OPTIONS ASSESSMENT REVIEW / REQUIREMENTS FORM

OAR Form: Determining whether there is a need for a new study		Form Ref. No: WD-REP-0037-18 Issue 2
1.	Site:	Berkeley
2.	Scope: *Waste streams (with IDs), facility, land area, project.* *If a waste, note whether it is VLLW, LLW or ILW or Borderline ILW / LLW.* *Also, is all of the waste stream/facility etc. considered or just part?* *If a new study were to be required, what would it concern / what are the options intended to achieve? For example, disposal route for active oils, or means of conditioning of waste in DCICs, or decontamination approach and target for contaminated concrete.*	The Modular Intermediate Level Waste Encapsulation Plant (MILWEP) at Berkeley will have a gaseous radioactive discharge to the atmosphere during its operational lifetime. Discharge Assessment (BNLS-REP-CMP-0094-17)[1] has identified that the encapsulation process may result in the release of approximately 776 GBq of gaseous tritium, as tritiated water vapour (HTO), on the basis that 2% of the tritium present in FED is released as a consequence of the encapsulation process. A subsequent sensitivity assessment of the tritium discharge (BNLS-EAN-ET-0112-17)[2] reported that as a worst-case a maximum of 5% of the tritium present in the FED would be released during the encapsulation process, resulting in a discharge of 1.93 TBq. Gaseous radioactive discharges other than tritium have been identified as trivial and not subject to further assessment (BNLS-REP-CMP-0094-17). The gaseous discharge from the encapsulation process will be managed by a dedicated ventilation system, discharging through its own stack on the MILWEP building. This discharge stack is included as a new authorised discharge point in the variation request to Berkeley site's Environmental Permit (EP-RSR) (Summer, 2019). The factors affecting the potential impact of the radioactive discharges from the operation of the MILWEP facility to the environment and human health have been subject to assessment and optioneering. The purpose of this document (WD-REP-0037-18) is to summarise the assessment and optioneering undertaken to date, so as to demonstrate that the current design has been optimised in line with the requirements of BAT/BPM (as set out in procedure S-391). The initial review was undertaken in 2017, covering the location of MILWEP within Berkeley site, abatement of the discharge, and the design of the ventilation system. Subsequent to a review of the design of the ventilation system (July, 2018), aspects of the design of the ventilation system have been changed. The parts of this document (WD-REP-0037-18) covering the design of the ventilation system have therefore been updated to reflect the further optioneering undertaken for this system. The sections on location of the MILWEP facility and the need for abatement of the gaseous discharge are unchanged from the first draft of this document. The factors that have been considered and presented in this document are: 1) The location of the MILWEP facility within the Berkeley Nuclear Licensed Site (Berkeley Site). The location assessment considered construction risk (from buried structures and contaminated land), environmental receptors, and exposure to on-site workers and off-site receptors. 2) The inclusion of abatement technology within the design of the MILWEP facility for the gaseous discharge. 3) The design of the ventilation system within the MILWEP facility to manage the discharges arising[3]; addressing the requirement for filtration of the discharge, the resilience and layout of the ventilation system, its construction, and the materials used. This section has been updated to reflect the further optioneering undertaken of the design of the ventilation system.
3.	Current plan: *(e.g. as set out in the site RWMC for ILW or the site LC35 decommissioning programme or the site LTP)*	The current strategy for the three areas of design considered is: 1) **Location** – the MILWEP facility is sited in the south east corner of the Berkeley Site, east of the Caesium Removal Plant (CRP) building). Designated 'Location 1' of the eleven locations considered. The strategy on location is unchanged from that presented in issue one of WD-REP-0037-18. 2) **Abatement** - the MILWEP design does not include any abatement of the gaseous discharge, with the current plan to discharge unabated. The strategy on abatement is unchanged from that presented in issue one of WD-REP-0037-18. 3) **Ventilation design** - a ventilation system to comprise the following structure and elements to manage the process extract from the encapsulation activities: o The process ventilation system to consist of a single stage cartridge HEPA filter. Filter to be located within a safe change housing.

[1] BNLS-REP-CMP-0094-17. Berkeley Site C&MP Aerial Discharge Assessment. Assessment of aerial discharges and off-site public doses for the worst-case year. June 2017.
[2] BNLS-EAN-ET-0112-17. Sensitivity of estimated tritium releases to inform Berkeley Aerial Discharge Assessments. July 2017
[3] 1865_RP_HVAC_001 revB. MILWEP Ventilation Basis of Design, Technical Report. September 2018

<table>
<tr><th colspan="2">OAR Form: Determining whether there is a need for a new study</th><th colspan="4">Form Ref. No: WD-REP-0037-18 Issue 2</th></tr>
<tr><td></td><td></td><td colspan="4">o HEPA filter to be located within the building. Standby filtration is not required.
o The fans to be of type D design and constructed of stainless steel. The ductwork to be of stainless steel construction and of high integrity construction.</td></tr>
<tr><td>4.</td><td>Is there a relevant existing options assessment study?
See Options Assessment Database and/or refer to Options Assessment Database Manager</td><td>Yes ☒</td><td>Go to Box 5</td><td>No ☐</td><td>Go to Box 8</td></tr>
<tr><td>5.</td><td>Study title and reference for the existing study:</td><td colspan="4">Existing options assessment studies have been undertaken for each of the three areas of design:
1) Location – two studies are of relevance here. Document ref. WD/REP/0255/16 - Assessment of the optimum siting for the Berkeley encapsulation plant, Issue 1, March 2017; and document M/EF/BKA/EAN/0012/16 - Variation in radiation doses from aerial discharges due to the location and discharge height of MILWEP at Berkeley Site. Issue 1. February 2017.
2) Abatement – document ref. BNLS-BAT-0128. Review whether discharging without abatement, or abating, the HTO vapour is demonstrating Best Available Techniques (BAT).
3) Ventilation – two options assessment studies have been undertaken for the design of the ventilation system:
o NS4000-11-500-2014. MILWEP Phase 1 – Design Development. Ventilation Options Report. 4th January 2017. Report produced by NSG for Magnox.
o 1865-MM-PROJ-002. Value Engineering Exercise on the Ventilation serving MILWEP. 3rd July 2018. Minutes of meeting (Ventilation Value Engineering Workshop). The design developed from this review is described in 1865_RP_HVAC_001 revB. MILWEP Ventilation Basis of Design, Technical Report. September 2018. Report produced by Alpha Engineering Ltd for Magnox.</td></tr>
<tr><td>6.</td><td>Brief description and outcome of existing assessment:
Provide summary BAT/BPEO/BPM argument from the existing study if one is provided.
Provide summary ALARP argument from the existing study if one is provided.</td><td colspan="4">1) LOCATION
The existing assessment (WD/REP/0255/16) assessed a long list of eleven potential locations for the MILWEP facility at Berkeley Site (shown on Figure 1 of WD/REP/0255/16). The long list was subsequently reduced to four locations following a screening exercise. Locations were screened out on the basis of:
- Location 2 – required an existing building (CRP) to be removed in advance.
- Location 3 – identified as sub-optimal to Locations 4 and 6 as a consequence of the presence of below ground structures, and proximity to the ISF, and primary routes within Berkeley Site for traffic and pedestrians.
- Location 7 – identified as sub-optimal to Location 6, primarily as a result of ecological impacts (the presence of amphibians).
- Locations 8 and 9 – not large enough to accommodate MILWEP.
- Locations 10 and 11 – located outside the Site Licence Boundary for Berkeley Site, and therefore requiring changes to the Site's Nuclear Site Licence (a costly and time consuming process).
The locations shortlisted were:
- Location 1 – SE corner of Berkeley Site, to the east of the CRP building.
- Location 4 – NE corner of Berkeley Site, to the east of the ISF.
- Location 5 – between the reactor (Safestore) buildings.
- Location 6 – N end of Berkeley Site, to the west of the ISF.
The shortlisted locations were assessed against a subset of the attributes identified in Procedure S-391. The nature of the construction and operation of MILWEP mean that not all of the selection attributes in S-391 are applicable to the assessment of potential locations. The attributes used are detailed in Appendix D of WD/REP/0255/16.
The attributes that were a differentiator between the four locations, and therefore identified as having a significant effect on the location were:
- Dose to workers in MILWEP from the ISF. Identified as a specific issue for Locations 4 and 6.
- Public dose during operation of MILWEP.
- Deployment difficulty, specifically the presence of below ground structures for Locations 5 and 6, and the need to remove trees and the spoil heaps for Location 6.
The assessment concluded that Locations 5 and 6 would present the greatest pre-construction and foundations issues, and Locations 4 and 6 would have the detriment of</td></tr>
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being close to the ISF and the key on-site personnel routes. Location 1 was concluded as the preferred location.

Radiation dose to workers and the public was assessed in more detail in M/EF/BKA/EAN/0012/16[4]. A separate assessment considered the magnitude of radioactivity discharges from MILWEP. The results of this are summarised in Table 1 of M/EF/BKA/EAN/0012/16. This assessment concluded that the lifetime doses likely to be received by the public are trivial. However, as the four shortlisted locations for the MILWEP facility are of varying distances to off-site receptors, then the specific location selected will have an effect on the actual exposure incurred.

The exposure to Site workers in the 'near wake' of MILWEP at a level exceeding a 1 mSv dose for 500 hours occupancy, was determined to be unrealistic for the nature of the operations being conducted at MILWEP. Exposure to Site workers was therefore not considered as part of the assessment of location; only exposure to people off-site.

Table A – Approximate distance in metres to local receptors from the centre of MILWEP

Proposed location for MILWEP	Distance (metres) to receptor (relevant dose point)			
	Site fence	Stroud security lodge	Hamfield sports club	Hamfield farm
1: SE corner of the site	45	260	380	380
4: NE corner of the site	30	450	110	220
5: between the reactor (Safestore) buildings	120	200	350	450
6: N end of the site	60	360	290	430

Assessment M/EF/BKA/EAN/0012/16 applied these assumptions:

- The actual radiological discharges from MILWEP are the same for each location.
- The discharges are continuous through the year.
- The distances presented in Table A are from the centre point of MILWEP. The discharge stack is in the centre of the facility.

The assessment of the effect of location on inhalation dose to the public considered:

- The distance between source and the receptor (Table A).
- The height of the discharge above ground level. The current design of the MILWEP facility has a stack height of 18 m. The assessment calculation used an effective stack height value of 20 m to account for the effect of self-entrainment of the gaseous discharge by the MILWEP building.
  a) Discharging through a taller stack determined that unless the stack was increased significantly in height there would be no significant reduction in dose (i.e. more than a factor of 2). Designing for a taller stack was therefore not considered further.
- The number of hours of exposure (occupancy factor). Assessed as:
  a) Site fence – 14 h at the south side of the Site (hours of exposure assigned to students travelling in cars and walking at lunchtime), and 50 h for the north side of the Site (dog walker).
  b) Stroud College Security Lodge – 2,000 h (full time job).
  c) Hamfield Sports Club – 1,000 h (part time job).
  d) Hamfield Farm – 4,600 h (routine habitation).
- Prevailing wind and the effects caused by adjacent buildings.
  a) The prevailing wind is the same for all four locations.
  b) Adjacent buildings, in particular the two large Safestore buildings, will have an effect when the discharge points are close enough to these buildings for the discharges to become entrained within the air currents around them. This applies to Locations 1 and 5, and consequently an effective release height of 54 m has been used in the assessment calculations for the gaseous discharges from

[4] M/EF/BKA/EAN/0012/16. Variation in radiation doses from aerial discharges due to the location and discharge height of MILWEP at Berkeley Site. Issue 1. February 2017.

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MILWEP at these two locations.

Taking all of these aspects into account determined a relative dose inhalation value for each location.

- For Locations 1, 5 and 6 the highest inhalation dose location is Hamfield Farm.
- For Location 4, the Hamfields Sport Club receives the highest dose inhalation.
  a) When comparing the locations, the inhalation dose at Hamfield Farm from Locations 4 and 6 is approximately 2.1 times and 1.5 times respectively greater than the inhalation occurring from Locations 1 and 5. Location 4 also gives the highest inhalation dose to the public (Hamfields Sports Club) of any of the four locations. This dose is 2.8 times higher than the lowest inhalation dose incurred at Hamfield Farm (from Locations 1 and 5).

Further consideration was then made to other dose pathways on public dose. Magnox uses the Inter Utilities Working Group (IUWG) model to calculate the lifetime (50 year) dose to the public for all pathways from aerial discharges, at the nearest location of habitation (Hamfield Farm). The main contributor in the gaseous discharge from MILWEP is tritium. The IUWG model demonstrates a higher ratio for this radionuclide for ground and ingestion pathways, in comparison to the inhalation and cloud doses. This highlights Hamfield Farm as being the key public receptor for gaseous discharges from MILWEP, when considering overall dose uptake, due to the ground gamma and ingestion dose pathways at the Farm.

The assessment concluded that Hamfield Farm is the public dose receptor that receives the highest lifetime dose. Of the four prospective locations for MILWEP, Locations 1 and 5 result in the lowest inhalation dose to this receptor. Altering the height of the discharge stack from the current design (18 m) will not have a significant effect of the doses incurred to public receptors. Doses to workers are not significant.

The results from this assessment were in line with those from the wider Optimum Siting Study (WD/REP/0255/16), with Location 1 selected as the preferred location in both assessments.

2) ABATEMENT

The existing assessment (BNLS-BAT-0128) considered whether discharging the HTO vapour from the MILWEP facility, with or without abatement is BAT. It is noted that the present philosophy for Magnox facilities is to discharge gaseous effluents directly to the atmosphere. Where effluents are not discharged, the approach is to ensure they are placed in an immobilised form prior to storage on site, or transport off site. Therefore, should abatement be implemented then the abatement technology would have to enable the generation of an immobilised waste.

The assessment (BNLS-BAT-0128) assumed any contributions to discharges and doses from the other gaseous species (or example elemental tritium or Carbon-14) are negligible and do not require assessment.

Technologies for the separation of tritium and tritiated water from gaseous waste streams have been identified and assessed (primarily at Sellafield and Chapelcross).

- At Sellafield the methods developed (including complex methods such as tritium enrichment and thermal oxidation, and also a relatively simpler method using desiccant) were found not to be viable when the levels of tritium in the waste streams were low, and/or resulted in the creation of secondary (solid) wastes which required further handling and immobilisation; as well as subsequent storage and/or disposal.
- At Chapelcross relatively simple technologies such as dehumidifiers and molecular sieves were developed for the reduction of HTO vapour levels in aerial discharges where the potential tritium levels are in the order of magnitude of 500+ TBq.

The existing assessment (BNLS-BAT-0128) concluded that the methods developed at Sellafield and Chapelcross were not suitable to abate HTO vapour from the relatively low concentration waste streams encountered at MILWEP (1.93 TBq)[5]. The methods were also considered to be limited as a consequence of safety/dose implications to workers, and the generation of secondary solid wastes.

Discharge without abatement is expected to result in the very rapid dispersal of the HTO vapour, with little impact to the environment. Assessment of the predicted dose received by

[5] A worst-case discharge of 1.93 TBq of tritium has been assumed to occur from the encapsulation process at MILWEP. This is based on 5% of the tritium present in the waste being released during the encapsulation process (the release fraction). The previous version of the assessment assumed a 2% release fraction, resulting in 0.776 TBq of tritium released.

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people living in the vicinity (<100m) of Berkeley site (using the PC CREAM assessment tool)[6] following an annual discharge of 2 TBq of tritium, identified an annual effective dose of 2.49×10^{-2} µSv/y.

On the financial and infrastructure resources aspects, the MILWEP facility will have a short operational lifetime (3-4 years). Therefore, investment in new potential abatement technologies, and the development and construction of new plant, is also not considered appropriate, given the low potential impact of the unabated release.

3) VENTILATION

Ventilation of the MILWEP building is required to manage the radioactive gaseous discharge arising during the encapsulation process, and to provide appropriate conditions to workers and plant within the building.

The options considered in the development of the ventilation design were based around the following objectives:

- Air should flow from areas of least contamination to highest contamination by cascade flow.
- Airflow to be minimised to limit the entrainment of particulates.
- Ventilation to provide a satisfactory working environment for personnel to meet pertinent legislation, and to provide the conditions required for the process, plant and equipment.
- Airflow directions to be maintained through openings.
- Compliant with statutory regulations and site licence requirements. Noted that abatement to manage the level of tritium discharged, such that the existing site licence discharge limit could be maintained (without amendment) was identified as not feasible (see section above on Abatement) and therefore not included as a design parameter.
- To maintain the relative humidity (RH) of airflow across HEPA filters to <80% RH to protect the filters from potential damage.
- To satisfy any Safety Functional Requirements placed on the system.
- To minimise energy usage whilst maintaining the necessary air conditions identified.

Those objectives relating to the management of contamination are in accordance with industry standard Sellafield Guidance ES_0_1738_1.

Two options assessment exercises have been undertaken for the design of the ventilation system, described below.

3a) 1st Options Assessment

The first assessment undertaken (NS4000-11-500-2014) addressed the options available for the development of the ventilation system for the MILWEP facility, covering the requirement for filtration, system resilience and system construction. The options considered and the conclusions drawn from this options assessment are outlined below:

The option considered in relation to filtration was the two-stage filtration of the main discharge, with sub-options of:

a) HEPA primary and HEPA secondary filters. HEPA filtration provides the highest level of protection with respect to particulate discharges. The use of a HEPA primary filter provides a high level of protection of the secondary filter and minimises blinding of that filter. Consequently, this increases the lifetime of the secondary filter.
b) Coarse primary filter with HEPA secondary filter. Removes the requirement for two relatively expensive HEPA filters. Both options will result in the generation of secondary wastes (replaced filters).

The options considered in relation to the resilience of the ventilation system were:

- The number and layout of the fans. Options of:
    a) Single duty fan with or without a second fan on standby. The single fan with no standby offers the lowest CAPEX and OPEX requirements. Failure of the single fan would result in a halt in production, whilst the fan was repaired, and a potential accumulation of hydrogen. The inclusion of a standby fan in the arrangement provides the most resilient design as it avoids these

[6] This assessment was made as part of the Article 37 Annex V submission to the European Commission (ref. BNLS-REP-MILWEP-0226-17). The assessment modelled the annual effective dose occurring from Berkeley site's total discharge of tritium. A worst-case figure of 2 TBq was used for this. The release from MILWEP (1.93 TBq) accounts for almost all of the tritium released from Berkeley site.

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disadvantages, but does entail more complex control systems and a higher CAPEX requirement.

b) Two duty fans operating in parallel, each of which is rated at 50% of the required airflow. Provides an advantage of some extract ventilation being maintained in the event a fan fails, although the ventilation provided with one fan may not be sufficient in terms of containment or management of hydrogen levels. Higher CAPEX and OPEX requirements than a single fan.

- Location of the ventilation plant (extract fans and the filters) either within the MILWEP facility or outside it. Locating this plant outside the building provides space saving within the building, but requires the plant to be weather proofed, and the filters to be trace heated and insulated to avoid condensation issues. Exposure of the filters to condensation will reduce filter integrity.

The options considered in relation to the construction of the ventilation system were:

- Type of fan used. Document ES_0_1710_1 (Sellafield Design Guide for Centrifugal Fans) identifies two types of fan suitable for use in a nuclear materials process where some flammable gases may be present.
  a) Type B – a gas tight fan of mild steel construction, typically utilised where there neither corrosive elements to the fluid handled, and no requirement for nuclear decontamination.
  b) Type D - a gas tight fan of stainless steel construction, typically utilised where there are likely to be corrosive elements to the fluid handled, and/or a requirement for nuclear decontamination.

Ductwork material. Options considered were mild steel (DW/144), high integrity mild steel, or high integrity stainless steel. Whilst the DW/144 material has the lowest cost, it is not suitable for the coastal outdoor environment experienced at Berkeley.

On the basis of the assessment undertaken, the design comprises:

- Filtration of the main discharge – primary coarse filter located within a safe change housing, with a HEPA secondary filters also located within a safe change housing.
- Number and layout of fans – single duty fan with a second fan on standby. The inclusion of this approach in the design is driven primarily by the need to manage hydrogen levels.
- Location of the fans and filters – the fans are located outside of the building in their own enclosure. The filters are located within the building to provide safe-changing space.
- Type of fan used – Type D fan selected, on the basis of the environment in which the fan will operate, and suitability for eventual nuclear decontamination so as to reduce the level of contaminated waste arising on completion of the project.
- Ductwork material – high integrity stainless steel ductwork (of high integrity construction) to provide the corrosion resistance required by the outdoor coastal environment at Berkeley Site. High integrity construction throughout is also included as a consequence of the potential for hydrogen accumulation should the ventilation system be shutdown for any period.

The management of potential accumulations of hydrogen is addressed appropriately in the DSEAR assessment (Ref. NS4000-12-500-2018)[7].

3b) 2nd Options Assessment

A further review of the ventilation design for the MILWEP building was undertaken at a Ventilation value engineering workshop (July 2018), as part of the ongoing development of the design. This review considered the:

- Overarching ventilation strategy for the MILWEP building.
- Filtration requirements for the system.
- Requirement for standby plant.
- Management of condensation.
- Monitoring systems required.
- Specification of the ductwork.

The other aspects of the ventilation system reviewed as part of the initial assessment, namely the type of fan, and the location of fan and filter are unchanged.

[7] NS4000-12-500-2018. DSEAR assessment for proposed MILWEP facility at Berkeley. Report by NSG for Magnox. Issue 5. August 2017.

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Overarching ventilation strategy for the MILWEP building

The ventilation system design developed following the first options assessment (NS4000-11-500-2014) was based on a single system to manage the radioactively contaminated process extract from the CBs, as well as the quality of the air within the unclassified parts of the building.

A review of this strategy at the Ventilation value engineering workshop 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.

Following this, two ventilation systems for the MILWEP building were proposed as a more efficient system, each with its own discharge point from the MILWEP building:

- A process extract ventilation system to manage the radioactively contaminated process extract from the CBs. This air will contain radioactive contamination (tritium, carbon-14 and beta particulate); and
- A building ventilation system to manage the quality of the air within the unclassified parts of the building. The MILWEP building as a whole is categorised as 'Unclassified' for radioactive contamination and as such can be treated as a conventional industrial building for the purposes of ventilation.

Separating the ventilation system in this way, into two systems means that the size of the air handling units (AHUs) and 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. Changing to a dedicated separate process extract and building ventilation systems is considered to be BAT on this basis.

It is noted that the location of the intakes to the building ventilation system means that it will not receive potentially radioactively contaminated air. Therefore, discharges from it will not be included as part of the EP-RSR permit for Berkeley site.

The design objectives of the ventilation system for the process extract are as follows (ref. 1865_RP_HVAC_001). These are in accordance with industry standard Sellafield Guidance ES_0_1738_1:

- Minimise the spread of contamination from areas of higher contamination potential (in the CB ullage) to areas of lower contamination potential (general building area).
- Maintain the CB ullage under the temporary lid at a nominal depression to provide a minimum containment velocity though the temporary lid fill port.
- Remove airborne particulate from the discharge air to ensure that the emissions are within the prescribed discharge limits for the facility.
- To manage the hydrogen evolved from the curing process to ensure that the concentration in air does not exceed 1% by volume.
- To maintain the process extract airflow below 80% Relative Humidity (RH) to protect the HEPA filtration from potential damage.
- To satisfy and Safety Functional Requirements placed on the system.
- Discharge stack to be designed in accordance with ES_0_1738_1 and maintain a minimum efflux velocity of 15 m/s to meet best practice, minimise rain ingress and also prevent condensed moisture running down the stack internal face

The process extract ventilation system developed to meet these objectives is standardised for BRK, HPA and CHX in the form of a high integrity Mobile Filtration Unit (MFU), with a single stage of HEPA filtration on the process extract. The modular approach applied across the three sites should provide further savings in materials and wastes generated at fabrication stage. For information the building ventilation systems for the BRK and HPA sites has also been standardised with regards to ductwork, damper and grill sizes, and AHU duties.

Filtration requirements

Filtration of the process extract air that is discharged is required as a consequence of the potential for particulate to have been generated during the encapsulation of the ILW in the CB, and the subsequent curing of the contents of the CB. Filtration is not required for the building extract, thereby providing savings in materials, secondary waste generation and operating costs.

Filtration of the process extract system will have a single stage HEPA filtration, with pre-filter.

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		Requirement for standby plant The original assessment identified a requirement for a single duty fan with a second fan on standby. This approach was driven primarily by the need to manage hydrogen levels. The Ventilation value engineering workshop discussed the removal of the standby plant, due to the low risk to safety following ventilation failure. It was deemed acceptable to remove the standby facility as the potential for fan/motor failure over the operating lifetime was deemed significantly lower than the potential for loss of power to the facility. This approach was supported by the DSEAR assessment (ref. NS4000-12-500-2018). Removal of the standby fan reduces the materials requirements without compromising on safety over the operating lifetime of the plant. **Management of condensation** A review of the requirements to manage condensation within the process extract system determined that all trace heating, insulation and the in-duct heating element could be removed from the design, whilst still ensuring that the HEPA filter is not challenged by exposing it to airflow exceeding 80% relative humidity. This change will reduce material requirements, secondary wastes generated and operational costs. **Monitoring systems required** Stack monitoring will be installed in accordance with EG_1_2505_1 (which draws on requirements from BS ISO 2889:2010), and will monitor for the presence of tritium, carbon-14 and beta-particulate. - 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 to stack monitoring for the presence of tritium, carbon-14 and beta-particulate, the ventilation system will also have differential pressure (dP) monitoring 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. **Specification of the ductwork** The original assessment identified a requirement for high integrity stainless steel ductwork (of high integrity construction) to provide corrosion resistance required by the outdoor coastal environment at Berkeley Site, and to manage the potential for hydrogen accumulation should the ventilation system be shutdown for any period. The separation of the ventilation system into two systems, reduces the requirement for high integrity ductwork, with the building ventilation system to be constructed from standard ductwork (DW/144). The process extract will still be constructed with high integrity ductwork, although this is now recognised as a consequence of the high humidity within the system, rather than a coastal environment location. **Summary of current design of the ventilation system** On the basis of the optioneering undertaken, the current design of the ventilation system for the MILWEP building has separate ventilation systems for the process extract and the building ventilation. The process extract system comprises: - An MFU installed within the building providing a dedicated ventilation system from the CB process station to the discharge stack on the outside of the building. The MFU contains a single stage safe change HEPA filter and a duty only extract fan. - Ductwork manufactured in high integrity stainless steel specification (ES_0_1723_2). - Sampling ports in the discharge stack to facilitate the connection of isokinetic stack sampling probe. The discharge stack is the only part of the process extract ventilation system to be located externally of the MILWEP building, protruding three metres above the roof level. The current design of the ventilation system, following the optioneering review, is considered 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.
7.	**Since the existing assessment was produced,**	Yes ☐

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	have there been any significant changes that could alter the outcome? *E.g., for wastes, changes to the waste volume, classification, timescales for management, technologies available (see F-225 for LLW or ILW dispositions), policy.*	No ☒ The existing assessments summarised present the current level of detail on the optioneering associated with the MILWEP facility.	
8.	**Is the matter "routine" work already adequately covered by existing assessments and / or procedures?** *E.g. if the project concerns size reduction for LLW, is there a site procedure which fully addresses this?*	Yes ☐ No ☒ *Give details.*	
9.	**Is there only a single option / one clearly preferable option?** *For LLW and ILW final dispositions, use F-225 to identify options (management techniques) available.*	Yes ☒ **Location, Abatement** and **Ventilation system**. **Location** – The preferred option for the location of the MILWEP facility is Location 1. **Abatement** – The BAT option is not to abate the levels of tritium in the gaseous discharge prior to the release from the MILWEP facility. **Ventilation system** – The existing assessments identified a clearly preferable option for each aspect of the ventilation system. No ☐	
10.	**Is a new options assessment study under S-391 required?**	The issue concerned is NOT subject to any EPR permit / RSA authorisation BAT / BPM clause relevant to the scope of S-391[8].	☐
		There is an existing assessment that remains valid, as justified in Box 7 above.	☒
		Routine operations covered by existing assessments and/or procedures as justified in Box 8 above.	☐
		Only one option is available / clearly preferable, as justified in Box 9 above.	☒
		If any box above is ticked, then NO NEW STUDY IS REQUIRED under S-391. Tick here to confirm that no new study is required.	☒
		If no boxes above are ticked then a NEW STUDY IS REQUIRED. Tick here to confirm that a new study is required.	☐
		If a new study is required, is it of more than local significance? Tick here if YES. ***See notes below.***	☐
		If a new study is required, what is the lead topic? Select one only: **Radioactive waste management (solid and non-aqueous liquid wastes)** ☐	

[8] That is, those Radioactive Substances Legislation BAT / BPM requirements relating to:

- minimising the volume and activity of radioactive waste created and / or disposed of; and/or
- minimising the radiological impact of disposals on people and the environment.

OAR Form: Determining whether there is a need for a new study		Form Ref. No: WD-REP-0037-18 Issue 2
		Decommissioning ☐ **Aqueous and gaseous discharges** ☐

Criteria for more than local significance are:

a) *The study is of a type listed in Appendix A of S-391.*

b) *Options will include one or more which would be changes to NDA strategy if adopted.*

c) *Options will include one or more which would be changes to existing S-036 strategy or site LC35 Decommissioning Programmes if adopted (see below).*

d) *The study has been subject to a direction ("called in") by the Waste Strategy & Permissioning Manager, the Decommissioning Director or Head of Profession, Environment and Waste.*

Specific matters covered by S-036 and site LC35 Decommissioning Programmes are:

- *Broad LLW or ILW disposal routes available.*
- *Types of treatment for ILW available*[9]*.*
- *Final waste forms for ILW as packaged for disposal.*
- *Waste streams to be retained (after packaging) on site during C&M / extended period of quiescence*
- *Site interim or final end-states.*
- *Timing of achievement of Final End State (radiological) for major facilities and land.*

[9] "Treatment" means operations intended to change the characteristics of the waste. By definition, alternative treatment options do not achieve the same end-point in terms of waste characteristics.

Form Prepared By:

Name: Colin Cartwright

Signed: C.O. Cartwright

Role: Environmental Specialist

Date: 24/6/2019

CONSULTEES FOR COMPLETION OF THIS FORM:

IF MORE THAN LOCAL SIGNIFICANCE (tick all relevant):		IF LOCAL SIGNIFICANCE (tick all relevant; see table below):	
Waste Strategy & Permissioning Manager NAME......................	☐	Waste management (solid and non-aqueous liquid): NAME......................ROLE....................	☐
Decommissioning Director NAME......................	☐	Decommissioning: NAME......................ROLE....................	☐
EHSS&Q Director NAME......................	☐	Discharges (aqueous and gaseous): NAME......................ROLE....................	☐

Decision to undertake / not undertake an assessment under S-391 agreed by:

Name: Hema Patel

Signed: Hema Patel

Role: Environment Specialist
~~Magnox Head of Profession, Environment and Waste (1)~~ /
Site Provider of RSL Advice (BAT / BPM) (2)

Date: 09/07/2019

Form reviewed by:

Name: Erica Rolfe

Signed: E J Rolfe

Role: Site Provider of RSL Advice
~~Options Assessment Oversight Manager (1)~~ /
Site Head of Radio~~logical~~ Pro~~tection~~ and Environment (or equivalent) (2)

Date: 09-07-2019

(1) More than local significance (2) Local significance

FORM COMPLETION CONSULTEES BY SITE (STUDIES OF LOCAL SIGNIFICANCE)

Lead topic	Harwell / Winfrith	Other reactor sites
Waste management (solid and non-aqueous liquid)	Regional Waste Manager	Waste Manager / Regional Waste Manager
Decommissioning	South Sites Engineering Compliance Manager	Site Engineering Manager
Discharges (aqueous and gaseous)	Environment Manager	Site Head of Radiological Protection and Environment (or equivalent)