OPTIONS ASSESSMENT REVIEW / REQUIREMENTS FORM

OAR Form: Determining whether there is a need for a new study		Form Ref. No: BNLS-BAT-MIMP-0136 – 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 scope of this options assessment is the management of the gaseous discharges arising from the retrieval and processing of the ~1,400 sludge cans present in Vault 3 of the Active Waste Vault (AWV) building at Berkeley site. The R4 Sludge Cans project (the R4 project) will retrieve the sludge cans from the vault and process them to separate the sludge contents from the cans. The potential for waste gases (including hydrogen) to be present in the sludge cans, as well as the likely generation of airborne particulate releases during the retrievals and processing stages means that a ventilation system is required for the project. Specifically, the ventilation system will need to (ref. 21-REP-MIMP-18039): - Extract any potential airborne contamination that arises during the retrievals and processing stages. - Provide containment of the retrievals and process areas. - Enable safe discharge of the waste gases (hydrogen) that may be present in the sludge cans, to the environment. In addition, a sludge transfer system will provide the interface between the processing area for sludge cans and the destination waste package for the sludge. Consisting of one or more tanks for homogenisation and sampling, the ventilation system will be required to (further to the bullet points above): - Provide containment for the tanks and for connection / disconnection of the waste package Activity Summary: Expected radioactive discharges from the R4 project are up to 9.9 GBq tritium and up to 0.6 GBq carbon-14 (ref. BNLS-REP-CMP-0094-17)[1]. Levels of ß-particulate are considered negligible (ref. BNLS-REP-CMP-0094-17)[2].
3.	**Current plan:** *(e.g. as set out in the site RWMC for ILW or the site LC35 decommissioning programme or the site LTP)*	As part of the current strategy at Berkeley site for the management of the intermediate level waste (ILW) streams present, the ~1,400 sludge cans present in Vault 3 of the AWV building will be retrieved from the vault and processed to separate the ILW sludge from the low level waste (LLW) cans. There is no specific strategy for the management of gaseous or particulate discharges arising from this activity. The options assessment presented here has arisen following the identification of a number of capacity risks and concerns with using the existing ventilation system in the AWV building.
4.	**Is there a relevant existing options assessment study?** *See Options Assessment Database and/or refer to Options Assessment Database Manager*	Yes ☒ **Go to Box 5** | No ☐ **Go to Box 8**
5.	**Study title and reference for the existing study:**	Existing studies of relevance to this assessment: - BNLS-BAT-MIMP-0136 Issue 1, July 2018. - 21-REP-MIMP-18039. *R4 Sludge Can Ventilation Optioneering Report.* March 2015. - 21-SPEC-MIMP-18448. *R4 Sludge Can Project. Ventilation Technical Specification.* April 2015.

[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] It is noted that the discharge values presented in BNLS-REP-CMP-0094-17 (Table 2) are estimated annual aerial discharges from Vault 3 (comprising the R3 Containerised Waste and the R4 Sludge Cans projects). There are no separate discharge figures for the R4 project. The aerial discharges from the R4 project will therefore be less than the 9.9 GBq and 0.6 GBq of tritium and carbon-14 respectively.

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6.	**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.*	The original study (ref. 21-REP-MIMP-18039) considered three basic configurations with a total of eight possible options for the design of the ventilation system for the R4 project. This study concluded that separate ventilation systems, comprising the existing AWV ventilation system and a new system using one or more MEUs (mobile extraction units) connected to an external discharge point, was the BAT option to provide the ventilation system required by the R4 project. The selection of a separate ventilation system was made on the basis that the existing ventilation system for the AWV building may not have sufficient capacity to provide the flow rate required by the R4 project (ref. 21-REP-MIMP-18039). The expected further modifications to this ventilation system by the other retrievals projects also meant that it was not possible to undertake system performance tests to confirm in advance the flow rate that would be available to the R4 project at the time of operation. Consequently, in the assessment of the eight options identified (ref. 21-REP-MIMP-18039), the option of separate systems combining the existing AWV ventilation system with an additional stand-alone MEU based system was selected as the preferred option (ref. 21-REP-MIMP-18039). The existing AWV ventilation system would be used to manage gaseous and particulate discharges from the retrievals area (area 100), and the MEU system used to manage discharges to air from the processing area (area 200). The MEU would discharge to an external release point. The subsequent study (ref. 21-SPEC-MIMP-18448) has supported the conclusion that the separated system described is the BAT option.
7.	**Since the existing assessment was produced, 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.*	Yes ☒ No ☐ The significant design change implemented since the original assessment (ref. 21-REP-MIMP-18039) is the change from out of vault depressurisation of the sludge cans (in the Depressurisation Vessel (DPV)), to in-vault depressurisation. This has resulted in the removal from the design of the DPV which was a key source of (nitrogen) gaseous discharge in the processing stage of the R4 sludge cans, following their retrieval from the vault. However, the level of (radioactive) gaseous discharge arising in the R4 project remains the same, as do the three requirements for the ventilation system identified in the original assessment (ref. 21-REP-MIMP-18039), namely: - Extraction of potential airborne contamination in the process room (area 200). - Containment for the process area (area 200) and retrieval area (area 100). - Safe discharge to the environment of the potential hydrogen and gaseous hydrocarbons contained in the sludge cans (existing AWV ventilation system). - Safe discharge to the environment of the potential hydrogen and gaseous hydrocarbons formed during sludge processing and transfer (additional stand-alone MEU based ventilation system). It is considered that the removal of the DPV does not alter the outcome of the options assessment presented in ref. 21-REP-MIMP-18039. The reasons for selecting separate ventilation systems remain unchanged, as does the overall ventilation strategy with the existing AWV ventilation system used for the retrievals stage (including the in vault activities), and the new stand-alone MEU ventilation system covering the processing stage. The method of transferring sludge to the destination waste package has also been developed since the original assessment. A branch of the new ventilation system will now provide containment for the tank(s). The proposed tank ventilation system: - will be a branch of the R4 ventilation system already covered under

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		the assessment, - is transferring materials (sludge) already assessed, and - introduces no new hazards, the change does not alter the outcome of the options assessment presented in ref. 21-REP-MIMP-18039.
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 ☒ This document (ref. BNLS-BAT-MIMP-0136, issue 2) has been written to provide the required appropriate assessment that the ventilation strategy for the current design (March 2018) is BAT and replaces BNLS-BAT-MIMP-0136 Issue 1.
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 ☒ No ☐ **One clearly preferable option**. This is the Option 5 described in the original assessment (ref. 21-REP-MIMP-18039). Option 5 consists of: *a new installation provided by one or more MEUs connected directly to the process area (area 200) through an extraction point in order to meet the ventilation and containment requirements of the processing area (area 200). In the retrieval area (area 100), an extract duct will be connected to the existing AWV vent system. The stand-alone MEU system requires the installation of a new discharge stack outside the AWV Building.* As described above, the assessment presented in ref. 21-REP-MIMP-18039 was made against a design with a DPV. In the current design (March 2018) the DPV has been designed out, with depressurisation of the sludge cans taking place in vault. However, the assessment presented in ref. 21-REP-MIMP-18039 is still considered to be valid for the current (March 2018) design. In the current design the existing AWV ventilation system is used to manage the gaseous discharges arising during the depressurisation and retrievals process (comprising the activities in the vault, and within Area 100 (a C3/ C4 environment), the two being joined via air infiltration paths in the existing gamma gate rather than a connecting duct. The new HEPA filtration system will be used to minimise discharges from the process area of the R4 project, specifically Area 200 (which is categorised as a C2/C3 environment) and the sludge tank(s) (expected to be a C3/C4 environment). In addition, a key reason in the selection of Option 5 (in ref. 21-REP-MIMP-18039), namely the concerns over potential capacity risks for the existing AWV ventilation system, remain valid. Therefore the basis for the optioneering presented in ref. 21-REP-MIMP-18039 and the selection of separate ventilation systems is still considered to apply and to be valid. As described in the existing assessments of ventilation options and requirements for the R4 project (refs. 21-REP-MIMP-18039 and 21-SPEC-MIMP-18448), the current separated ventilation system is considered to be BAT. The options available for the specific aspects of the ventilation system, namely the ductwork, the design of the HEPA filter bank, fan, and the location and positioning of the discharge point, and sampling capability, have also been reviewed, with the selected design considered to be BAT. These design details selected for the ventilation system are described below and shown in the sketch presented in appendix A: <u>Ductwork</u>

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	- Ductwork selected to withstand a coastal environmental without corrosion for its five year design life. (Berkeley is considered to be within a coastal environment). - Ductwork will adhere to the required leak tightness for an active ventilation system of this type. - Ductwork to include test points to confirm continued filter efficiency and to confirm system flow rates for commissioning and the scaling factor for discharge sampling results. - Ductwork distribution system to extract air from Area 200 and from the tank(s) in the import / export area. - In-line heater to reduce relative humidity and protect the HEPA filters, plus coalescer filters (impingement separators) from the Area 200 extract. Coalescer filters are connected to drain lines terminating at a local catch-pot, which will be sampled and emptied manually, in line with other similar systems on site (existing aqueous waste routes) <u>Filter Bank & Fan</u> - The fixed filter bank is to comprise two stage HEPA filtration (each stage comprising two HEPA filters in parallel (duty/duty)) and a fixed fan unit. HEPA filters to be nuclear grade, and in safe change housings. - A flow control loop will control the fan's variable speed drive to ensure that the total flow rate for Area 200 and the tank(s) is maintained at the required level of no more than 2.0 m^3/s. The precise volume will be set during commissioning, but will be limited by the capacity of the installed filters. - As with the ductwork, the filter housing is to be corrosion resistant. - The HEPA filter bank and fan will be located in a shelter / plant room partly to mitigate the risk of contamination migration should a bag tear during filter changing. <u>Discharge point</u> - To be located adjacent to the import/export building to the West of the Active Waste Vaults Building - The efflux velocity (>15 m/s) and the stack height (3 m above adjacent roof height) are in accordance with Design Guidance (ref. EG-0-1738-1)[3]. - Discharge stack rainwater management is to be confirmed; either a Swedish cowl, or a stack drain to a collection vessel. <u>Sampling capability</u> - System to include an isokinetic nozzle and a tritium nozzle with connecting pipelines to a designated sampling location. - Sampling equipment designed in accordance with ES-1-2505-1[4], with UPS and alarms in line with current best practice on site <u>Summary of Waste Streams:</u> - Gaseous aerial discharge via the new stack adjacent to the R4 Import / Export building - Solid and aqueous waste dispatched to the Conditioning Facility in waste packages for conditioning - Ventilation system catch-pots, sampled and discharged via the LECP The radioactive discharges predicted to occur from the R4 project (up to 9.9 GBq tritium and up to 0.6 GBq carbon-14) are within the new discharge limits being sought for the Environmental Permit for Berkeley Site. <u>Environmental Aspects:</u> - R4 facility containment ventilation causing potential radiological aerial discharge, primarily of tritium and Carbon-14, with negligible β particulate. - Condensation and moisture carry-over into ventilation system

[3] EG-0-1738-1 Ventilation Systems for Radiological Facilities. Design Guide, Issue 1, Sellafield Ltd.
[4] ES-1-2505-1 Stack and Duct Sampling and Monitoring Principles, Issue 1, Sellafield Ltd.

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		causing eventual damage to ductwork (aqueous discharge to ground) and filters (unabated aerial discharge) - Moisture collection from ventilation system (aqueous discharge, manually collected, analysed and disposed of via existing routes – LECP) <u>Operating Techniques:</u> - Aerial discharge (stack) to include an isokinetic sample system which will be managed in line with other such systems on site (alarms, UPS, weekly sample paper collection and analysis, scheduled maintenance including nozzle inspections and flow rate confirmation) - Aerial discharge (stack) to include a gaseous sample system for tritium and Carbon-14, to be operated in line with other such systems on site (weekly for 24 hours) - Ventilation catch-pot contents to be sampled, emptied and disposed of via the LECP at a frequency determined during commissioning - Scheduled maintenance to confirm system integrity (visual checks) and continued performance (flow and pressure checks) - HEPA filters to undergo initial and periodic DOP testing in line with current site best practice - HEPA filters to be changed on differential pressure, contact dose, or operating life, depending on which limit occurs first - Key system instrumentation for maintenance of performance will be calibrated on a periodic basis (as recommended by the instrument manufacturer and assessed by SQEP engineers). - Key alarms for the ventilation and stack sampling systems to be repeated to the Site Security Control Room (gatehouse), with the required responses in line with current site systems of this nature		
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[5].	☐	
		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)** ☐ **Decommissioning** ☐		

[5] 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.

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		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*[6].
- *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.*

[6] "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: SNOWDON BRIERLEY	Signed:
Role: VENTILATION CONSULTANT	Date: 17-07-19

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: Erica Rolfe	Signed: EJ Rolfe
Role: Site RSL Advisor ~~Magnox Head of Profession, Environment and Waste (1)~~ / Site Provider of RSL Advice (BAT / BPM) (2)	Date: 17-07-2019

Form reviewed by:	
Name: L. DELANEY	Signed:
Role: HEAD OF RADIOLOGICAL PROTECTION & ENVIRONMENT ~~Options Assessment Oversight Manager (1)~~ / Site Head of Radiological Protection and Environment (or equivalent) (2)	Date: 17/07/19

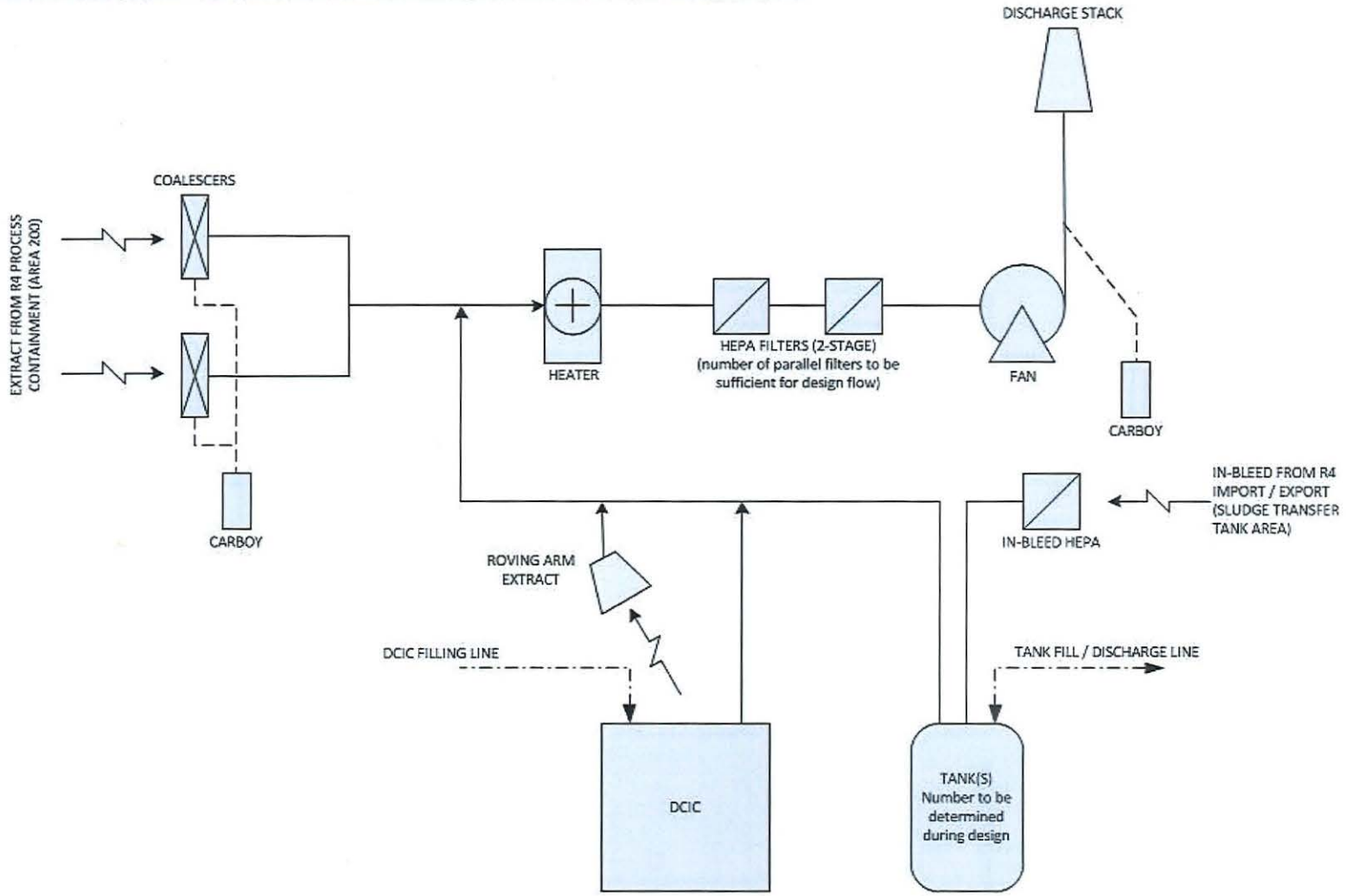
(1) More than local significance (2) Local significance

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)

APPENDIX A: (note: sludge transfer ventilation detailed design to be confirmed)

Active Waste Vaults: R4 (including Sludge Transfer) Containment Ventilation System



Flow rates to be determined during the design process