as part of the consultation.'**	The Environment Agency (EA) is an independent regulator and is assessing the risks to members of the public and the environment. This is part of our determination of the permit application which includes a full review of the ESC submitted in support of the application. Other independent bodies, PHE and COMARE have also commented on the application, as part of our consultation process. We will also be consulting on our draft decision, which will be available to the public.
We received various comments about the impact and safety of the waste. These are detailed below: **It is acknowledged that dust plumes could arise from tipping of loose waste. Where strong winds prevail, a lack of containment could arise resulting in exposure to the waste at locations in a considerable distance from the site.** **Will there be any danger from airborne dusts?**	Loose tipping will occasionally be undertaken where necessary. The applicant has stated that in most cases it is expected that the waste will be damp and therefore give rise to little airborne dust, or if dry and dusty local dust suppression (water spray) will be used to minimise airborne dust. The applicant has stated that LLW will be covered by at least a 0.3 metre (m) thickness of suitable cover immediately after disposal to prevent, the exposure of the waste. Other options to prevent wind-blown waste include: dust suppression, tipping the LLW into a trench that has been dug in the non-radioactive waste within a cell, use of litter fencing and not tipping during windy conditions. The applicant has carried out radiological risk assessments to determine the risks from airborne dusts. The ESC has considered worker and public exposure from a dust plume created when tipping loose waste. We are considering this assessment as part of our determination of the permit application. The applicant will be required to have procedures in place for the management of disposals and these

	will be checked as part of our regulatory interactions with the site should a permit be issued. The applicant proposes to carry out quarterly site perimeter dose rate monitoring and radiochemical analysis of dust collected from a downwind location on the site boundary. This sampling and analysis work can be used to check assumptions made within the ESC and the dose assessments are accurate and also to monitor discharges and impacts from the disposals. If adverse or unexpected impacts are shown, then we will expect these to be investigated and appropriate action taken to mitigate any problems. The final details of the monitoring schedule are yet to be defined. We have requested further information about the monitoring regime and will work with the applicant to make sure that it meets our requirements and will be sufficient to identify any impacts from dust dispersal.
A member of the public asked: **'Will any venting of radioactive material occur, making it air borne?'**	Radioactive gas can be released to atmosphere from the waste. During operations, landfill workers on the site would be exposed to gas emanating from disposed waste and the applicant has considered worker dose in their assessments. Public exposure to gas would only occur at some distance from the source after considerable dilution. Dose assessments in the ESC have been based on the nearest residential area. Dose assessments have also been conducted for a theoretical recreational user of the landfill site after it has ceased accepting waste and has been restored to grassland. The doses will be compared to the dose criteria and we will only issue a permit if these doses are shown to be acceptable. The applicant proposes to carry out bi-annual radiochemical analysis of landfill gas. This sampling and analysis work can be used to check assumptions made within the ESC and the dose assessments are accurate and also to monitor discharges and impacts from the disposals. If adverse or unexpected impacts are shown, then we will expect these to be investigated and appropriate action taken. The final details of the monitoring schedule are yet to be defined. We have requested further information about the monitoring regime and will work with the applicant to make sure that it meets our requirements.
A member of the public commented:	'Some distance' has not been specified in the ESC. However, the dose assessment has been based on the nearest residential area to the landfill and the

'The ESC admits that the inadvertent release of gases during operations may expose landfill workers on the site and public exposure to gas may also occur at "some distance from the source". How far could "some distance" actually be?'	nearest residential area downwind of the landfill. Gases will disperse further beyond these areas, but will continue to dilute significantly as they do, meaning that if it is demonstrated that the closest areas are protected, then so will areas further away. The applicant proposes to carry out quarterly site perimeter dose rate monitoring and radiochemical analysis of dust collected from a downwind location on the site boundary, as well as bi-annual radiochemical analysis of landfill gas. This sampling and analysis work can be used to check assumptions made within the ESC and the dose assessments are accurate and also to monitor discharges and impacts from the disposals. If adverse or unexpected impacts are shown, then we will expect these to be investigated and appropriate action taken to mitigate any problems. The final details of the monitoring schedule are yet to be defined. We have requested further information about the monitoring regime and will work with the applicant to make sure that it meets our requirements.
Stockton Borough Council commented: **'The site has broad waste acceptance criteria and this does not appear to preclude the potential for Alpha-emitting particles to be present. It needs to be ensured that these do not become airborne and inhaled which will have dramatic health implications for the vicinity and residents of this Borough.'**	The applicant has submitted an ESC in support of this application. This considers the risks from all proposed radionuclides, including alpha emitting particles, and the risks from air dispersal and inhalation. The applicant will also have specific waste acceptance criteria (WAC) that will determine the types and radioactivity of waste that can be accepted. These WAC will restrict the disposals of radioactivity to levels demonstrated to be safe taking into account all possible release pathways, including inhalation after airborne transmission. There will also be procedures in place and operational controls to control the disposal and coverage of the waste: Dust suppression is used where required. There is a limit on putrescible materials accepted at the hazardous landfill ensuring that microbial activity is minimised and gaseous release from microbial action or from fire leading to a dose is also minimised. Augean requires the surface of waste packages to be clean to ensure dusts do not represent a hazard. Wastes placed in the landfill are also covered immediately to reduce external exposure. Operational constraints have been put in place to restrict the placement of waste in a landfill cell, placing non-radioactive waste to a specified depth

	at the base (2 m), sides (2 m) and top (1 m) of a cell. This creates a barrier between the LLW and the side liner of a waste cell which will need to be located when the cell is capped. It also means that all LLW will be 2.3 m or greater below the restored surface of the site. An additional limitation is proposed for wastes with significant radium contamination in order to reduce doses from radon gas, which is released from the radioactive decay of radium. Such wastes will be disposed at least 5 m below the restored surface of the site. This places radium below a reasonable excavation intrusion depth and reduces the potential dose due to radon gas release from material extracted from the landfill during intrusion. We will review the supporting assessment to ensure the dose criteria is met. An additional limitation is proposed for wastes containing a significant quantity of Ra-226 (Radium contaminated wastes) with a requirement to immediately bury these wastes at least 5 m below the restored surface of the site. The applicant proposes to carry out quarterly site perimeter dose rate monitoring and radiochemical analysis of dust collected from a downwind location on the site boundary. However, the final details of the monitoring schedule are yet to be defined. We have requested further information about the monitoring regime and will work with the applicant to make sure that it meets our requirements.
North Billingham's Residents Association commented on the lack of information about the half-lives of the radionuclides that are proposed for disposal: 'This devalues the credibility of estimated maximum expected exposure levels'.	Radiological risk assessments have been undertaken to ensure doses are within the dose constraints and risk guidance levels specified in our guidance on requirements for authorisation of near-surface disposal facilities for solid radioactive waste. The half-life of each radionuclide is accounted for in these assessments, as detailed in Table E.9.1. The assessments are based on the radionuclides that could be disposed of which are used to calculate the total radiological capacity for the site.
A member of the public asked: **'Why has this site been identified and has there been a risk assessment carried out that is available to view?'**	The choice of site is a commercial decision made by the operator of the landfill site. We do not influence or regulate site selection. This decision is made by the operator in consultation with the local planning authority. We can only take account of issues within the relevant environmental regulations or inside the remit of the Environmental Permitting Regulations 2016.

	It is our role to assess the safety of people and the environment. As part of the application the applicant is required to submit an ESC which assesses the risks to members of the public and the environment. We have asked the applicant to demonstrate disposal of LLW at the landfill is consistent with application of best available techniques (BAT). We will review these assessments as part of our determination of the permit application. The application, which includes the ESC, is available to view on Citizen Space.
A member of the public commented: **'I feel that the contamination of ground water will be a massive issue, especially as the area has a history of flooding due to natural issues.'**	The impact on groundwater will be assessed as part of our determination of the permit application. The applicant proposes to carry out bi-annual radiochemical analysis of groundwater from several boreholes close to the site and quarterly. radiochemical analysis of leachate treated off-site. This sampling and analysis work can be used to check assumptions made within the ESC and the dose assessments are accurate and also to monitor discharges and impacts from the disposals. If adverse or unexpected impacts are shown, then we will expect these to be investigated and appropriate action taken. The final details of the monitoring schedule are yet to be defined. We have requested further information about the monitoring regime and will work with the applicant to make sure that it meets our requirements.
A member of the public commented: **' If it does go ahead, must follow regular safety assessments, review of future land use and radioactive projection (including water table rises, river rises in line with climate change, soil erosion of the landfill, leakage of waste into the water table).'**	If a permit is issued there will be a requirement for the operator to periodically review the ESC, taking account of factors such as those referred to. A permit variation application, along with a new ESC, will be required in the situation of the applicant wanting a future significant change in disposal operations.
Stockton Borough Council asked: **'Whilst the material proposed being brought to site may be a fraction of the normal exposure to humans (via background radiation) clarification is required as to whether this is as part of normal exposure or**	The doses from the landfill site would be in addition to the background radiation. It is not practical to assess the dose to each individual member of the public and therefore the radiological dose assessments use an individual that would represent someone from a group that would be the most exposed to the source of radiation (also referred to as the representative

in addition to it.'	person). Factors considered when assessing the dose to the representative person include: • Radionuclides being disposed of (source of radiation) • How these can enter the environment (pathways): air, water, land • Age of representative person - we use four age groups: foetus, 1 year old, 10 year old and adult • Behaviour of people around the site for example: member of the public, farming family, fishermen, sewage treatment workers, high consumers of certain foods from the area • Timescales: during the operation of the landfill; after the landfill has closed; human intrusion into the landfill after it has closed or following erosion Therefore the average person would receive far lower doses when compared to the most exposed (representative) person.
Stockton Borough Council asked: **'Have the radiological impacts to site users after the site has closed been considered?'**	Yes. The applicant has carried out radiological risk assessments for the post-closure period, which are presented in Appendix E of the ESC. These risk assessments include consideration of the impacts on recreational users due to gas releases and external radiation; impacts due to the erosion of the landfill; impacts due to inundation from the sea and impacts associated with inadvertent human intrusion into the site, including development and habitation of the site. Water abstraction and overtopping of the cells (bathtubbing) scenarios are considered unlikely to occur but have also been considered as 'what if' scenarios by the applicant and assessments have been provided.
PHE made various detailed technical comments on the radiological risk assessments. (mainly relating to Appendix E).	We have asked the applicant to address these comments. See Appendix 1 for PHE's comments.
Topic: Coastal erosion and flooding	
PHE commented: three of the most important scenarios in terms of potential impact to the public are considered to be coastal erosion, flooding including tidal inundation and intrusion into the site. Coastal intrusion is stated to occur in	We agree with PHE's comments. We have asked the applicant to carry out a more detailed assessment of the implications of future climate change and associated potential for flooding or erosion of the site and use this to justify its assumptions for the earliest possible timing of these events. We have also asked the applicant to use this information in a consistent manner to assess

year 4476 (para 115). The Environment Agency is better placed than PHE to comment on the accuracy of this estimate, but PHE notes that this is a precise date and gives a false impression about the accuracy of the estimate. Elsewhere in the document it states that erosion will not occur before 4560 years (para 125) so there is a lack of consistency of this precise value within the report. The flooding is assumed to occur after 450 years. As stated before, PHE takes advice from the EA about the accuracy of these timings, but stresses that if coastal erosion or flooding were to occur sooner than the times given in the report this could have a significant impact on the doses depending on the radionuclides which are disposed of to Port Clarence i.e. if the inventory includes significant amounts of short-lived radionuclides.	impacts associated with flooding and erosion in greater detail.
We received various comments from members of the public, Stockton Borough Council, Redcar and Cleveland Borough Council, Billingham Town Council and North Billingham Residents Association. The comments were based on concerns over the impact of coastal erosion/climate change and flooding on the landfill site due to the proximity to the River Tees and the landfill being sited in marshland area; contamination of groundwater and coastline; the protection of the landfill by flood barriers and assumptions being 'unduly optimistic'	We recognise these risks and we have asked the applicant to carry out more detailed assessments, in particular of the nature and timing of coastal erosion, as we consider these to be important risk scenarios. The ESC explains the landfill site has been reclaimed from salt marsh and mudflats over many decades through the deposition of wastes, clinker and slag deposits from industries including gas works, lime works, chlorine works, soda works, blast furnaces and salt evaporating pans. The applicant has considered erosion of the landfill, in the period after the landfill has ceased operations, in the radiological assessments. This will be assessed as part of our determination of the application. The landfill restoration profile rises above the floodplain and in the existing plan there are two waste cells that overlap with the projected flood level used for planning purposes.

	We have asked the applicant to carry out a more detailed assessment of the implications of future climate change and associated potential for flooding or erosion of the site. In particular, we have asked the applicant to assess the impacts associated with flooding and overtopping of the cells (bathtubbing) in greater detail, recognising that these events could lead to migration of contaminants from the landfill in surface water or groundwater in the near-surface environment. The applicant has confirmed that the site has never flooded. However part of the site does fall within a flood zone. The applicant has confirmed they will not dispose LLW in this area. We will not accept any credit for the protection of the landfill by manmade sea or flood defences, made by the applicant in their assessments, after the time of surrender of the environmental permit, which is currently assumed to be 2130. Uncertainties in dose assessments have been considered and arise from natural variability, limitations in the knowledge of processes or data, alternative interpretations, and the potential for change in the future. We expect the applicant to use reasonable 'worst case scenarios' to assess the impact. Sensitivity testing of the values used in the assessments has also been conducted. This involves using various parameter values and are further explained in Section E8.1 in Appendix E of the ESC. We will review these assessments when provided and we will only permit disposals of LLW if the dose and risk criteria in the Guidance on Requirements for Authorisation for Near-surface Disposal Facilities on Land for Solid Radioactive Wastes (known as the GRA) are met and we are satisfied the risks are acceptably low.
Topic: Landfill location	
Members of the public asked: **Why, if Augean already have a permitted site for radioactive waste, are they seeking more permission?** **Why not use the Northamptonshire site.**	This is a commercial decision made by the operator of the landfill site. We cannot comment on this.
A member of the public asked:	The operator has chosen to apply for a permit to accept LLW at the Port Clarence landfill site. Applications are site-specific so this application

'Has this application been submitted to other areas, was it turned down? Why?'	would not be suitable for other landfill sites elsewhere in the country. We require an applicant to submit an ESC which specifically considers the environmental setting specific to the chosen site. These will differ from site to site. For example the impact of coastal erosion is a significant consideration for the Port Clarence landfill site whereas Augean's site in Northamptonshire is inland and therefore coastal erosion does not need to be considered. The applicant has a permit for the disposal of LLW to the ENRMF in Northamptonshire. It has not applied for any other LLW disposal permits in England.
Members of the public asked: **'Have any other sites been considered? If so which sites and why were they less suitable?'**	The 2007 Government policy on the long-term management of solid LLW in the UK (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/254393/Low_level_waste_policy.pdf) has deemed the disposal of LLW to landfill as an acceptable disposal option if it meets the environmental safety criteria set by the regulators. Our requirements are set out in the UK environment agencies' guidance on requirements for the authorisation of near-surface disposal facilities on land for solid radioactive waste (GRA). This application is site-specific and based on commercial decisions made by the operator of the landfill site. We will assess the application against our environmental safety criteria in the GRA. There are other landfill sites that have been permitted to accept LLW - EMNRF in Northamptonshire; Clifton Marsh in Lancashire, Lillyhall in Cumbria and Sellafield that accepts waste produced on the Sellafield site.
Redcar and Cleveland Borough Council commented that government should take the lead in developing policy that required waste to be disposed of locally close to the point of source. **They also stated 'surely it was sensible to require waste to be disposed of close to its source, rather than exporting to other parts of the country, it was noted there are only three such**	The 2007 Government policy on the long-term management of solid LLW in the UK is explicit in stating that the proximity principle needs to be taken into account when consigning sites take waste management decisions. The policy also states that the proximity principle needs to be weighed against other factors when considering options. This will inevitably mean that sometimes the preferred option may not be the nearest to the site of origin of the waste. There are currently four other landfill sites permitted to accept low activity LLW in England. These are EMNRF in Northamptonshire; Clifton Marsh in

facilities nationwide and so waste could come from any part of the country to the application site'.	Lancashire, Lillyhall in Cumbria and Sellafield that accepts waste produced on the Sellafield site. Having these sites has reduced the amount of waste being disposed of to the Low Level Waste Repository (LLWR) in Cumbria, which is a long distance from some nuclear sites. If a number of landfill sites are authorised for the disposal of low activity LLW this will help, in part, to address the proximity principle.
Topic: Waste streams/ volumes/ storage	
Members of the public asked: **How is the waste stored?** **What is the life span of the storage facility?**	The ESC states that on receipt of the waste it may be temporarily stored for a maximum of 24 hours unless quarantined pending return to the consignor. The operator's procedures will ensure prompt burial of radioactive waste, either on the day of receipt or the next working day if waste has been delivered to the site too late to allow disposal on that day. The waste will be disposed of into an engineered landfill site. The lifespan of the site is dependent upon planning permission and the rate at which waste is disposed of in to the landfill site, which has a finite capacity, which will be dependent upon a wide range of commercial factors. If we choose to permit the proposed disposals the Environment Agency will limit total site capacity in terms of radioactivity, but not necessarily site life span. The current landfill planning permission does not have an end date for disposals. It is proposed, by the applicant, that the landfill will operate for about 50 years with a 60 year aftercare period, although the applicant has stated this will probably be longer. This will be reviewed as part of the determination of the application.
Members of the public asked **'Where would the waste come from?'**	The source of the waste will be mainly from the UK nuclear industry, but potentially also from other radioactive substance users such as hospitals, research and industry. Nuclear industry may include sites involved in power generation, nuclear fuel manufacture, research, defence and decommissioning. LLW typically comprises construction and demolition waste such as rubble, soils, crushed concrete, bricks and metals from the decommissioning of nuclear power plant buildings and infrastructure, lightly contaminated miscellaneous wastes from maintenance and monitoring at these facilities such as plastic, paper and metal, residues from plant at which LLW is

	incinerated and wastes from manufacturing activities, science and research facilities and hospitals where radioactive materials are used. It is not possible for the applicant or us to cite the precise source of the wastes to be disposed. Waste acceptance is a commercial decision made by the operator of the landfill site and is dependent upon rates and types of waste generated at the consigning sites.
A member of the public wanted to know who will monitor the waste and ensure no ILW (Intermediate) nor HLW (High) level waste will be dumped.	Consignors of waste are required by their environmental permit to provide accurate information to the consignee in accordance with the requirements of the waste receiving sites. The site will be expected to ensure accurate information is received from consignors and that any consignment meets the receiving site's waste acceptance criteria – this will contain the total activity of a list of radionuclides and/or groups of radionuclides that the waste receiving site can accept. Procedures will be in place to monitor the external dose rate of the packages and a quarantine procedure for any non-conforming waste that is received. We, or other relevant environment agencies, regulate these transfers of waste between the consignor and consignee. This will include inspections of waste producers, including their waste characterisation and choice of disposal route. We may also carry out waste quality checking work that involves seizing, sampling and checking the waste prior to disposal. We will expect both consignors and consignees to work closely together to ensure accurate and appropriate information is made available. The ONR also regulate the transport of radioactive waste.
A member of the public commented: **'I am aware that some waste is having to be moved from old bunkers now. What will stop this being necessary here in the future? Is there any plan to limit (& police) the actual quantity of waste to be placed?'**	Port Clarence landfills have a defined volumetric capacity, which is specified in the current environmental permits and planning permission. The applicant has used the results of the radiological risk assessment presented in Appendix E of the ESC to define a 'radiological capacity' for the site, that is a maximum amount of radionuclides that can be disposed of without exceeding our dose and risk constraints, and the maximum radioactivity concentrations of relevant radionuclides. Limits on disposals will be specified in an environmental permit if we choose to issue one. Future disposals will have to be managed to ensure that consignments are below the maximum activity

	concentrations and are within the overall site capacity. We would also regulate the site by carrying out inspections, reviewing disposal records and environmental monitoring data.
Members of the public asked: **'How can a landfill for non-hazardous materials be used for disposal of materials that are hazardous?'**	Port Clarence landfills are currently permitted to accept both hazardous and non-hazardous wastes. Radioactive waste is excluded from the European Union Waste Framework Directive; the definition of radioactive waste can be found in Schedule 23 of the Environmental Permitting Regulations 2016. The 2007 Government policy on the long-term management of solid LLW in the UK has deemed the disposal of LLW to landfill as an acceptable disposal option if it meets the environmental safety criteria set by the regulators. Our requirements are set out in the UK environment agencies' guidance on requirements for the authorisation of near-surface disposal facilities on land for solid radioactive waste. The non-radiological hazards of the waste that will determine whether the wastes will be disposed of in either hazardous or non-hazardous cells. .
A member of the public asked: **'How much is it proposed to dump?'**	Port Clarence landfills have a defined volumetric capacity, which is specified in the current environmental permits and planning permission. When completed, the total volume (current and proposed future cells) of the non-hazardous landfill will be of the order of 4,100,000 m^3 and the total volume of the hazardous landfill will be of the order of 3,500,000 m^3. There is no planning constraint on the amount of LLW that can be disposed of within this volume. The amount of LLW that could be accepted would be limited by the radiological capacity of the site. The permit will specify the total radiological capacity of the site. It is assumed for the purpose of the risk assessment that LLW will comprise no more than 20% of the waste tonnage disposed at the Port Clarence landfill.
A member of the public asked: What are the known effects of the mass of material? e.g. generation of heat?	LLW will not generate heat due to the relatively low radiological content of the waste which is significantly below that at which heat is generated. Radioactive wastes that generate heat will be deposited in a geological disposal facility which will be 100-1000s of metres below ground. The search for a suitable geological disposal facility is part of a national programme led by RWM Ltd and is not related to this application. The landfill site will have a total radiological capacity which will control the level of radioactivity that can be disposed of. We

	will set limits in a permit to ensure that our dose and risk criteria are not exceeded. The applicant is also required to consider the non-radiological properties of the waste. The Port Clarence landfill site has two landfills that accept hazardous and non-hazardous wastes. These are already permitted by the Environment Agency. There are site pre-acceptance and acceptance procedures in place to ensure that no explosive, flammable, corrosive, oxidising or infectious wastes are accepted at the site. The hazardous wastes accepted at the hazardous waste landfill site are largely hazardous due to harmful, toxic, carcinogenic, irritant or eco-toxic properties. The characteristics of the radioactive wastes introduce no additional non-radiological hazards beyond those already assessed and controlled through the designs and procedures implemented through the existing Environmental Permits for the landfill sites. The impact of non-radioactive properties of the LLW waste are therefore covered by the HRA assessments. The landfill sites will generate leachate and gas and the operator has procedures in place to manage this, as required by the existing landfill permits. Landfill gas is carefully managed so as to avoid the creation of a landfill fire. Radiological assessments based on a landfill fire and landfill gas production scenarios have been produced. We will review the HRA and radiological assessments as part of our determination of this application.
A member of the public asked: **How long will the material remain radioactive?**	The length of time the waste will remain radioactive will vary depending on the radionuclides accepted and their radiological half-life. This is considered in the radiological risk assessments that have been produced in support of the application, and summarised in Table 198 of the ESC.
A member of the public made the following comments: **The ESC states that LLW can contain different mixtures of radionuclides but that "it is not possible to know now the exact mixture of radionuclides that will be contained in future radioactive wastes received at**	We agree with this statement made by the applicant. This is a commercial operation and wastes could be accepted from a variety of nuclear facilities producing different wastes with different radiological content. Each consignment of waste will be assessed on an individual basis, against the site's waste acceptance criteria, and the type of radionuclides and their activities will be compared against the limits set in any environmental permit issued. The limits will include a total radiological capacity for the site and also radiological

Port Clarence". **What is the precise nature of the radioactive waste? i.e. chemical composition, level of radioactivity?**	concentration limits. The waste acceptance criteria will also limit other aspects such as discrete items, loose tipping and the chemical composition of the waste. The applicant intends to manage the radiological capacity of the site to make sure that the total radionuclide content will not result in impacts that exceed our dose and risk criteria (as set out in our guidance on requirements for authorisation of near-surface disposal facilities on land for solid radioactive waste).
A member of the public asked the following questions: **Why are you not wanting to continue disposing the nuclear and radioactive waste in Cumbria or Dounreay as has been the norm since the late 1950's?**	The Environment Agency does not make decisions about where radioactive waste is disposed. This is a matter for government and the operators, of landfill sites, in consultation with the local planning authorities. UK policy for the long-term management of solid LLW recognises that the Low Level waste Repository (LLWR) in Cumbria is a valuable resource and that, where appropriate, LLW should be diverted away from there to preserve its capacity. The policy therefore allows disposal of suitable LLW to appropriately permitted landfills. We cannot comment on the regulation of Dounreay as this is regulated by the Scottish Environmental Protection Agency (SEPA).
Why start a new site amongst a densely populated area?	We do not influence or regulate site selection. This decision is made by the applicant in consultation with the local planning authority. As part of our determination of the application we will assess the radiological impacts from the landfill site on the surrounding area against the GRA.
Are those existing waste sites close to their permitted radioactive limits, and how long would you expect it to take to fill Port Clarence up to its permitted radioactive limits too?	LLWR's environmental permit was varied in 2015, following a major review, to continue accepting LLW at higher limits than those proposed for the Port Clarence landfill sites. Subject to future permitting and planning permission the operator hope the LLWR will have capacity for another 100 or more years. There is no defined time period for the disposal of LLW at Port Clarence. However the operator has stated the operational period will be 50 years. The time taken to reach the permitted limits will depend on the radiological content of the waste which will be influenced by commercial decisions and/or the lifetime of the established landfill operations made by the operator. The operational period for the landfill is also subject to planning

How happy have the locals at these 2 sites been with the storage of radioactive material/waste next to where they live?	permission which has not yet been granted for the acceptance of LLW. There is an established site stakeholder group for the LLWR which meets regularly to discuss matters associated with the site and its operations. This involves the operators of waste treatment and disposal sites, regulators, local councillors, members of the local community and any other interested parties. These are open meetings and information can be found at www.wcssg.co.uk. The operator also uses other means to communicate with local residents. As with this application for disposal, all significant changes to environmental permits at the LLWR are also consulted upon.
A member of the public asked: **'During the 1st and 2nd World Wars quite a lot of different wastes were dumped there will there be any cross contamination?'**	The ESC explains the landfill site has been reclaimed from salt marsh and mudflats over many decades through the deposition of wastes, clinker and slag deposits from industries including gas works, lime works, chlorine works, soda works, blast furnaces and salt evaporating pans. Any historically deposited wastes will now be located beneath the sites engineered lining systems. These are designed to contain the deposited wastes. It is proposed that the waste will mainly be disposed of in containers. There is the potential for this waste to mix with other wastes that have already been disposed of to the landfill but this will not add to the chemical or radiological risks associated with the wastes as these have been assessed prior to the waste being accepted. Risk assessments are required for the acceptance of hazardous wastes as well as for radioactive wastes. The landfill will also have specific waste acceptance criteria to ensure permitted limits are not breached.
Topic: Landfill engineering	
North Billingham Residents Association commented: **'A significant portion of the bund will be above ground level, with the capping layer exposed to the open air. There is potential for structural breaches, leading to possible contents entry in the**	The landfill sites are designed and operated based on the principle of engineered containment with low permeability basal, perimeter and capping seals constructed to an engineering specification which is the subject of approval by the Environment Agency under the Environmental Permit for hazardous waste disposal and non-hazardous waste disposal and the Landfill Directive. Waste disposed of to landfill will be immediately covered with a minimum 300 mm of a cover layer. A

atmosphere and dispersal by rain and strong winds.'	temporary cap is placed over filled cells prior to final capping if waste disposals have temporarily stopped or, in some circumstances, pending placement of the final cap. When a cell is full it is covered with an engineered capping layer to separate the wastes from the surface environment and to minimise the infiltration of rainfall. The landfill will be capped with low permeability layers overlain with restoration materials. Once waste has been placed to final levels, each phase of operation is progressively restored under a defined scheme of capping and restoration. A low permeability engineered cap is constructed on the top of the waste (0.3 m thickness) and restoration materials are placed over the cap (minimum thickness 1.0 m). The final landform will be vegetated. This design meets good practice for hazardous and non-hazardous waste landfills. We have asked the applicant to review the potential for cap degradation, including the effect of differential settlement, slope failure and erosion on cap performance and assess the implications on site impacts. The applicant has an existing fugitive emissions control procedure in place to ensure that fugitive emissions are, where possible, prevented and in all cases controlled and abated so as not to cause nuisance, harm to health or the environment. All waste loads likely to cause a litter problem in windy conditions (> 15 mph) shall be identified prior to disposal. The waste will be compacted to immobilise the waste and the waste will be covered. Vehicles containing loose waste will be sheeted and the site entrance, access road and landfill perimeter will be inspected daily. If required litter fencing will also be used. The applicant has confirmed that the site receives very little waste which may become windblown. There have never been any litter complaints regarding the site and the vast majority of LLW will be packaged and therefore would not become dispersed by the wind. All LLW will be covered immediately following placement.
Stockton Borough Council commented: **'There are concerns regarding historic and proposed landfill cell structures (by Augean and Zero Waste Management) and**	The landfill sites are designed and operated based on the principle of engineered containment with low permeability basal, perimeter and capping seals constructed to an engineering specification set out in a Construction Quality Assurance (CQA) Plan which is approved by the Environment Agency.

information as to what onsite monitoring is being undertaken to assess the integrity of the historic/proposed cells.'	Construction works are subject to CQA Supervision with the provision of a CQA Verification Report to confirm that each aspect of the cell construction has been carried out in accordance with the specification. Since the site was permitted the landfill cell structures have always met the engineering standards. This includes the period when the site was initially operated by Zero Waste Management, who constructed phases 1, 2a & 2b, 3 & 4 at the site. These phases were all constructed with a QA'd clay lining system and artificial liner (to the correct engineering specification). Phase 1 was engineered with just the clay i.e. didn't have the artificial liner, but this met the standard at that time. These phases have all been completed and capped, with one exception being a small shallow limited void (3m deep) that is currently used for an access route. Augean have confirmed to the Environment Agency that they would only dispose of radioactive wastes in recently constructed phases, and not in the small remaining void. There is an established groundwater monitoring programme in place, with control levels set, which in part is used to assess the performance of the landfill. Should results go above the control levels this may indicate an issue with the integrity of the landfill and the operator would be required to investigate. We will not allow surrender of the disposal permit until we are satisfied that the site is passively safe and requiring no active intervention or monitoring.
Stockton Borough Council asked: **'What capping layer would be placed on this Low-level radioactive waste material?'**	The site is operated in a cellular manner to minimise leachate generation. Prior to final capping of the cells waste disposed of to landfill will be immediately covered with a minimum 0.3 m of a cover layer, usually soils. A temporary cap is placed over filled cells prior to final capping if waste disposals have temporarily stopped or, in some circumstances, pending placement of the final cap. To separate the wastes from the surface environment and to minimise the infiltration of rainfall the landfill will be capped with low permeability layers overlain with restoration materials. The detailed design of the low permeability capping layer at the site will be agreed with the Environment Agency and constructed to an engineering specification set out in a CQA Plan which is approved by the Environment Agency. The construction works are subject to CQA Supervision

	with the provision of a CQA Verification Report to confirm that each aspect of the cell construction has been carried out in accordance with the specification and will comprise, a 0.3m regulating layer, a protection geotextile, a low permeability geosynthetic clay liner and 1 m of restoration soils. The placement of a cap and restorations soils will reduce the amount of rainfall infiltrating the site.
Stockton Borough Council asked: **'If there were any restrictions on planting due to this capping layer or the disposition of low-level radioactive waste - As you will be aware tree roots will take up nutrients but they will also take up contaminates and their growth may adversely affect the structural integrity of the capping layer.'**	In accordance with the planning permission, the landfill site will be restored to rough grassland, scrub and woodland and the surrounding areas will be restored to areas of open water, aquatic marginal vegetation, scrub, wet meadow and ruderal grassland with small hollows, banks and ridges suitable for nature conservation use. Operators of landfill sites must not plant trees or shrubs that could potentially penetrate through the engineered cap. This is assessed when reviewing restoration plans. This would therefore prevent the uptake of any contaminants. We have asked the applicant to demonstrate the steps that it will take to ensure that the erosion potential of the cap is minimised and assess the time period likely to be taken before the cap could be eroded enough to expose the waste. If this is likely to occur before the earliest likely date of coastal erosion then we would expect impacts to be assessed. The applicant has assessed impacts to animals that burrow into the landfill.
What depth is it proposed to bury the material? Can it be exposed by the activities of animals? The effects of flowing water?	The minimum depth of non-radioactive waste or material covering LLW is 0.3 m and the LLW will be covered immediately after disposal. Operating procedures will include specifications on the depth of non-radioactive waste that will be placed at the base (2 m), sides (2 m) and top (1 m) of a landfill waste cell. This creates a barrier between the LLW and the side liner of a waste cell which will need to be located when the cell is capped. It also means that all LLW will be 2.3 m or greater below the restored surface of the site once the final cap is installed. Radioactive waste will not be deposited in the engineered separation bund. An additional limitation is proposed for wastes containing a significant quantity of Ra-226 (Radium contaminated wastes) with a requirement to bury these wastes at least 5 m below the restored surface of the site. This places radium below a reasonable excavation intrusion depth and reduces the potential dose due to radon gas during any future site habitation.

	It would be unlikely for burrowing animals and water erosion to expose the waste due to the depth at which the waste will be buried and the use of low permeability capping layer which will prevent water ingress in to the landfill. However, the ESC includes an assessment of impacts to animals that burrow into the landfill.
Is it just dumped in the ground?	The landfill site has engineered disposal cells with basal and side-wall liners, as well as a low permeability capping layer. These engineered barriers reduce leachate generation and migration from the landfill site. There will also be specific waste acceptance criteria and procedures to ensure the waste will be buried in a landfill cell as soon as practicable after inspection on arrival at Port Clarence and within a maximum of 24 h following acceptance for disposal at the Port Clarence site and covered immediately. LLW is not placed within 2m from the base of the cell and the perimeter seal. No LLW is placed within the top metre of the waste in each cell. Wastes containing significant activity concentrations of Ra-226 (i.e. >5 Bq/g) will be placed at least 5 m below the final restored surface (see Appendix E, Section E.5.5.2). After placement, the deposited LLW will be covered with a minimum thickness of 0.3 m of suitable cover material over all exposed surfaces and the location of each load within the landfill is recorded.
We received comments on surface water management on the site: **'The applicant has stated that there is no artificial surface water management system at the site as surface water all drains away naturally. This raises a significant risk of containment failure for waste stored at the site prior to burial.'**	Waste for disposal will be placed in a landfill cell as soon as practicable after inspection on arrival at Port Clarence and within a maximum of 24 hours following acceptance for disposal at the Port Clarence site. Any waste not accepted for disposal will be placed in a quarantine area, which has an impermeable surface to prevent contamination from run-off, and returned to the consignor as soon as practicable. We therefore do not consider this to be a significant risk. The profiling of the restored surface will encourage surface runoff, preventing the development of puddles and reducing infiltration.
Members of the public expressed concerns over leakage from the landfill. Their comments and questions are below: **It is also acknowledged that contaminated leachate could**	Landfill sites are designed and operated based on the principle of engineered containment with low permeability basal, perimeter and capping seals constructed to an engineering specification set out in a Construction Quality Assurance (CQA) Plan which is approved by the Environment Agency. Construction works are subject to CQA Supervision with the provision of a CQA Verification Report to

also be dispersed well beyond the site. **What plans are in place if any of it leaks?** **Could the waste get into the waterways?** **What methods will be used in the prevention of radioactive leachate from entering the ground water supply /or the river tees.** **Stockton Borough Council asked:** **'The site has in its entirety, been built on made ground and the landfill cells have been constructed above potentially permeable and unknown fill, what measure will be put in place to ensure that any resultant groundwater particularly from tidal surge will be prevented from moving freely through the unsaturated/saturated zones into all water bodies?'** **Could the waste leak upon being stored?**	confirm that each aspect of the cell construction has been carried out in accordance with the specification. The landfill is designed to contain all of the waste and the leachate that is created for the period of operation, as long as it is monitored and maintained and for as long as possible thereafter. There is a leachate management system for the collection and extraction of the leachate. The leachate levels are controlled by pumping leachate from the leachate collection sumps or other extraction wells drilled as necessary. The level at which the leachate is maintained is specified in the existing Environmental Permit for the landfill site. Cell caps will be constructed once disposal cells are full, reducing water ingress, and hence reducing potential leachate generation. However, inevitably, over long periods of time all landfill containment systems will begin to fail and leachate will escape the engineered barriers and potentially enter groundwater and the local environment. We require this risk to be assessed and will only permit disposals if we are satisfied that any such releases in the future, both during and after operations, would be acceptable and of low risk should they occur. We will only allow an operator to surrender a permit at the end of its life if we are satisfied that this risk remains low and surrender criteria are met. The applicant has produced an HRA, a requirement of the current landfill permit, to show that leachate from the landfill will not pose an unacceptable risk to groundwater at any stage of its lifecycle. The HRA and related assessments enable groundwater control levels and compliance limits for the landfill to be set. The purpose of these are to ensure the operator can determine the engineering standards and other operational controls necessary to protect groundwater. Groundwater control levels are used as site-specific assessment criteria to: determine whether a landfill is performing as designed; and draw the attention of site management to the development of adverse trends in the monitoring data. If groundwater control levels are breached, they indicate that the landfill may not be performing as predicted. They are used as an early warning system to implement appropriate investigation or corrective measures. Leachate generation will occur throughout the landfill's operational phase and continue into the

	aftercare phase, long after waste disposal at the site stops. Discharge rates and leachate quality may change over time so assessments take into account the uncertainties of liner and capping systems' durability. The assessment must consider degradation of artificial lining systems (and other management systems such as leachate collection, transfer and treatment). Environmental monitoring throughout the time that the site is permitted will check the integrity of barriers and safety plans, helping to confirm the system is operating as expected. We consider that the applicant has appropriate controls in place to minimise and monitor leakage of leachate from the landfill site. As part of our determination of the application we will also consider whether this is appropriate for radioactive waste disposals. There is no intention for the waste to be stored prior to disposal. The majority of waste will be disposed of in drums and packages and will be placed in the landfill as soon as practicable after inspection on arrival at the landfill and within a maximum of 24 hours following acceptance for disposal at the landfill site. Any waste not accepted for disposal will be placed in a quarantine area, which has an impermeable surface to prevent contamination from run-off, and returned to the consignor as soon as practicable. We therefore do not consider leakage from stored waste to be a risk.
Redcar and Cleveland Borough Council raised concerns in respect of carbon capture and production of methane from the site.	Landfill gas is comprised predominately of methane and carbon dioxide. Landfill gas is extracted and pumped to the waste recovery park where it is used to generate electricity and any excess gas is burned in a flare stack. Combustion of the gas destroys potentially harmful and odorous components in the gas and minimises the release of methane. Carbon capture is not in use at the landfill site. The management of landfill gas at the hazardous and non-hazardous landfill sites is the subject of conditions of the Environmental Permits. Landfill Gas Management Plans are in place and implemented through the Augean management systems. The LLW wastes that will be disposed of at the site will have a generally low level of organic matter and are only slowly degradable, if at all. Putrescible materials are not accepted. The levels of radioactivity in LLW are too low to give rise to a risk

	from the production of radioactive hydrogen gas. The site operates a gas management system that is able to manage any gas generated from the waste. It is unlikely that significant quantities of landfill gas will be generated from LLW that will be deposited at the site. If gas is generated by the non-hazardous or hazardous waste and/or LLW, the gas will be collected in the gas management system and be combusted. A dual system of migration control will continue to be operated at the site. 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 will continue to be operated as necessary which prevents the accumulation of gas under elevated pressures in the landfill minimising further the risk of the migration of gas and the emissions of gas to the atmosphere. The collected gas will continue to be directed to the power generation unit to the south east of the landfill and burnt.
Topic: Wildlife	
Members of the public were concerned about the impact disposals of LLW in the landfill would have on the local wildlife and nature reserves.	We have consulted with Natural England who responded with no objection to the application. The applicant has also carried out a radiological risk assessment on the impact of the disposals to wildlife inhabiting the local terrestrial, estuarine and coastal environments (ESC Appendix E).This will be assessed as part of our determination. We will only issue a permit if we are satisfied that there are not unacceptable impacts.
A member of the public commented: **'It is acknowledged that a wide range of wildlife occupies the site - were any to be exposed to significant levels of radiation, they could potentially spread it to the wider food chain.'**	There is the potential for contaminated waste to be spread by wildlife but is very unlikely as the applicant has procedures in place to prevent wildlife from accessing the waste. For example, waste will generally be disposed of in bags or drums, the waste is covered at the end of each working day and the applicant has existing procedures in place for managing pests such as rodents and scavenging birds. Landfill engineering will also prevent access to the waste after operations have ceased. The landfill will be capped with soils or clay, a geosynthetic clay liner, a geotextile liner and at least 1m of restoration soil. The radiological impact on burrowing animals that dig into the waste has also been considered in the ESC.
Topic: Monitoring	

A member of the public commented: **'I request that any groundwater transport and discharges that carry radionuclides be minimised to avoid affecting the area (especially downstream wetland areas) and be regularly, externally monitored In addition, monitoring of dose rates for residents of Port Clarence prior, during and land storage of LLRW.'**	The construction of the landfill site is designed to contain and minimise leachate generation and therefore minimise contamination of the groundwater. The applicant has carried out baseline monitoring to establish the background levels of radioactivity in the leachate, groundwater, surface water, dust and soils around the site The applicant has proposed a monitoring programme for groundwater including bi-annual radiochemical analysis of groundwater for several existing boreholes close to the site. The applicant also proposes to carry out quarterly site perimeter dose rate monitoring and radiochemical analysis of dust collected from a downwind location on the site boundary. The final details of the monitoring schedule are yet to be defined. We have requested further information about the monitoring regime and will work with the applicant to make sure that it meets our requirements. There are no groundwater abstraction points within 2 km of the site and the groundwater beneath the site is subject to saline intrusion from the estuary making the water unsuitable for drinking or for irrigation. The direction of groundwater flow is assumed to be toward the estuary. Impacts to human health and biota from radioactivity leaching into the groundwater are considered in the radiological risk assessment. This is being assessed as part of our determination of the application.
Stockton Borough Council commented: **'Insufficient offsite monitoring for such pollutants has been considered nor the severity of their nature properly noted.'**	Section 7.5 of the ESC does set out the proposed monitoring regime for the site. The applicant proposes to carry out quarterly site perimeter dose rate monitoring and radiochemical analysis of dust collected from a downwind location on the site boundary. However, the final details of the monitoring schedule are yet to be defined. We have requested further information about the monitoring regime and will work with the applicant to make sure that it meets our requirements. The nature and impacts of the proposed radionuclides have been considered in the radiological risk assessments, see Appendix E of the ESC.
Stockton Borough Council asked: **'How will contaminated leachates be monitored and**	Leachate Management: The engineered landfill containment system includes a leachate management system for the collection and extraction of leachate. A leachate

controlled both on site and off site including within groundwater(s)?'	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 level at which the leachate is maintained will be specified in the Environmental Permit. The leachate generated at the site will not be used for dust suppression. The excess leachate will be pumped into a leachate storage tank and used in the on-site Waste Recovery Park in place of clean water. If the leachate cannot be processed in the on-site waste treatment facility it will be removed from site by tanker for treatment at a suitably authorised waste water treatment plant. Leachate is monitored for chemical characteristics to confirm that the contaminants remain below the levels specified in the hydrogeological risk assessment. This monitoring will be extended to include radiological characteristics. When landfill operations and the following period of active management have ceased, the leachate level may increase. With an increasing head the potential for leachate flows, through liner defects, to groundwater increases. For the purposes of the groundwater radiological risk assessment, it has been assumed that the landfill cells are completely saturated and that all of the radiological inventory can potentially be dissolved in pore water. Leachate Monitoring: The applicant currently operates a LLW permit monitoring programme at the ENRMF. They propose to use a similar LLW permit monitoring programme and reporting arrangements at Port Clarence. The key aspects are: • bi-annual radiochemical analysis of groundwater for several existing boreholes close to the site, analysis would be for gamma spectrometry, gross alpha / beta in waters and tritium in aqueous samples; • annual radiochemical analysis of bulked leachate, analysis would be for gamma spectrometry, gross alpha / beta in waters and tritium in aqueous samples; • quarterly radiochemical analysis of leachate treated off-site, analysis would be for gamma spectrometry, gross alpha / beta in waters and tritium in aqueous samples.

	The monitoring programme for groundwater has considered the predicted groundwater concentrations, the detection limits and the expected doses from the predicted concentrations. There is uncertainty associated with the groundwater model predictions and for this reason the list of radionuclides routinely analysed in groundwater should be reviewed as the inventory accumulates. Thus, additional radionuclides would be analysed as the inventory of the radionuclides increases and passes certain trigger levels. The final details of the monitoring schedule are yet to be defined. We have requested further information about the monitoring regime and will work with the applicant to make sure that it meets our requirements.
Topic: Consultation and permitting	
Members of the public and Stockton Borough Council asked if the emergency services were consulted on the application.	We do not routinely consult with the emergency services. The transport of radioactive waste is not within our regulatory remit.
Members of the public were concerned about the perceived lack of public consultation / sharing of information on this application.	We advertised this application on Citizen Space and received 2329 responses. We engaged with local MP's, councillors and the Tees Valley Mayor as well as attending interviews on local radio. The applicant also produced a leaflet and distributed to about 17,000 properties in the area. Public drop-in sessions were also held in November 2019 in High Clarence and Billingham, which we attended. The High Clarence event was reported on local television.
A member of the public asked: **'Will there be a licence issued by either the Council or the Environment Agency and who will be responsible for its enforcement.'**	If we determine the application has provided enough evidence to show that the application meets our requirements set out in our guidance on requirements for the authorisation of near-surface disposal facilities on land for solid radioactive waste, including meeting our dose and risk criteria, then we will issue the applicant with an environmental permit to dispose of low level radioactive waste at the landfill site. We will be responsible for the regulation of the site to ensure compliance with all of the permit conditions.

	At this stage we are still determining the application. We will be consulting again on our draft decision. The local planning authority are responsible for granting planning permission for the landfill and enforcing those requirements.
Topic: Other	
Members of the public stated they did not think there was enough research or assessment into the disposal of LLW to landfill.	Surface or near-surface disposal is internationally recognised as an acceptable route for the disposal of lower activity radioactive waste and is in line with current practice in all countries having a significant inventory of lower activity radioactive waste. This is based on many years of research which informs guidance and expectations set by international agencies such as the International Atomic Energy Agency which in turn informs UK Policy. The 2007 UK policy for the long-term management of solid LLW allows disposal of suitable LLW to appropriately permitted landfills in order to free up the capacity of the LLWR. The applicant has produced an ESC which we are currently assessing as part of our determination of the permit application. We are assessing the ESC against the principles and requirements of our guidance on requirements for authorisation of near-surface disposal facilities on land for solid radioactive wastes, which are consistent with international standards and requirements. Our determination has identified areas where we will require further information to support the claims made in the ESC.
A member of the public asked: **'What impact will there be on the area from environmental activists opposed to this proposal now and if granted?'**	We are not aware of any interest from environmental activists. The applicant has produced a procedure for dealing with protesters.
A member of the public asked: **'Will the fracking site on the moors impact the proposal? If there is a series of earthquakes, as has happened on the west coast site, will this cause a safety issue with the proposed safe storage?'**	A company called Third Energy was granted permits, by the EA, to support gas extraction at their existing sites in Pickering, on the border of the North York Moors. We were informed that the gas extraction could involve hydraulic fracturing (fracking). Fracking was suspended by the Government at the end of August 2019. Third Energy did not carry out hydraulic fracturing and in November 2019 the Government said they

	would not grant consents for fracking unless the industry can reliably predict and control tremors linked to the process.
A member of the public asked: **'What safety regulations must be adhered to?'**	Safety is regulated by the Health and Safety Executive (HSE) under the Health & Safety at Work Act 1974 and the Ionising Radiation Regulations 2017.
Members of the public expressed concerns over site security. One member of the public specifically asked: If intruders were to breach the sites inadequate wire fencing perimeter, it is not definitively stated that 24 hour security will be active and there is no guarantee that a rapid enough police response presence would be available.	The landfill site has security measures in place. We have asked the applicant to clarify what additional requirements it is proposing before receipt of any LLW.
Stockton Borough Council commented: No consideration is given to a fire or terror incident and again the potential consequences of such an event have not been considered.	Augean has produced a radiological risk assessment for a fire at the Port Clarence landfill sites see section E3.6 of Appendix E of the ESC. This will be assessed as part of our determination process, including considering whether this scenario is appropriate to bound impacts relating to a terror incident.
Members of the public and Stockton Borough Council were concerned about terrorism: **This Council requires firm reassurances that this material could not be used for terror activity.** **Could the waste be used for terrorism?**	The types of waste that would be accepted for disposal would typically include demolition waste and items of personal protective equipment. The risks posed by this type of waste will be low as it will have relatively low activity concentrations and associated doses. To put this into context the amount of radioactive waste the landfill can accept must not lead to a dose constraint of greater than 0.3 mSv/y during the operational period. The legal dose limit for members of the public is 1 mSv/y. Access to the waste will be restricted by the site's security measures and containment of the waste within the landfill: 1. Site security measures include: perimeter fencing, security staff patrol the site out of hours and 24 hour CCTV.

	2. The waste will not be stored on site, unless in quarantine where it will be stored prior to returning to the customer. Waste will be accepted and immediately disposed and covered. The radioactive waste will be co-disposed with conventional waste and will therefore be difficult to locate once mixed with the waste and covered.
Stockton Borough Council asked: **'If waste could be accepted from outside of the UK, what measures will be in place to ensure that the standards for transportation and movement of radioactive materials will be enforced?'**	The UK does not generally accept imports of radioactive waste for disposal, although where a country doesn't have the capacity to manage the waste we can agree to it in certain circumstances and if it meets the UK's LLW policy. Such imports rarely occur. We would only accept imports for treatment and disposal where a robust assessment and justification of the available options showed clearly that import to the UK was the only practical option. Radioactive waste would be transported to a disposal facility under strict controls and in accordance with national and international regulations applicable to the mode of transport used (i.e. road, rail, or sea). Compliance with these regulations will provide the necessary levels of safety and security during transport. ONR are responsible for the regulation of the transport of radioactive materials and waste. The import and export of radioactive waste is regulated by the Environment Agency under the Transfrontier Shipment of Radioactive Waste and Spent Fuel Regulations 2008. The movement of waste requires an authorisation from us. Before we decide to authorise or refuse the application to make transfrontier shipments we will obtain the consent of the authorities of the countries directly involved in the shipments, as well as ONR.
A member of the public commented on: **'Lack of trust in Augean / consignors to 'play by the rules', i.e. not to cut corners, push boundaries which could result in misconsignment. '** **Another member of the public commented:**	Augean operate various waste facilities around the country, which are regulated by the Environment Agency. We conduct routine compliance activities which include inspections and audits of operations and the management procedures and assessment of monitoring returns. We have no concerns with their competency or compliance with their current permitted activities. We also regulate the activities of the consignors to ensure compliance with their permits. As above we

'Companies say they will dispose of this waste safely, but quite honestly, companies are there to make a profit and if they can cut corners and costs they will. In 2014 Sellafield Nuclear Plant was fined £700,000 for failing to send 'low level' radioactive waste to the correct disposal site; they sent it to land fill instead. This could, of course, have been an accident, but this is also another reason NOT to dispose of radioactive waste near towns and cities. And that is the point isn't it? Humans are apt to make mistakes and the correct procedures are not always followed and the innocent public suffer.'	conduct routine compliance activities through inspections and audits of operations and management systems. Consignors of waste are required by their permit to provide accurate information to the consignee in accordance with the requirements of the waste receiving sites. The site will be expected to ensure accurate information is received from consignors and that any consignment meets the site waste acceptance criteria – this will contain the total activity of a list of radionuclides and/or groups of radionuclides We, or other relevant environment agencies, regulate these transfers of waste between the consignor and consignee. We will expect both consignors and consignees to work closely together to ensure accurate and appropriate information is made available. We have regulatory powers to take enforcement action against any non-compliance with the conditions of a permit which range from advice and guidance to enforcement notices and prosecution. If we identify any non-compliances with the permit conditions we will take the appropriate enforcement action. We prosecuted Sellafield Ltd in 2010 for the mis-consignment of intermediate level waste to Lillyhall landfill site which is permitted to accept high volume very low level waste.
A member of the public made the following comment: **'The proposed site is on top of a hill where the wash off goes into the Tees river. It is on a flood plain. The whole area is subsiding below river height. Port Clarence and the surrounding area is on a sinkhole alert area according to world maps executed by USA seismologists.'**	Port Clarence Landfill is a land raise constructed on land reclaimed from the Tees Estuary. There is a potential for run-off and leachate from the landfill to enter the estuary. The applicant proposes to carry out routine monitoring and radiochemical analysis of surface water, groundwater and leachate at the site. The final details of the monitoring schedule are yet to be defined. We have requested further information about the monitoring regime and will work with the applicant to make sure that it meets our requirements. We have also asked the applicant to carry out a more detailed assessment of impacts associated with flooding and erosion. We are aware that there has been subsidence in the vicinity of Port Clarence as a result of historic salt extraction, including at the RSPB Saltholme reserve. However, most of the salt extraction occurred to the north and west of Port Clarence and we are not aware of any subsidence in the immediate vicinity of the landfill.

Redcar and Cleveland Borough Council stated: **'Concerns were expressed in respect of the operational period of 40 years if the waste disposal operator were to change or the regulatory body were to change, how would succession planning be dealt with'.**	The operator of a landfill is required to keep records of all disposals. This includes the consignor, waste types and the location of the waste within the landfill site. If the operator was to change we would require the landfill permits and associated records to be transferred to the new operator. As part of this transfer we would assess the competence of the operator to manage the landfills for both conventional and radioactive waste. The Environment Agency was created by the Environment Act 1995 and is the regulatory body for issuing environmental permits under the Environmental Permitting (England and Wales) Regulations 2016 and ensuring compliance against the conditions of these permits. If Government decided the Environment Agency was no longer going to be the regulatory body it would be a matter for Government to ensure regulatory responsibilities, under the legislation, were transitioned and maintained.
Redcar and Cleveland Borough Council members expressed great concern as to the length of time it takes even for low level radioactive waste to be 'safe'. There was concern that the regulating body was dealing with future, potentially unknown impacts, using present management practices and procedures	We can only determine the application based on current practices. Landfill engineering and management are well established practices and are based on industry standards and the requirements of the Landfill Directive. The applicant has submitted radiological risk assessments, based on the proposed radionuclides and their associated half-lives they expect to dispose, to determine the dose impact during and after the operational period of the landfill. The dose from the disposals must meet our regulatory dose and risk criteria and if they do not we will not issue a permit. These criteria look at the dose impacts during the operational phase, the time after operations have ceased and potential human intrusion into the landfills.
Members of the public asked: **What studies have been carried out to evaluate the impact of an accident or leak on the local areas?**	The applicant has an emergency plan which includes how they would respond to incidents that occur on site. Any off-site accident would be considered under the transport regulations which are regulated by ONR. The applicant has considered the potential dose impact of a major accident occurring at the nearby petrochemical facilities and road/rail distribution centre. See section below. Leaks from the landfill sites have also been considered in the Landfill engineering section earlier in this report.

A member of the public asked: **'Is dumping radioactive waste near a centre of urban growth, and in close proximity to a significant number of Top Tier COMAH sites really such a good idea?** **Has the proximity of a number of radioactive waste dumps been considered by the Top Tier COMAH establishments in their submissions to operate, made to the HSE, and have these establishments been consulted about the potential effects on their continued operations?'**	The applicant has considered the potential impact of a major accident at a neighbouring site close to the Port Clarence facilities. There is a petrochemical storage facility and a road/rail distribution centre that could potentially result in a boiling liquid expanding vapour explosion (BLEVE). Such an explosion at nearby facilities could cause a fire on the Port Clarence site, encompassing both the Waste Recovery Park (WRP) and the landfill sites for the disposal of hazardous and non-hazardous wastes. The assessment has considered the potential dose to a member of public from such an event. We would not issue a permit unless we were satisfied the assessment was within the dose and risk criteria. The top tier COMAH sites would only consider impacts from nearby waste disposal sites if they had the potential to have an adverse impact on the COMAH site and its operations. There are no feasible accident scenarios on a landfill site that could impact on the operations of nearby COMAH sites. The operators of the COMAH sites have had the opportunity to comment and consider the implications of this application on their site operations. The application was advertised on Citizen Space and local councillors were also informed of the application and on how people could provide their comments. The applicant also sent out leaflets to members of the public and businesses in the surrounding area. We also attended two public drop ins, organised by the applicant, to speak to anyone about the application.
Topic: Further clarification on the information submitted by the applicant - comments from COMARE	
The executive summary is provided but in places this could benefit from more clarity – for example in paragraph 470 and 471, reference is made to Tables 34 and 35, but insufficient detail is provided to make the point being made at all clear.	We have asked the applicant for a clearer presentation of its case for environmental safety.
The case makes considerable reference to the 'sum of fractions' rule, but the two	We have requested further clarification on this.

definitions in the body of the case (paras 392 and 406) make no sense mathematically. The reader has to delve into the extremely long Appendix E to find an example that explains the concept.	
It would be a good idea to add a few pages which summarise the case in layman's terms. Such a summary may well benefit from an indication of the annual dose to each of the groups identified in Table 37 from a waste inventory with a sum of fractions equal to unity. Appendix D does not do this and is also difficult to follow.	We recognise this is a technical topic and have taken this comment on board. It is something we may require future applicants to provide when making applications.
The executive summary concludes that the dose constraint from a single source used in the safety case is 0.3 mSv per annum for a member of the public. We assume that the source referred to is the entire Port Clarence landfill site as indicated in paragraph 189 – however this is not explicitly stated, and reassurance may reasonably be sought.	This assumption is correct. We have asked the applicant to clarify this.
Topic: Further clarification on the information submitted by the applicant - comments from PHE	
The structure of the report is hard to follow in some sections and it would have been helpful for the reader if a summary of the main criteria for waste acceptance criteria was clearly stated in one place as these are considered as part of the safety case.	We have asked the applicant for a clearer presentation of its case for environmental safety. Waste acceptance criteria is covered specifically in section 7.4 of the ESC.
The proposed limits are given in Tables 33, 34 and 35 of Section 7.4. Tables 34 and	We have requested further clarification on how the applicant intends to manage the radiological capacity (i.e. the radionuclide content) of the landfill.

Table 35 gives the suggested radiological capacity for 5 scenarios for the hazardous and non-hazardous landfills so it is not clear which value is proposed (although it is assumed that will be limiting one).	
Para 178 mentions a procedure for acceptance and the receipt of waste, assay, waste emplacement. Does this include emplacement of Ra-226 at depth as this could potentially have a significant impact on the dose to landfill workers if not correctly implemented?	Yes, the applicant is proposing to implement a procedure for the disposal of consignments containing higher activities of Ra-226 at a depth of at least 5m, see section 7.4 paragraph 400 (p.121) of the ESC
The ESC states that the operations at the ENRMF are similar to those at Port Clarence, therefore the doses are anticipated to be similar. However, this does depend on the inventory to be received at Port Clarence being similar to that at ENRMF – is Augean confident that the actual inventory received is likely to be similar at the two sites?	We have asked the applicant to reassess this statement on the basis that they have requested higher activity concentrations at Port Clarence Landfill than are currently permitted at ENRMF
Para 319 It is not clear from the text whether the doses from ingestion and external irradiation are treated separately or are summed together. Is inhalation of particles considered?	We have requested the applicant to clarify whether the doses from ingestion and external irradiation are treated separately or are summed together. The applicant has screened out assessment of inhalation of radioactive particles (paragraph 1164 of the ESC).
PHE made a number of specific comments on errors in the dose calculations supporting the ESC	We have asked the applicant to address these comments. See Appendix 1 for PHE's comments.

4. Next steps

We are currently assessing the application and the consultation responses will be considered as part of this assessment. We expect a decision to be made later in the year or early 2021. There will also be further opportunity to comment on this application as we will also be consulting on our draft decision document before we reach our final decision on whether to issue a permit.

5. Glossary

Consignor (of waste)

An organisation or person that sends waste to a facility for disposal.

Disposal

Disposal is the emplacement of waste in a specialised land disposal facility without intent to retrieve it at a later time; retrieval may be possible but, if intended, the appropriate term is storage. We shall regard the time of emplacement as the time of disposal, even if the facility is eventually closed many years later.

Dose guidance level (for human intrusion)

In the context of near-surface disposal facilities, the dose standard against which the radiological consequences of human intrusion are assessed. It indicates the standard of environmental safety expected but does not suggest that there is an absolute requirement for this level to be met.

Environmental safety case (ESC)

The collection of arguments, provided by the developer or operator of a disposal facility, that seeks to demonstrate that the required standard of environmental safety is achieved.

Exempt waste

Radioactive wastes are considered exempt from regulatory control if they fall outside the scope of Environmental Permitting Regulations 2016 or there is an extant exemption order.

Exposed group

For a given source, any group of people within which the exposure to radiation is reasonably homogeneous; where the exposure is not certain to occur, the term ‘potentially exposed group’ is used.

Geological disposal

A long-term management option involving the disposal of radioactive waste in an engineered underground facility, where the geology (rock structure) provides a barrier against escape of radioactivity and where the depth, taken in the particular geological context, substantially protects the waste from disturbances arising at the surface.

Geological disposal facility

A facility that meets the requirements for geological disposal.

Hazard

A property or situation that in certain circumstances could lead to harm.

High level waste (HLW)

Radioactive waste in which the temperature may rise significantly as a result of the radioactivity, so that this factor has to be taken into account in the design of disposal facilities.

Higher activity waste

Radioactive waste having a radioactive content exceeding four gigabecquerels per tonne (GBq/te) of alpha or 12 GBq/te of beta/gamma activity and any radioactive wastes below these thresholds that are unsuitable for near-surface disposal.

Human intrusion

Any human action that accesses the waste or that damages a barrier providing an environmental safety function after the Period of authorisation.

Intermediate level waste (ILW)

Radioactive waste exceeding the upper activity boundaries for low level waste (LLW) but which does not need heat to be taken into account in the design of disposal facilities.

Inventory limits

Limits and conditions set by the regulators on volumes, radionuclides and/or activity concentrations for waste disposal.

Leachate

Any liquid which has been in contact with waste. Leachate is collected in the base of vaults and trenches and arises as a result of the infiltration of rainwater or groundwater.

Low level waste (LLW)

In Government policy, low level waste is defined as ‘radioactive waste having a radioactive content not exceeding four gigabecquerels per tonne (GBq/te) of alpha or 12 GBq/te of beta/gamma activity’. It consists largely of paper, plastics and scrap metal items that have been used in the nuclear industry, hospitals and research establishments. In future, there

will also be large volumes of LLW in the form of soil, concrete and steel, as existing nuclear facilities are decommissioned.

Monitoring

Taking measurements so as to be aware of the state of the disposal system and any changes to that state. This may include measuring levels of radioactivity in samples taken from the environment, and also measuring geological, physical and chemical parameters that are relevant to environmental safety and that might change as a result of construction of the disposal facility, waste emplacement and closure.

Near-surface disposal facilities

Facilities located at the surface of the ground or at depths down to several tens of metres below the surface. Near-surface facilities may use the geology (rock structure) to provide an environmental safety function, but some may rely solely on engineered barriers.

NORM

Naturally Occurring Radioactive Material

Operator (of a disposal facility)

The organisation responsible for operating a disposal facility after waste emplacement has begun. This organisation will need to hold an authorisation under Environmental Permitting Regulations 2016

Passive safety

Not placing reliance on active safety systems and human intervention to ensure safety.

Period of authorisation

The period of time while disposals are taking place and any period afterwards while the site is under active institutional control.

Potential exposure (to ionising radiation)

Exposure to ionising radiation that is not certain to occur.

Putrescible waste

A solid waste that contains organic matter capable of being decomposed by microorganisms so as to cause a malodour, gases, or other offensive conditions, or which is capable of providing food for birds and other vectors.

Radiological capacity of a disposal facility

An inventory of radioactive material that a facility is capable of accepting based on the environmental safety case.

Radiological risk

The probability per unit time that an individual will suffer a serious radiation-induced health effect as a result of the presence of a radiation source, for example, a disposal facility. In this context, a serious radiation-induced health effect is a fatal cancer or a severe hereditary defect. Radiological risk can only be assessed and not measured.

Reference person

It is not practical to assess the dose to each individual member of the public and therefore the radiological dose assessments use an individual that would represent someone from group that would be the most exposed to the source of radiation (also referred to as the representative person). Factors considered when assessing the dose to the representative person include:

Radionuclides being disposed of (source of radiation)

- How these can enter the environment (pathways): air, water, land.
- Age of representative person - we use four age groups: foetus, 1 year old, 10 year old and adult
- Behaviour of people around the site for example: member of the public, farming family, fishermen, sewage treatment workers, high consumers of certain foods from the area
- Timescales: during the operation of the landfill; after the landfill has closed;
- Human intrusion into the landfill after it has closed or following erosion

Risk

A combination of the probability that someone or something valued will be adversely affected by a hazard and the magnitude of the consequences that might arise from that hazard.

Risk assessment

An assessment of radiological risk.

Risk guidance level

A level of radiological risk from a disposal facility which provides a numerical standard for assessing the environmental safety of the facility after the period of authorisation.

Scenario

A postulated or assumed set of conditions and/or events.

Site

For a disposal facility, the piece of land where the facility is, or is intended to be, located. More generally, the piece of land where one or a number of sources of radioactivity are, or are intended to be, located.

Site constraint

The site-related dose constraint applies to the aggregate exposure resulting from discharges from a number of sources with contiguous boundaries at a single location. It includes the radiological impact of current discharges from the entire site, but excludes the impact of direct radiation and historical discharges. The site constraint of 0.5 mSv/year applies irrespective of whether different sources on the site are owned and operated by the same or by different organisations.

Storage (of waste)

Placing waste in a suitable facility with the intent to retrieve it at a later date.

Very low level waste (VLLW)

Waste with very low concentrations of radioactivity.

Waste acceptance criteria (WAC)

Quantitative and/or qualitative criteria, specified by the operator of a disposal facility and approved by the regulator, for solid radioactive waste to be accepted for disposal.

Waste characterisation

Determination of the physical, chemical and radiological properties of waste.

Waste consignment

Any waste sent by a consignor to a disposal facility.

Waste package

The Waste form and any container(s) and internal barriers (e.g. absorbing materials and liner), prepared in accordance with requirements for handling, transport, storage and disposal.

6. Appendix

PHE comments on the ESC (Appendices A-D)
Para 392 and 406: Ratio of sum of fractions is incorrectly shown. The equation also uses J whilst the key uses I.
Para 432: Units should be cm^{-2} rather than cm^{2}.
Table 44: The dose rates are quoted in mSv h^{-1} - presumably this are incorrectly quoted otherwise they are worryingly high.
Para 510: Error statement present.
PHE comments on the ESC (Appendix E)
1. Para 596: X in the equation should be distance not dose rate.
2. Table 76: For immersion in a tritiated water cloud, absorption through the skin can an important pathway; has this skin absorption component been taken into account?
3. Para 648: A reference for the external dose coefficient for immersion in a cloud should be provided.
4. Para 665: The text implies that the farming family only consists of adults and no children or infants are present; is this correct? How does this statement match with the data in Table 83 which shows infants and children?
5. Table 82: There are two entries of 'Delay between spreading sludge and animal grazing"; when is each used?
6. Table 83: How are the non-food data for infants and children used (inhalation rates, soil ingestion rates etc.)? Are non-adults assumed to spend time in the conditioned field or does this represent wind-blown material getting into areas occupied by the family? **Table 83: The data provided could be read as a farmer would spend over 4300 hours in the field (DPUR outdoor occupancy of 0.5) or 2200 hours (mean outdoor occupancy of 0.25); clarification to which was considered is needed.** **Table 83: For the adult the mean inadvertent ingestion rate (30 g/y), at 5 mg/h implies a time for ingesting soil of 6000 hours – this is much higher than the recommended annual rate given in NRPB-W41 (of about 8 g/y for a critical rate and 4 g/y for an average rate). Is this intended? How does this annual**

ingestion rate relate to the outdoor occupancy time given in the table 83 (see point above)? **Table 83: The mean inhalation rates represent daily average values from NRPB-W41 and therefore include time spent sleeping – are these appropriate given that what is being assessed is the dose to a farmer working in a field ?**
7. Para 673: What is the scaling factor for the specific pathway? Where are these listed and what do they represent given that the dose rate for each pathway has been explicitly calculated.
8. Para 675: Text states that the exposed group are only adults whilst Table 97 shows infants and children.
9. Para 694: The equation needs to be clarified so it is clear what is the inventory assumed, what is the release fraction or are they the same parameter and how this relates to the respirable fraction. **Para 694: What does the decontamination factor represent?**
10. Para 721: In the equation, what is the value for soil?
11. Para 724, 857, 867 and 871: Dose should have units.
12. Para 741: This is the first time that a LLDPE membrane is mentioned – all the discussion in the main text is of a HDPE membrane – is this consistent? There is no description of GCL.
13. Para 757: Why have the occupancy rates for infants and children been adjusted from the generic time of 750 h/y? Why are these values not included in Table 101?
14. Table 101 and Table 125 The inhalation rates given in the table are the 24-hour average rates from NRPB -W41; if exposure is from the recreational use of the land then a higher rate, not including time spent sleeping for example, would be more appropriate.
15. Figure 19: Unable to see q_out in the figure – could this be described in relation to the other rates or shown in a different scale?
16. Para 850 and 851: The text states that the exposed group is comprised of adults only. However, the text and Table 116 also discusses and shows data for exposure to infants and children. If infants and children are included why is only adult drinking water rate listed in para 858? In Table 117 only dose coefficients for adults are given.
17. Para 909: The exposure time in the equation (57 h/y) does not match that in Table 125 (73 h/y).
18. Para 934: It states that the potential dose to a road construction worker will be limited by that to a borehole worker. Greater justification for this assumption should be given as potential volume of spoil and the potential of a road passing through the ground at depth could result in exposure to contaminated waste rather than just spoil. **19. Para 946: ICRP 89 recommends are that, for radiation protection purposes, the dose rate to the skin should be estimated to a depth of 70 μm and over an area of 1 cm2. The beta dose rate is assumed to be a depth of 40 μm, this approach is not consistent with ICRP recommendations.**

20. Para 950: The doses in Table 133 are in mSv/y per MBq not µSv/y per MBq
21. Para 956: The text states that the highest dose to a trial pit excavator shown in Table 135 is 2.5 mSv from exposure to Th-232 whilst the dose given in Table 135 from Th-232 is 1.3 mSv; these do not appear to be consistent. The dose from Ra-226 and Pa-231 presented in Table 135 are also higher than that from Th-232.
22. Table 138: Oin,c and Oin,I are for a child and infant not adult
23. Section E.5.6.2: No method is presented for the inadvertent ingestion of soil.
24. Table 149: What is the parameter 'Occupancy dust' and what is it used for?
25. Para 1022: Units needed on the gas release rates.
26. Para 1054 and 1060: Parameter B, breathing rate, should be removed from the ingestion part of the equation.
27. Para 1056: The text in previous paragraphs relates to exposure from an uncovered slab whilst the text in this paragraph mentioned dust loading from a core which is confusing.
28. Para 1068 and 1074: More explanation is needed about the assumption that handling a core equates to a distance between core and skin of 5 cm? It would seem more appropriate to use the dose rate assuming the core is in contact with the skin of the hands.
29. Para 1114: The ingestion rate presented is for dust and small objects. Has pica and the potential, deliberate ingestion of a single, larger object (perhaps a few cm in dimension with associated activity in volume or on the surface) been considered, especially by a young child?
30. Para 1180: The reference for the point source dose rates to the skin should be given. Note that references for point source exposure of the skin for beta dose factors at 70 µm do exist (for example Delacroix, D., et al. (2002). "Radionuclide and radiation protection data handbook 2002." Radiation Protection Dosimetry 98(1): 1-168.). In order to remain consistent with recommendations from ICRP 89 then a depth of 70 µm should be used.

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