Environment Agency Permitting Decisions: RSR Permits

Applicant Name Magnox Limited

Reference Number ZP3893SG/V005

Record of decision

We have decided to grant the application to vary the permit by Magnox Limited at Berkeley Site, Berkeley, Gloucestershire, GL13 9PA.

The decision is effective from 1st May 2021

We consider in reaching that decision we have taken into account all relevant considerations and legal requirements and that the permit will ensure the appropriate level of protection of people and the environment.

These considerations are set out in

- DECC RSR Guidance
- RGN RSR1 RSR Environmental principles
- RGN RSR2 The regulation of radioactive substances activities on nuclear licensed sites
- and the documents referenced from those documents

Purpose of this document

This decision document sets out the reasons for our decision.

Part 1: Permits and variations for the accumulation and disposal of radioactive waste.

Introduction describing the application.

On 21st November 2019 an application from Magnox Ltd to vary an Environmental Permitting Regulations 2016 (EPR 2016) pemit to carry out radioactive substances activities at Berkeley site was duly made.

Berkeley site is currently being decommissioned within a life time plan that will enable the site to be placed into an interim Care and Maintenance (C&M) configuration, pending future dismantling and disposal at final site clearance. The Berkeley site has 3 waste vaults which contain intermediate level radioactive wastes (ILW) which must be removed and put into a safe waste form prior to care and maintenance. These waste forms will be stored in the site Interim Storage Facility (ISF) until a national Geological Disposal Facility (GDF) becomes available.

This process requires the development of new facilities to manage the retrieval of waste from the vaults and a process to package the recovered wastes for temporary storage at the site pending final disposal. This process will reduce hazards and facilitate the sites entry into a C&M configuration. New facilities will result in additional temporary discharges whilst the process is undertaken.

This variation application is for the addition of two new gaseous discharge routes and an increase of the discharge limit for gaseous tritium in the radioactive substances permit. These facilities are the subject of this determination.

1. One of the new facilities is the R4 sludge canning project building. This project aims to retrieve 1400 sludge cans from vault 3 in the Active Waste Vaults Building (AWVB). The Intermediate Level Waste (ILW) sludge content will be separated from the cans which will be decontaminated to Low Level Waste (LLW). This process is expected to produce low levels of gaseous and liquid discharges which are not expected to exceed the current discharge limits.

2. The second new facility is the Modular Intermediate Level Waste Encapsulation Plant (MILWEP). The purpose of MILWEP is to encapsulate solid radioactive waste from the Berkeley vaults into a reinforced $6m^3$ Concrete Boxes (CB). The CBs are delivered to the MILWEP pre-loaded with ILW, and are then filled with grout at the MILWEP to encapsulate the ILW within the 6m3 CBs. This process will not be used for any other wastes on the Berkeley site or for wastes from other sites. In order to carry out this process the site are requesting an increase to their current discharge limits for gaseous tritium.

These are temporary steps in the decommissioning process and the projects are planned to last for 7 years.

In addition, as part of the application a non-human dose assessment was made for the sites aqueous discharges as a review of the permit conditions. This was carried out to bring the permit in line with current requirements regarding non-human dose assessment.

Justification and Euratom Article 37 (RSR Part A Q9, RSR Part B3 Q2b)

'The Justification of Practices Involving Ionising Radiation Regulations 2004' (GB Parliament, 2004) are not part of the environmental permitting regime. But if an application for an environmental permit relates to a practice, as defined in the 'Basic safety standards directive' (BSSD) (EU, 1996), we can only grant a permit if the practice is justified (see appendix 1 of

Government policy - radioactive & nuclear substances (GB Parliament, 2015a) for further details).

The activities undertaken at Magnox Sites are a practice "3: Generation of electricity by nuclear reactors.[1]." and are justified.

In addition to justification the Environment Agency considers optimisation and the application of dose limits during the decision making process. We expect Operators to use BAT to achieve a high degree of protection of the environment, taken as a whole and to meet the principle of optimisation.

An Article 37 submission is required for this application. A submission has been made to the EC and an opinion given on 8th October 2020 that the application is not liable to result in contamination of the water, soil or airspace of another member state that would be significant from the point of view of health.

Discussions were held by Magnox and BEIS to understand the requirements prior to submission of the permit variation to the European commission in May 2018. The European Commission made two additional data requests, the first in May 2018 and the second in July 2018. The data requests made were regarding the authorised airborne discharge limit for Carbon-14 included in the General Data for the modified plan being 10 times higher than the value included in the General Data submitted to the Commission in 2001, for which the Commission gave its opinion in 2002. The United Kingdom, in its response to the Commission's request for additional information concerning the Carbon-14 limit, replied that "the UK had inadvertently submitted an incorrect figure in the 2001 A37 submission".

Consultation

We advertised and consulted on the application from 24th January 2020 to 19th February 2020, in accordance with our Public Participation Statement and Working Together Agreements. We have placed the responses on the public register. Additionally, we publicised the consultation by presenting directly to the Berkeley Site Stakeholder Group (SSG) and invited them to participate.

We received 9 consultation responses, see Annex 1 for further details of our consultation on the application.

The comments we received in response to our consultation are referred to in Part 2, where they have affected our approach or our decision. Otherwise, they are addressed in Annex 1.

Part 2. Our Assessment

Operator and Operator competence (RSR Part A Q10)

We are satisfied that the applicant is the person who will have control over the operation of the facility after the grant of the permit. We have assessed the applicant's competence against the Radioactive Waste Management Arrangements (RGN2). We have not identified any reasons indicating that the operator is unable to operate in accordance with the permit.

[1]See Department of Energy and Climate Change (DECC) guidance on the application and administration of the Justification of Practices Involving Ionising Radiation Radiations Regulations 2004, Annex 2.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/432763/JoPIIRR_guidance.pdf

Disposal of Radioactive Waste (RSR Part B3, Q3, 4a)

For the purposes of this assessment we have considered the high level strategy change from DCIC's to 6m3 concrete boxes to assess whether the MILWEP is required as a part of the HAW management strategy at Berkeley.

Magnox corporately assessed the wastes across the fleet and considered the principal waste management strategies for ILW packaging and interim storage for six Magnox Sites, including Berkeley in M/WF/GEN/REP/0013/14 and addendum, Strategic Options Assessment Study: ILW packaging for interim storage.

The original Magnox assessment considered different waste packaging options and identified the BAT options at each of the Magnox Sites. For Berkeley three options were considered in detail:

- Ductile Cast Iron Containers (DCICs);
- $3m^3$ Boxes and drums; and
- Self-shielding encapsulated packages (includes grouted $6m^3$ CBs and un-grouted 500L MOSAIKs®).

The strategy currently being utilised at the Berkeley site is the use of DCICs which have had considerable technical underpinning work undertaken for Berkeley with the process and risks well understood and no further construction being required. The option had the benefits of self-shielding containers with only a relatively small increase in packaged volume over the minimum achievable with these options.

Magnox found that the Best Practicable Environmental Option for Berkeley was the use of 6m3 Concrete Boxes, TRU Shields® and MOSAIKs®, because of the disproportionate cost in realising any of the advantages of DCICs.

An additional Berkeley specific assessment was undertaken by Magnox to consider the optimisation of the packaging of ILW wastes within a $6m^3$ concrete box at Berkeley (WD/F/4169). This considered the BAT methodology to fill the concrete boxes. The preferable option was to place waste in a steel sacrificial container ('bin') and grout inside the bin only, leaving an expansion gap. This option:

- Allows a sufficient expansion gap whilst minimising voidage to a level that is acceptable to RWM (Radioactive Waste Management);
- Packages the waste in the fewest number of containers;
- Avoids the need to construct a second ISF;
- Requires fewer modifications to the existing retrievals plant as larger containers can be filled (rather than small drums);
- Immobilises the waste within the container;
- Can actively manage the generation of hydrogen from the encapsulation process;
- Is of lower cost due to some of the above reasons.

A detriment associated with this option is higher H-3 discharges as a result of direct encapsulation. It was also noted that there will also be additional secondary solid and liquid wastes associated with this methodology from the grouting process and as a result of building new facilities to house the encapsulation process, compared to the current strategy using DCICs.

Based on these BAT assessments, Magnox concluded that the use of $6m^3$ concrete boxes using a steel bin is the BAT option for Berkeley site and therefore the MILWEP plant is required in order to produce these waste packages.

We have assessed this proposal and accept that at a high level this strategy is optimised. There have been many additional BAT cases written by the operator to demonstrate optimisation of the process of encapsulating waste in concrete boxes which have not been

considered as a part of this permit application. These will be subject to further considerations as the project develops.

We would expect Magnox to have received a Final Letter of Compliance (FLoC) from RWM to demonstrate that they are disposable in the Geological Disposal Facility (GDF) prior to active commissioning of the plant. Berkeley are currently in the process of applying for a FLoC for the concrete box waste packages and expect to have received a FLoC in 2021.

Disposal Routes (RSR Part B3 Q4b)

Magnox Ltd have applied to vary their permit by adding two new gaseous discharge routes. These new routes are the R4 Sludge Canning project and the MILWEP. For the purposes of this assessment aqueous discharges were not considered.

R4 Sludge Canning Project

Magnox Ltd provided the BAT assessment; BNLS/BAT/MIMP/0136, which is used to identify the BAT option for managing the gaseous discharges arising from the retrieval and processing of R4 sludge cans. This assessment specified the performance criteria for the ventilation system in order to identify the BAT option. Based on this it was identified by the operator that the existing ventilation system in the Active Waste Vault (AWV) building may not have sufficient capacity to provide the flow rate required by the R4 project. Consequently the option of having separate systems for the existing AWV ventilation and a stand-alone Mobile Extraction Unit (MEU) for the R4 project was selected as the preferred BAT option.

As a part of this assessment we took account of the responses to the consultation. One of these responses asked the question of why this discharge cannot be routed through the existing AWV ventilation system, thus taking advantage of the extra dilution from this larger volume discharge and avoiding the need for a new stack. We considered this point during the decision making process. Based on the assessment carried out by the operator we accept that the benefits outweigh the detriments and we accept that this approach is BAT.

Aqueous discharges have not been considered as a part of this application. These will be subject to further consideration as the project develops.

MILWEP

Magnox have provided WD/REP/0037/18 which summarises the assessments and optioneering undertaken to demonstrate that the current MILWEP gaseous ventilation design has been optimised in line with the requirements of BAT/BPM (Best Practicable Means). This document provides an overview of the findings of BNLS/BAT/0128 which considers whether it is BAT to use abatement for gaseous discharges of tritiated water vapour (HTO).

This assessment undertaken by the operator concluded that methods developed at Sellafield and Chapelcross to abate HTO vapour were not suitable for the relatively low concentration waste streams likely to be encountered in the MILWEP. The methods were also considered to be limited as a consequence of safety/dose implications to workers, and the generation of secondary solid wastes. Therefore direct discharge of HTO to atmosphere without abatement was considered by the operator to be the BAT option.

This document also provided an overview of the assessments undertaken to underpin the ventilation design for the MILWEP building. This concluded that the air from the unclassified parts of the building did not require the same level of management and filtration as the process extract. Separating the ventilation system into two systems with individual discharge points was considered by the operator to be BAT on the basis that the size of the air handling units (AHUs), ductwork installations and the filtration requirements can be reduced, thereby saving on the materials required. Restricting the length of the ventilation system that may be exposed to radioactive contamination will reduce the quantity of secondary contaminated waste generated (contaminated ductwork) at the end of life of the MILWEP building. This will also

reduce the requirement for high integrity ductwork, with the building ventilation system to be constructed from standard ductwork (DW/144). This means that the concrete boxes must be connected to the active ventillation system at all times during the filling, moving and curing process using movable attachments. The discharge stack is the only part of the process extract ventilation system to be located external to the MILWEP building, protruding three metres above the roof level.

The design objectives of the ventilation system for the process extract are in accordance with industry standard Sellafield Guidance ES_0_1738_1. The process extract ventilation system developed is a high integrity Mobile Filtration Unit (MFU), with a single stage of HEPA filtration on the process extract.

The design of the ventilation system, is considered by the operator to be BAT on the basis that it has been optimised to deliver specific ventilation requirements within the building and consequently enable savings to be made in material requirements, and secondary waste generated (filters and ductwork at end of life), without increasing risks to people and the environment.

The Environment Agency have assessed the BAT cases submitted by the operator regarding the ventilation design and accept the proposed ventilation design is proportionate. Wider considerations of the plant will be considered through routine regulatory activities.

Discharge Limits (RSR Part B3 Q4b)

Choice of Radionuclides to Be Limited

The proposal put forward by the operator in this permit variation is to increase the discharge limit for gaseous tritium. The site are not proposing to change any of the other discharge limits.

The planned new discharge from the MILWEP waste processing (encapsulation) facility accounts for the majority of the requested increase in the permitted aerial discharge of tritium from Berkeley site. An aerial release of tritium is expected to be released from the ILW waste from the encapsulation process. This is due primarily to the heat generated within the waste as it is encapsulated.

The permit limits for carbon-14 have been set based on current operations. A source of gaseous C-14 was determined as unlikely to occur based on an assessment of the potential discharges. Based on this and the fact that currently the site runs at 9-15% of the discharge limit, it was considered unlikely that the site would reach the current discharge limit. We accept this assessment and will make no amendments to the existing gaseous C-14 discharge limit.

Operator's proposal for Discharge Limits

Magnox provided three documents which provide a timeline of updated thinking with regards to the discharge limit derivation:

- M/WF/GEN/REP/0006/16 - Initial Assessment of MILWEP Aerial Radioactive Discharges & Resultant Off-Site Doses
- BNLS-REP-CMP-0094-17 - Berkeley Aerial Discharge Assessment
- BNLS-AN-ET-0112-17 - Sensitivity of Estimated Tritium Releases to inform Berkeley Aerial Discharge Assessments

M/WF/GEN/REP/0006/16 which was an initial assessment of generic MILWEP aerial radioactive discharges presents order of magnitude estimates for comparison to current site annual limits. Based on a number of assumptions, this assessment estimated that predicted annual discharges of gaseous tritium would be 324 GBq and therefore the discharge limit of 20 GBq would be exceeded. This was based on an assumed 2% Release Fraction (RF) of tritium from the waste when it is heated up.

The BNLS-REP-CMP-0094-17 Berkeley Aerial Discharge Assessment report specifically covers the Berkeley discharges and is a high level, conservative assessment of aerial discharges based on a worst-case year during Care and Maintenance Preparations (C&MP). This assessment concludes that based on 203 concrete boxes per year throughput and using the 2% RF based on the previous report, the result is a 776 GBq release per annum. This would result in total discharges from all authorised discharge outlets being 809 GBq per annum, as shown in table 1.

Table 1. Estimates of H-3 and C-14 discharges from Authorised Discharge Outlets during the peak year

Authorised Discharge Outlet	Estimated Discharge H-3 (GBq)	Estimated Discharge C-14 (GBq)
Vault 2 & R2	9.44 GBq	1.65 GBq
Vault 3, R3 & R4	9.90 GBq	0.613 GBq
MILWEP	776 GBq	Trivial
AVDS	5.06 GBq	0.0102 GBq
Safestores	8.82 GBq	0.458 GBq
Total	809 GBq	2.73 GBq

Table 2. Estimates of H-3 discharges from Minor Discharge Outlets during the peak year

Minor Discharge Outlet	Estimated Discharge H-3 (GBq)
Shielded Area Buffer Store	0.0572 GBq
Sludge Can Buffer Store	0.0572 GBq
ISF	4.46 GBq
Total	4.58 GBq

The 2% Release Fraction was considered theoretically conservative for Berkeley wastes as it is derived from directly heating Magnox metal FED; but this Release Fraction required review from Active Commissioning data as there are arguments to suggest that releases could be higher (i.e. the presence of hydrogenous cement, prolonged exotherm, etc.). Uncertainty in the Radioactive Waste Inventory (RWI) could also be significant if the RWI underestimates the overall H-3 content of the waste. Therefore the 2% RF from active commissioning data may not be conservative enough.

As a result of this, Magnox produced the sensitivity analysis report BNLS-EAN-ET-0112-17. This looked at the sensitivity of the 2% RF, by reviewing data and assessments. The two primary factors that required investigating in terms of their sensitivity were: 1) the Release Fraction and 2) the inventory. This also assessed how increasing the assumed Release Fraction changes how discharges increase.

On the basis of sampling which has decreased the level of uncertainty inherent in the RWI from 10 to ~3, the RWI is assumed to be bounding for the actual tritium inventory associated with the waste going through MILWEP, even considering the additional measurement uncertainty. Additional conservatism is provided as the RF is based on a FED Magnox Release Fraction, although a large proportion of the tritium at Berkeley will be associated with FED graphite which has a lower RF.

A review of trials by the operator carried out across the Magnox fleet concluded that there is little evidence pointing to an RF greater than 2% for encapsulating wastes at Berkeley, but that increasing the proposed permit limit to 2TBq based on a 5% RF would provide the site with additional confidence the limit would not be in danger of being exceeded.

The permit variation and Article 37 submissions both request a proposed 2TBq limit based on evidence of the theoretical releases with a level of conservatism for the variables and changes in work scope. Through the application of BAT, Berkeley site would still operate to minimise all discharges and so should see a figure closer to the 1TBq level.

Having considered the operators proposal we have reviewed the data with them and requested a further assessment to consider a lower discharge limit. See the next section for more details.

Our assessment of Annual Limits

Based on the Environment Agency limit setting guidance the site is expected to propose discharge limits that are the minimum levels necessary to permit “normal” operation or decommissioning of a facility. Normal operations should take into account the relevant operational fluctuations, trends and events that are expected to occur over the likely lifetime of the facility. Therefore the operator may include a headroom factor in the proposed limits which would allow for operational flexibility.

The proposed increased discharge limit for gaseous tritium is 2TBq, which includes a 1TBq headroom factor. Based on the documentation provided in the permit application we have not seen any substantiating evidence to underpin this headroom factor. The evidence provided gives substantiation for a discharge of 814GBq based on a 2% release fraction which is described as a conservative estimate of the discharges from site.

During this assessment we also took account of the responses to the consultation which raised concerns about the proposed discharge limit increase. It was identified in the responses to the consultation that there is no justification for the 5% RF value and this would result in the increase in gaseous tritium discharges to be very significant numerically, a 100-fold increase from 20 GBq to 2 TBq. This caused concern among a number of the consultation respondents. There was also concern noted from a respondent that the estimate of tritium release made from MILWEP at the proposed 5% RF is 1.93 TBq which leaves little headroom from the requested limit of 2 TBq.

Having considered the consultation responses and the operator’s proposal we reviewed the data with them and requested that they either produce a further assessment to substantiate the 2TBq discharge limit that was requested or agree to lower their requested discharge limit based on the information they originally submitted. Based on these discussions the operator agreed that based on the revised throughput assumptions for the plant and an assumed release fraction to amend their request to a 1TBq limit.

Therefore we propose to increase the discharge limit for gaseous tritium to 1TBq which is in line with the substantiated evaluation of the sites requirements.

We are not proposing setting Quarterly Notification Levels (QNLs) or Weekly Advisory Limits (WALs). QNLs are usually set where short term operational changes may result in a temporarily increased discharge. As the operations at Berkeley are expected to be steady and we are not anticipating the site carrying out work that would result in higher discharges over a short term, we are not proposing to use QNLs.

WALs are usually used on operating sites to manage potential acute high discharges. At Berkeley we expect the discharges to be chronic over a prolonged period of time and therefore do not consider the use of WALs necessary.

The revised site discharge limits are shown in Table 3. Berkeley Discharge Limits

Table 3. Berkeley Discharge Limits

Radionuclide	Previous Annual discharge limit	New Annual discharge limit
Tritium (H-3)	20 GBq	1 TBq
Carbon-14	5 GBq	5 GBq
Beta Particulate	0.02 GBq	0.02 GBq

Monitoring (RSR Part B3 Q5)

For the proposed new MILWEP discharge point Magnox provided the Ventilation Basis of Design (WD-REP-0180-18). This sets out the design of the stack and the monitoring that will be included in the design.

For both new discharge points stack monitoring will be installed in accordance with EG_1_2505_1 (which draws on requirements form BS ISO 2889:2010) and will monitor for the presence of tritium, carbon-14 and beta-particulate isokinetic sampling.

- Tritium and Carbon-14 to be monitored by 1 off Mechatech S35 gas sampler with S35-01A furnace (Total Oxidation Unit) bubbler unit.
- Particulate should be sampled by 1 off beta particulate sampling system, permanently operating and consisting an isokinetic sample nozzle, a Regulated Air Pump (RAP), filter paper holder, needle valve and rotameter with high and low flow alarms.

In addition the ventilation system will have associate alarms linked to the Building monitoring System (BMS) including differential pressure (dP) across the HEPA filter. The purpose of this monitoring will be to alert for the presence of blockage of the HEPA filter (high dP) and filter failure (low dP). The system will feed back to the process ventilation control panel, with low, high, and high-high alarms. Dispersed Oil Particulate (DOP) injection, sample and return points are provided to test filter efficiency on the ductwork system.

A single stage safe change HEPA filter, comprising of a single duty only house containing one inset, complete with depression relief valve and filter will be fitted. The filter bank shall include a locally positioned differential pressure instrument.
We have considered the design and specifications for monitoring arrangements and accept that this is sufficiently robust. We accept that this satisfies the M1 guidance and we will expect that this will be included as a part of the sites management arrangement.

Based on the expected dose which has been assessed to be less than 0.005 mSv per year which is lower the site dose constraint, Magnox are not proposing to make any changes to the current environmental monitoring programme.
We accept that this is proportionate and in line with the Environment Agency Radiological Monitoring Technical Guidance Note 2: Environmental Radiological monitoring principles.

We have assessed the applicant's proposals and conclude that they do represent BAT for monitoring.

Radiological Assessment (RSR Part B3 Q6)

Introduction

Below we present the results of our assessment of the radiological impact on people from the proposed discharges from Berkeley Site. We assess doses to members of the public from discharges at the limits set out in the permit and compare them with the criteria specified in Schedule 23 Part 4 Section 1 of EPR 16. The current criteria are:

- the source constraint of 300 microsieverts per year (µSv/y)
- the site dose constraint of 500 µSv/y
- the public dose limit of 1000 µSv/y

Our assessment of doses uses realistic assumptions about the behaviour and dietary patterns of representative members of the exposed public, as required by EPR 16.

The applicant has carried out radiological assessments at the discharge limits requested in the application. We have carried out assessments at those requested discharge limits and the discharge limits we have set in the permit. The assessments carried out also take account of doses from direct radiation from the site and discharges from nearby sites.

Radiological assessments of doses to the public from future discharges are based on the behaviour and concentrations of radionuclides once they are in the environment. It is assumed that discharges are made at 100% of the current or proposed discharge limits for 50 years. Our assessment used our screening model (Initial Radiological Assessment Tool (IRAT)) together with general information on people's habits.

In accordance with the current International Commission on Radiological Protection (ICRP) recommendations, we calculate the dose to the 'representative person'. This is an individual receiving a dose that is representative of those members of the public who are estimated to receive the highest dose overall (from gaseous and aqueous discharges and direct radiation). The dose to the representative person is then compared with the dose constraint and dose limit. (The term 'representative person' replaces, 'average member of the critical group' as used in previous ICRP Recommendations). Where doses are separately assessed for different types of discharges, the term 'group most exposed to' is used for each discharge. The dose to the representative person may be less than the total of all the doses to the 'groups most exposed', as the representative person may not be fully exposed to all the discharges and direct radiation.

Radiological assessments of doses to non-human species from future discharges were carried out by the operator and by us. Our assessment used our screening model (Initial Radiological Assessment Tool (IRAT)). Magnox carried out assessments using the ERICA model. Both of these models use a reference organism methodology which identifies the organism that will receive the highest dose from each discharge. For the purposes of completeness and to provide a holistic assessment we asked Magnox to produce a non-human dose assessment from their aqueous discharges based on the current discharge limits for the Berkeley site as they have not requested a permit variation since this became a requirement and this will bring the permit in line with current requirements regarding non-human dose assessment.

Determining worst case radionuclides for group discharges

For both gaseous and aqueous discharges there is a discharge limit which does not specifically reference a particular radionuclide. For gaseous discharges this limit is “beta emitting radionuclides associated with particulate matter” and for aqueous discharges this limit is for “other radionuclides”. In order to carry out a dose assessment for these limits a representative radionuclide or group of radionuclides had to be identified.

For this assessment both the Environment Agency and Magnox used two methodologies:

- The worst case method - this looks to identify the radionuclide that has the highest dose consequence to non-human biota and assume that this accounts for the entire

discharge at the discharge limit. This method produces the most conservative dose and provides confidence that the dose limit will not be exceeded.

- Fingerprint scale up – uses the radionuclide fingerprint from actual site discharges to proportionally scale up the percentage contribution of each radionuclide to the discharge limit. This method is still conservative but provides a more proportionate representation of the discharge.

Gaseous Discharges

The Environment Agency used the worst case method in IRAT to identify the representitive radionuclide for the human and non-human dose assessment. For this we used the list of radionuclides identified by Magnox.

The radionuclide with the highest dose to a member of the public in IRAT was found to be strontium-90 and the highest dose to terrestrial wildlife was found to be plutonium-241 as shown in Table 4.

Table 4. Environment Agency assessment of representative for gaseous discharges

Radionuclide	Discharge rate (Bq/y)	Human dose rate (µSv/y)	Non-human dose rate (µGy/y)
Ca-45	2.00E+07	6.8E-03	1.3E-06
C-60	2.00E+07	2.3E-01	4.1E-05
Ni-63	2.00E+07	2.9E-04	5.4E-07
Sr-90	**2.00E+07**	3.9E-02	**1.5E-04**
Tc-99	2.00E+07	2.3E-01	4.7E-05
Ru-106	2.00E+07	1.8E-02	1.1E-05
Sb-125	2.00E+07	2.7E-02	3.9E-06
Cs-134	2.00E+07	8.7E-02	3.1E-05
Cs-137	2.00E+07	1.4E-01	1.3E-04
Eu-154	2.00E+07	1.8E-01	3.1E-05
Pu-241	**2.00E+07**	**4.1E-01**	7.4E-08

Aqueous Discharges

The radionuclides used to represent other radionuclides for the aqueous discharges dose assessment were chosen by Magnox and based on fingerprint data. The output of the Magnox ERICA assessment is shown in Table 5 and the output of the Environment Agency IRAT assessment is shown in Table 6.

Table 5. Magnox assessment of representative radionuclide for aqueous discharges

Radionuclide	Discharge Rate (GBq/y)	PC-CREAM08 DORIS maximum media concentration outputs (10 years)		RQ value (ERICA)
		Seabed sediment (Bq/kg)	Seawater (unfiltered) (Bq/l)	
Am-241	200	3.34E+01	4.76E-02	8.95E+01
Cm-243	**200**	**8.42E+01**	**4.74E-02**	**1.07E+02**
Cm-244	200	7.92E+01	4.72E-02	1.06E+02
Pu-238	200	8.70E+01	4.76E-02	5.81E+01
Pu-239	200	9.02E+01	4.76E-02	5.47E+01
Pu-240	200	9.00E+01	4.76E-02	5.47E+01
Pu-241	200	7.28E+01	4.74E-02	1.48E-02
Sr-90	200	1.59E+01	4.96E-02	2.13E-01
Y-90	200	1.13E-02	4.17E-03	Not assessed

It is currently not possible to assess Y-90 within ERICA as the radionuclide is not currently supported within Tier 1 assessments. As a result Magnox initially carried out the ERICA assessment without Y-90. As can be seen in Table 7 Y-90 makes up nearly half of the discharge contribution and omitting this radionuclide resulted in a significantly lower discharge than the discharge limit. Magnox has re-carried out the dose assessment including Y-90 using an alternative methodology however did not re-carry out the representative radionuclide assessment for this radionuclide.

Table 6. Environment Agency assessment of representative radionuclide for aqueous discharges

Radionuclide	Discharge rate (Bq/y)	Human dose rate (µSv/y)	Non-human dose rate (µGy/y)
Am-241	2.0E+11	2.3E+00	1.4E+00
Cm-243	2.0E+11	1.2E+01	1.8E+00
Cm-244	2.0E+11	7.8E-01	1.8E+00
Pu-238	**2.0E+11**	4.8E+01	**1.2E+01**
Pu-239	**2.0E+11**	**5.4E+01**	1.2E+01
Pu-240	2.0E+11	5.4E+01	1.2E+01
Pu-241	2.0E+11	9.7E-01	6.3E-03
Sr-90	2.0E+11	2.2E-01	1.2E-03
Y-90	2.0E+11	2.0E-02	1.7E-02

The results of the worst case assessment carried out by both Magnox and the Environment Agency showed that the worst case radionuclide challenged the screening level and was considered to be highly conservative and neither realistic nor representative. This is because based on the most recent discharge returns at the time of submitting this application, the total 12 month discharges of 'other radionuclides' represented <0.01% of the 200 GBq discharge limit and based on our records from submissions of discharge returns from site, 'other radionuclides' has been consistently below 0.25% of the discharge limit since 2011.

Therefore the fingerprint scale up approach has been used for the dose assessment for Magnox and Environment Agency aqueous dose assessments. To apply a representation to the other radionuclides group the fingerprint data taken from an effluent bulk sample in Table 7 was used to proportionately scale up the contribution of each radionuclide to the discharge limit of 200 GBq. It is noted that this approach is still highly conservative as it assumes that the maximum permit limit is being discharged and it uses media concentration values which assume 10 year accumulation of discharges.

Table 7. Composition of the Berkeley bulk sample

Radionuclide	Discharge Activity (GBq)	% Contribution
Am-241	2.63E-04	0.539%
Cm-243/244	1.98E-06	0.004%
Pu-238	3.20E-05	0.066%
Pu-239/240	1.09E-04	0.223%
Pu-241	9.90E-04	2.029%
Sr-90	2.37E-02	48.57%
Y-90	2.37E-02	48.57%

We accept that this methodology is acceptable and although still conservative this applies a more proportionate representation of the discharge.

Dose to member of the public

The Environment Agency has undertaken a dose assessment to the most exposed member of the public from gaseous and liquid discharges. For gaseous discharges this was based on

the discharge limit for tritium set at 1TBq. The Agency used the dose screening model called IRAT2 (Initial Radiological Assessment Tool). This methodology is based on dose per unit release (DPUR) data, which are combined with the discharge limits to calculate doses to members of the public. In the gaseous assessment we used an effective release height of 0 which assumes that the release is made at ground level and not through the stack which gives the most conservative figure as it reduces to effect of dilution. This methodology is considered to be conservative and can be used as a bounding estimate. The results of these assessments can be found in Table 8 & Table 9.

For groups of radionuclides (Other beta particulate for gaseous discharges and other radionuclides for aqueous discharges)

Table 8. Environment Agency model of doses to the most exposed member of the public from gaseous discharges

Radionuclide	**Discharge limits we have set**	
	Annual discharge limit assessed (GBq)	**Annual effective dose (µSv/y)**
Tritium (H-3)	1000	0.98
Carbon-14	5	0.35
Beta Particulate (Pu-241)	0.02	0.41
Total		1.7 µSv/y

Table 9. Environment Agency model of doses to the most exposed member of the public from aqueous discharges

Radionuclide		**Annual discharge limit assessed (Bq/y)**		**Annual effective dose (µSv/y)**
Tritium (H-3)		1.00E+12		0.00016
Cs-137		2.00E+11		6.9
Other Radionuclides	Am-241	1.08E+09	Combined 2.00E+11	0.012
	Cm-243	8.12E+06		0.00047
	Cm-244	8.12E+06		0.000032
	Pu-238	1.31E+08		0.032
	Pu-239	4.47E+08		0.12
	Pu-240	4.47E+08		0.12
	Pu-241	4.06E+09		0.02
	Sr-90	9.71E+10		0.11
	Y-90	9.71E+10		0.0097
Total dose rate				7.3 µSv/y

Comparison of doses with the source constraint

EPR 16 specifies a dose constraint of 300 µSv/y for the maximum dose to people due to discharges from a single new source. While this constraint applies specifically to 'new' sources, we generally apply it to existing sources also. For this case, the source is defined as *a single power station with 2 reactor units*. The dose to be compared to this constraint should include

the dose from current or proposed discharges and direct radiation, but exclude the dose from historical discharges and from any adjacent site.
The dose that should be compared to the source constraint is the sum of doses from discharges and direct radiation to the representative person. The dose to the most exposed person from direct radiation is estimated to be trivial, based on data on Berkeley & Oldbury provided in Table 3.1 of RiFE 25 [Cefas, 2020] for 2019, the most recent year for which data is publically available. The current dose due to radioactive discharges is estimated to be less than 5 µSv/y from both Berkeley and Oldbury. This is less than 20 µSv/y which is the level at which we deem no further assessment of dose to members of the public is necessary. This is also less than the source dose constraint of 300 µSv/y.

Comparison of doses with the site dose constraint
EPR 16 also specifies a dose constraint of 500 µSv/y for the maximum dose to people due to discharges from a site as a whole (but excludes direct radiation). The dose to be compared to this constraint is the dose from current discharges, including discharges made by adjacent sites. Doses arising from direct radiation and from historical discharges are excluded.
Taking into account all the radioactive discharges from the Berkeley site, but discounting direct radiation, the total dose at 1TBq is 20 µSv/y and is less than the site dose constraint.

Comparison with the dose limit for members of the public
EPR 16 requires us to ensure that doses to members of the public from exposure to ionising radiation do not exceed 1000 µSv/y. The total dose to members of the public (representative person) near the site takes into account doses arising from:

- future discharges
- future direct radiation from the site
- future discharges from other nuclear sites in the vicinity of the site
- direct radiation from other nuclear sites in the vicinity of the site
- the residue of radioactivity in the environment from past discharges

The total dose of less than 20 µSv/y is below the dose limit for members of the public of 1000 µSv/y.

We consider that no further reduction is required and that emissions are ALARA and therefore comply with BAT requirements.

Dose to non-human species

Terrestrial

As we have taken the decision not to grant the discharge limits proposed in the original permit variation of 2TBq, the Environment Agency has undertaken a dose assessment based on a 1TBq discharge limit for tritium using the Initial Radiological Assessment Tool (IRAT). As above, this methodology is based on dose per unit release (DPUR) data for the worst affected organism for each radionuclide considered, which are combined with the discharge limits to calculate doses to non-human terrestrial biota. This methodology is considered to be conservative and can be used as a bounding estimate. The results of this assessment can be found in Table 10.

Table 10. Environment Agency Terrestrial assessment for Berkeley gaseous discharges

Radionuclide	Annual discharge limit assessed (Bq/y)	Annual effective dose for the Worst affected organism (µGy/hour)
Tritium (H-3)	1.00E+12	0.0035
Carbon-14	5.00E+09	0.00056

Radionuclide	Annual discharge limit assessed (Bq/y)	Annual effective dose for the Worst affected organism (µGy/hour)
Beta Particulate (represented by Sr-90)	2.00E+07	0.00015
Total dose rate		0.0042 µGy/h

The results, shown in Table 10, demonstrate that based on the proposed new discharge limit, the total dose rate to the worst affected organism is less than 1 µGy/h. It is therefore considered that the risk to non-human biota from the Berkeley gaseous discharges at the proposed limits is of negligible concern and no further assessment is required.

Marine

There is a requirement to assess the impact to non-human biota associated with the proposed increases to the discharge limits. To provide a holistic assessment Magnox also assessed aqueous discharges. Magnox used the ERICA dose assessment approach which is a recognised tool for non-human radioactive dose assessment. In this assessment they used the tier one assessment which is designed to be simple and conservative.

Tier 1 ERICA assessments are designed to be conservative and aimed at identifying areas or receptors of negligible concern, such that these are removed from further assessment with a high degree of confidence. This compounded with the added pessimistic measures described in the methodology gives further confidence to the results.

For the Tier 1 assessment, the conservative ERICA dose rate screening value of 10 µGy/h^{-1} was selected. It is considered that for initial assessments this screening value is sufficiently cautious, and if not exceeded populations of non-human organisms and their habitats are unlikely to be adversely affected.

If the sum of the risk quotients is <1, then it can be assured that there is a very low probability that dose rates to any organism would exceed the screening level (10 µGy/h^{-1}) and therefore the risk to non-human biota can be considered negligible. The site may then be 'screened out' from further assessment.

Table 11. Magnox Tier 1 Marine assessment for Berkeley aqueous discharges

Radionuclide		Permit discharge limit (Bq/year)		Risk Quotient (RQ) at ERICA dose rate screening value (10 µGy/h^{-1})	Limiting reference organism
Tritium (H-3)		1.00E+12		3.60E-06	Phytoplankton
Cs-137		2.00E+11		6.42E-02	Polychaete Worm
Other Radionuclides	Am-241	1.08E+09	Combined 2.00E+11	4.83E-01	Phytoplankton
	Cm-243	8.12E+06		4.34E-03	Phytoplankton
	Cm-244	8.12E+06		4.32E-03	Phytoplankton
	Pu-238	1.31E+08		3.81E-02	Phytoplankton
	Pu-239	4.47E+08		1.22E-01	Phytoplankton
	Pu-240	4.47E+08		1.22E-01	Phytoplankton
	Pu-241	4.06E+09		3.01E-04	Phytoplankton
	Sr-90	9.71E+10		1.04E-01	Mammal
	Y-90	9.71E+10		1.18E-02	Polychaete worm
Sum of Risk Quotients				9.54E-01	

The results, shown in Table 11, demonstrate that based on the existing discharge limits even if the maximum proposed limits were discharged, the sum of all risk quotients is less than 1 (9.54E-01). It is therefore considered with a high degree of confidence that the risk to non-human biota from the current Berkeley aqueous discharges is of negligible concern, and no further assessment is required.

In addition the Environment Agency has undertaken a dose assessment in parallel based on the proposed discharge limits using the Initial Radiological Assessment Tool (IRAT).

Table 12. Environment Agency Marine assessment for Berkeley aqueous discharges

Radionuclide		**Annual discharge limit assessed (Bq/y)**	**Annual effective dose for the Worst affected organism (µGy/hour)**
Tritium (H-3)		1.00E+12	0.00000046
Cs-137		2.00E+11	0.013
Other Radionuclides	Am-241	1.08E+09	0.0076
	Cm-243	8.12E+06	0.000073
	Cm-244	8.12E+06	0.000071
	Pu-238	1.31E+08	0.008
	Pu-239	4.47E+08	0.026
	Pu-240	4.47E+08	0.026
	Pu-241	4.06E+09	0.00013
	Sr-90	9.71E+10	0.00058
	Y-90	9.71E+10	0.0083
Total dose rate (µGy/hour)			0.09 µGy/hour

The results, shown in Table 12, demonstrate that based on the current discharge limits, the total dose rate to the worst affected organism is less than 1 µGy/h (0.09 µGy/h). It is therefore considered that the risk to non-human biota from the Berkeley liquid discharges is of negligible concern and no further assessment is required. There is no requirement for an amendment to the permit.

Other statutory considerations

EA 95, Section 4: Principal aim of the Environment Agency ('sustainable development')

We are required to contribute towards achieving sustainable development, as considered appropriate by the Ministers and set out in guidance issued to us. 'The Environment Agency's Objectives and Contribution to Sustainable Development: Statutory Guidance' (issued by Defra in December 2002) provides guidance to us on such matters as the formulation of approaches that we should take to our work, decisions about our priorities and our allocation of resources. It is not directly applicable to our individual regulatory decisions.

The statutory guidance states that our main contribution to sustainable development will be to deliver our various objectives in a way that takes account (subject to and in accordance with

EA 95 and any other enactment) of economic and social considerations. In respect of radioactive substances regulation, the guidance refers to the objective of regulating aerial and liquid radioactive discharges and solid radioactive waste disposal in accordance with statutory duties, statutory guidance and UK government policy.

We consider that the overall approach described in this document and, in particular, the application of BAT, which takes into consideration social and economic factors, and the assessment of the impact of the discharges on members of the public and environment, contribute appropriately to the aim of achieving sustainable development, having regard to the statutory guidance.

EA 95, Section 5: Pollution control powers

Section 5 of EA 95 sets out the purpose for which our pollution control powers, including our powers under EPR 16, must be used, namely: 'preventing or minimising, or remedying or mitigating the effects of, pollution of the environment'. We consider that we have properly used our pollution control powers for that purpose, in that:

- we have set limits and conditions based on BAT, as specified in the statutory guidance, and having regard to government policy
- the impact of the permitted discharges on members of the public is ALARA
- the environment is protected

EA 95, Section 7(1)(c)(iii): Well-being of local communities

Under section 7(1)(c)(iii) of EA 95, we must have regard to the effect our proposals may have on the economic and social well-being of local communities in rural areas.

We have had regard, as appropriate, to the potential effect on the economic and social wellbeing of the local community as part of:

- our assessment of Magnox Ltd. proposals in relation to the use of BAT, which involves consideration of costs and benefits
- our considerations in relation to the principal aim of the Environment Agency (sustainable development)
- our assessment of the impact of disposals

We do not consider that any additional or different limits or conditions are required, in relation to this duty.

Public participation and duty to involve

Regulation 60 of EPR 16 requires us to prepare and publish a statement of our policies for complying with our public participation duties. We have published such a document, 'Working together: your role in our environmental permitting' (Environment Agency, 2010a) and this application has been consulted upon in line with it. This satisfies the requirements of the Public Participation Directive.

Section 23 of the Local Democracy, Economic Development and Construction Act 2009 (GB Parliament, 2009d) requires us, where we consider it appropriate, to take such steps as we consider appropriate to secure the involvement of interested persons in the exercise of our functions by providing them with information, consulting them or involving them in any other way.

We have described our consultation in relation to this application in Chapter 3 of this document. We have described the way in which we have taken account of representations we have received in Chapters 4 to 8 and Appendix 1.

Part B Permit

As a part of the MILWEP project the site will be operating a concrete batching plant. This is a regulated facility under the Environmental Permitting Regulations and requires a Part B permit to operate. The operator has applied for and received a Part B permit from the local authority for this process.

Growth duty

We consider the requirements and standards we have set in this permit are reasonable and necessary to protect the environment and optimise the protection of people, and are consistent with our 'growth duty'. This also promotes growth amongst legitimate operators because the standards applied to the operator are consistent across businesses in this sector and have been set to achieve the required legislative standards.

Other considerations

Non-radiological issues

Some environmental legislation that normally applies to waste or emissions does not apply when the waste is radioactive waste. We have, therefore, included a standard condition in our permits (condition 2.3.7) requiring the operator to minimise the risk of pollution from the non-radiological properties of the radioactive waste and from any non-radioactive substances associated with the disposal of the radioactive waste, to the extent that this is not addressed by other environmental permits.
For this case, there are no activities that would require an environmental permit if the waste were not radioactive waste, so there is no requirement to carry out an assessment of the non-radiological impact of the discharges. We can control any minor impacts through the standard condition mentioned above.

Aqueous Discharges

In the variation application, Berkeley site have not requested an increase of their aqueous discharge limits, however both the MILWEP and R4 project are expected to produce aqueous wastes as a result of the activities being carried out in these facilities.

In the MILWEP plant, the primary waste water will be non-radioactive concrete and grout infused water left over from the grouting process. The site are expecting to produce 2-3 IBCs of water per week. This will be put in a silt buster to remove the particulate and will then be re-used in the grouting process. When the site are no longer able to recycle the water it will be disposed of offsite. No active effluent is expected to be produced during this process. As this is regarding non-radioactive effluent it is not a part of our RSR permitting remit.

The R4 Project is expected to produce aqueous wastes from 3 sources, for puncturing sludge cans, from the sludge during de-watering and for the cleaning of sludge cans.
The R4 sludge cans will be depressurised in the vault using an Abrasive Water Jet Cutting (AWJC) tool before being retrieved and processed (de-lidding, sludge removal and can wetting and cleaning). The removed sludge is transferred into a dewatering process to enable separation and recycling of process water, before transfer to a DCIC and final conditioning in the Conditioning Facility (AVDS). The empty sludge cans will be decontaminated during the processing stage, and be disposed of as Low Level Waste (LLW).

This aqueous radioactive waste is not expected to cause the site to exceed the discharge limits set out in the RSR permit for Berkeley, therefore this is not specifically addressed in this decision document. These will be subject to further considerations through routine regulatory activities as the project develops.

Other matters

Matters such as nuclear safety, the location of the facility, traffic movements and flood risk are generally dealt with under other regimes and/or by other bodies and not as part of our RSR permitting remit. Where consultees have raised issues relating to such matters, we provide more information at the end of Appendix 1.

Environment Agency initiated changes

In addition to the changes made as a result of this permit variation application, a number of agency initiated changes have been made to the permit and CEAR to bring them in line with the current version of the agency permit template. These changes are listed in Appendix 2 along with the reason for the change.

Decision

We conclude that that the operator can operate in accordance with the permit conditions to meet statutory requirements and the requirements of Government policy. We therefore grant the application, subject to the conditions of the permit which include the addition of two new gaseous discharge points (MILWEP Encapsulation Plant and R4 Standalone Mobile Extraction Unit) and an increase of the discharge limit for gaseous tritium from 20 GBq to 1TBq.

References

BEIS (2019), The Justification of Practices Involving Ionising Radiation Regulations 2004, Guidance on their application and administration

Cefas (2020), Radioactivity in Food and the Environment 2019, RiFE 25

DECC guidance on the application and administration of the Justification of Practices Involving Ionising Radiation Radiations Regulations 2004, Annex 2

DEFRA (2002) The Environment Agency's Objectives and Contributions to Sustainable Development: Statutory Guidance

Environment Agency (2017) Sampling requirements for stack emission monitoring, Technical Guidance Note (Monitoring) M1, Version 8

Environment Agency (2021) Initial Radiological Assessment Tool 2: Releases to Air

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Environment Agency (2015) Understanding the Meaning of a Regulated Facility, Regulatory Guidance Series, No. RGN 2, Version 3.1

Environment Agency (2012) Criteria for setting limits on the discharge of radioactive waste from nuclear sites, Version 1.0

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Magnox (2021) ERICA Tier 1 Dose Assessment – to support a variation to Berkeley Site environmental permit (EPR/ZP3893SG), M/EF/BKA/EAN/0009/19, Issue 2

Magnox (2019) Options assessment review/requirements form, BNLS-BAT-MIMP-0136, Issue 2

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Magnox (2018) Berkley Vaults: Optimisation Assessment for the Packaging of LSA wastes within a 6m^3 Concrete Box at Berkeley, WD/F/4169, Issue 5

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Magnox (2017) Options assessment requirements form, BNLS-BAT-0128, Issue 5

Magnox (2017) Sensitivity of Estimated Tritium Releases to inform Berkeley Aerial Discharge Assessments, BNLS-EAN-ET-0112-17, Issue 1

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Magnox (2017) Initial Assessment of MILWEP Aerial Radioactive Discharges & Resultant Off-Site Doses, M/WF/GEN/REP/0006/16, Issue 2

Magnox (2016) Strategic Options Assessment Study: ILW Packaging and Interim Storage Strategy – Addendum Regarding Repackaging Waste in Tru-Shields, M/WF/GEN/REP/0013/14 Addendum, Issue 1

Magnox (2015) Strategic Options Assessment Study: ILW Packaging and Interim Storage Strategy, M/WF/GEN/REP/0013/14, Issue 1

NSG (2018) Modular Intermediate Level Waste Encapsulation Plant (MILWEP): MILWEP Basis of Design, WD-REP-0180-18, Rev B

Appendix 1: Consultation and advertising responses

We ran a formal consultation on the GOV.UK website from 24th January to 19th February 2020. We contacted the Site Stakeholder Group directly to inform them of the consultation and to provide links to its location.

We felt that enabling stakeholders to comment on the consultation would help us with the determination, enable the public to have their say and ensure their views are taken into account.

Our consultation clearly explained that we will only increase the discharge limits in the Magnox Ltd permit if we believe that harm to the environment, people and wildlife will be minimised and that the operator has the ability to meet the conditions of the permit.

We received 9 responses in total, of which 1 was from a trade body and 8 from community groups and members of the public.

Responses to the consultation on the application

We received 9 responses to the consultation. These are summarised below, together with our consideration of them.

Topic: New discharge point for the R4 sludge canning project

Summary of issues raised	Our consideration of the issues
1 out of 9 respondents queried why the site were requesting a new discharge point for the R4 sludge canning project rather than using the existing vaults exhaust system. Raised by: Response 727068326	We considered this point during the decision making process and identified that the decision to have a separate ventilation system was made on the basis of BAT as the existing ventilation system for the AWV building may not have sufficient capacity to provide the flow rate required by the R4 project. We are not taking any further action.

Topic: Tritium discharges release

Summary of issues raised	Our consideration of the issues
2 out of 9 respondents queried the specifics of the release, including where the release would occur, whether it would be released directly to the environment and whether the site could employ discharge abatement to reduce tritium discharges. Raised by: Response 353703899, Response 537183162	The discharge limit represents the limit of the discharges from the whole site over any 12 month period. These discharges can take place from any of the named discharge routes listed in the Berkeley environmental permit. Tritium can be released directly to the environment via any of the discharge routes named in the site permit. The operator considered the use of abatement for the increased tritium discharges from the MILWEP through the use of a Best Available Techniques (BAT) assessment. This considered different potential abatement methods and concluded that direct discharge to atmosphere without abatement is the BAT option as there are limited methods of capturing tritium and those identified would not be suitable for the relatively low concentrations of tritium expected to be present in the MILWEP.

Summary of issues raised	Our consideration of the issues
	These options were also limited as a result of safety/dose implications to workers, and the generation of secondary solid wastes. We were satisfied with this assessment and therefore we are not taking any further action.

Topic: Scale of the proposed discharge limit increase

Summary of issues raised	Our consideration of the issues
3 out of 9 respondents queried the scale of the proposed increase. It was noted that the proposed discharge limit for gaseous tritium is 100 times the current limit and that there is no justification for the 5% release factor which may not be consistent with the ALARP/ALARA principles. It was also noted that the proposed discharge limit provides a very small headroom factor based on the data provided in the permit application. Raised by: Responses 537183162, 431497278 & 727068326	We took on board these responses and based on the information we received with this permit variation we agreed that Magnox Ltd. had not provided sufficient evidence to justify an increased discharge limit of 2 TBq. Based on the evidence provided, we believe that Magnox have substantiated a 2% release fraction of tritium from the FED waste to be encapsulated in concrete boxes, which conservatively amounts to an annual release from the whole site of 814GBq. Based on discussion with us, Magnox have agreed to reduce the discharge limit requested to 1TBq which we consider reasonable based on the information provided in the permit application.

Topic: Increased tritium concentrations in the environment and increased dose

Summary of issues raised	Our consideration of the issues
4 out of 9 respondents registered concern over increased tritium concentrations in the environment surrounding the site and the potential dose increase as a result of the discharge limit increase. Raised by: Response 889630982, 353703899, 751011662 & 431497278	As a part of the permit decision process, we assess the dose to the most exposed member of the public and for non-human biota both terrestrial and marine based on the discharge limits for the Berkeley site. The tools used to model these dose assessments considers the effects of contamination in the modelling process and increases in concentration would translate to higher doses. Based on all of the gaseous discharge limits, including a 1TBq discharge limit for tritium, the result was 1.4 µSv/year. The annual limit for a member of the public is 300 µSv/year, therefore this is two orders of magnitude lower than the dose constraint. For non-human species the total dose rate to the worst affected organism was modelled as 0.0088 µGy/hour. This is less than 1 µGy/h and it is therefore considered that the risk to non-human biota from the Berkeley gaseous discharges at the proposed limits is of negligible concern and no further assessment is required.

Topic: Matters outside the Environment Agency's permitting remit

Summary of issues raised	Our consideration of the issues
Location of the regulated facility Raised by: Response 431497278	Decisions about land use are matters for the land-use planning system. The location of the facility is a relevant consideration for environmental permitting, but only in relation to its potential to have an adverse environmental impact on members of the public or sensitive environmental receptors.
Nuclear Emergencies Concern over nuclear incident management. Considered what the plans are to mitigate contamination, how will this be communicated and how contamination will be dealt with. Raised by: Response 889630982, Response 353703899	We do not permit for nuclear incidents or emergencies. The response to a nuclear emergency would be a multi-agency approach with each providing advice to the public on specific areas.
Communication & consultation advert Raised by: Response 353703899, Response 221754349	We endeavour to consult with as wide an audience as possible to understand the areas of concern. We will take on board criticisms of our consultation approach to make improvements to the process.

Below is a list of respondents to this consultation:

1. 724806555 - Member of the public
2. 889630982 - Member of the public
3. 353703899 - Member of the public
4. 751011662 - Member of the public
5. 791415442 - Member of the public
6. 537183162 - Member of the public
7. 221754349 - SGS Commercial Services Ltd - Landlord of adjacent GSTP
8. 431497278 - Member of the public
9. 727068326 - Berkeley Site Stakeholder Group (SSG)

Appendix 2 – Schedule of Environment Agency initiated changes associated with variation EPR/ZP3893SG/V005

Changes to Permit EPR/ZP3893SG/V005

Condition number	Proposed change	Reason for the change
Schedule 3 Table S3.3	Remove Metallic LLW line Remove line which specifies the radioactive "metallic LLW" waste type.	This line does not appear in the current permit template and this waste type is covered by the LLW line in the table. It therefore does not require a specific line in this table.
Schedule 3 Table S3.3	Update line for "radioactive waste as defined in the transfrontier shipment of radioactive waste and spent fuel regulations 2008" to "Radioactive Waste as defined in the Transfrontier Shipment of Radioactive Waste and Spent Fuel (EU Exit) Regulations 2019"	To refer to the most up to date regulations and to align with the current permit template.
Schedule 3 Table S3.4	Remove the detailed description of monitoring techniques and specify that the site must use best available techniques.	This would bring the permit template in line with current best practice.
Schedule 7	Update Berkeley site plan showing the site boundary	Previous site plan was out of date and missing a number of buildings such as the ISF and the MILWEP building.

Changes to Compilation of Environment Agency Requirements, Approvals and Specifications (CEAR) Issue 6

Requirement number	Proposed change	Reason for the change
Requirement 2.4.1/v001	Add an agreement for the change of completion date for improvement condition IC1.	The Environment Agency have agreed to amend the dates for the required waste management plan (WMP) and Site Wide Environmental Safety Case (SWESC) in order to stagger the dates across the fleet. This change has been agreed with Magnox corporately.
Requirement 3.2.5(a)/v002	Add the following words: d) In the event that the Agency's contractor is not available at the time that the witnessed sample is due, the operator shall continue to take samples in accordance with paragraph (a) and shall by arrangement with the	To clarify that in the event of a situation where our contractor is unable to witness a sample then we will forgo the witnessing aspect of the taking of samples. Operators will be expected to continue to take samples as before, to ensure continuity of the sampling programme.

	Agency's contractor send the second aliquot to the Agency's designated laboratory.	