WASTE STREAM 9A57 Sludge (filter-precoat) from Berkeley Technology Centre

SITE	Berkeley
SITE OWNER	Nuclear Decommissioning Authority
WASTE CUSTODIAN	Magnox Limited
WASTE TYPE	ILW
Is the waste subject to Scottish Policy:	No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	48.5 m^3
Total future arisings:		0 m^3
Total waste volume:		48.5 m^3

Comment on volumes: There will be no further arisings of this waste stream. The volume was re-assessed prior to the 2004 Inventory.

Uncertainty factors on volumes:

Stock (upper):	x 1.1	Arisings (upper)	x
Stock (lower):	x 0.9	Arisings (lower)	x

WASTE SOURCE The sludge originates from routine filtration of liquid effluents and cooling pond water from the former Berkeley Technology Centre.

PHYSICAL CHARACTERISTICS

General description: The waste consists of contaminated Celite, a diatomaceous earth used as a Funda filter pre-coat in the Berkeley Technology Centre Active Effluent Treatment Plant. Sludges were collected on the Funda pre-coating filter and subsequently discharged along with the pre-coat material as a dry effluent residue into a can or liner lined with a PVC bag. The trapped sludge originated predominately from the treatment of general site low activity effluent but has also resulted from the treatment of higher activity effluents from the fuel pond. It should be noted that the material discharged into the drums would be damp and not completely dry. The term 'dry' is used to indicate that the sludge is not fully flooded or diluted in water as is normal for other sludge arisings. The waste will consist of magnesium hydroxide and other particulate material present in the Berkeley Technology Centre fuel pond, along with fuel contamination and graphite dusts. There will also be colbalt hexacyanoferrate which was added to assist in the removal of caesium from the ponds during filtration in the Funda filter. The waste drums will be processed as Miscellaneous Contaminated Items. Originally, this waste stream was classified as LLW, however it will now be treated and processed as ILW. There are no large items that may require special handling.

Physical components (%vol): The waste comprises Celite, a diatomaceous earth consisting mainly of calcium silicate. There might also be traces of colbalt hexacyanoferrate which was added to assist in the removal of caesium from the ponds during filtration in the Funda filter. The waste container is not included in this waste stream as it will be processed with the MCI streams.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m^3): 0.5

Comment on density: The density has been calculated using weights of Celite contained in Red Cans and the volumes already identified.

CHEMICAL COMPOSITION

General description and components (%wt): There are 527 red cans containing Celite in this vault section. The contaminated Celite consists of Magnesium hydroxide, magnesium carbonate, silicon dioxide, residual water and a range of other materials, including PVC (wt% not assessed). The drum is not included in this waste stream.

Chemical state: Alkali

Chemical form of radionuclides: H-3: Most tritium is expected to be present as water but some may be present in the form of other inorganic compounds or as organic compounds.
C-14: Carbon 14 may be present as graphite.
Cl-36: The chemical form of chlorine 36 has not been determined.
U: Chemical form of U isotopes has not been determined but may be oxides.
Pu: The chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

Metals and alloys (%wt): Any metals present would be in particulate form.

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	TR	The presence of metals has not been confirmed by measurement but there may be metal particles in the sludge. However only trace quantities are expected. There are steel drums containing the waste.	
Other ferrous metals.....	TR		
Iron.....			
Aluminium.....	TR		
Beryllium.....	TR		
Cobalt.....			
Copper.....	TR		
Lead.....	TR		
Magnox/Magnesium.....	TR		
Nickel.....			
Titanium.....			
Uranium.....			
Zinc.....	TR		
Zircaloy/Zirconium.....	TR		
Other metals.....	TR	"Other" metals have not been determined.	

Organics (%wt): A detailed assessment of organic materials in the waste has not been made.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics.....	TR		
Paper, cotton.....	TR		
Wood.....	0		
Halogenated plastics	2.0	PVC.	
Total non-halogenated plastics.....	0		
Condensation polymers.....	0		
Others.....	0		
Organic ion exchange materials....	TR		
Total rubber.....	TR		
Halogenated rubber	TR		
Non-halogenated rubber.....	TR		
Hydrocarbons.....			
Oil or grease			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar).....			
Bitumen.....			
Others.....			
Other organics.....	NE		

Other materials (%wt): Traces of graphite may be present.

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	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	TR		
Inorganic sludges and flocs.....	~98.0		
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	0		
Sand.....			
Glass/Ceramics.....	0		
Graphite.....	TR		
Desiccants/Catalysts.....			
Asbestos.....	0		
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....	NE		
Free non-aqueous liquids.....	TR		
Powder/Ash.....	0		

Inorganic anions (%wt): Inorganic anions will be present but have not been fully quantified.

	(%wt)	Type(s) and comment
Fluoride.....	NE	
Chloride.....	NE	
Iodide.....	0	
Cyanide.....	TR	
Carbonate.....	NE	
Nitrate.....	NE	
Nitrite.....	NE	
Phosphate.....	NE	
Sulphate.....	NE	
Sulphide.....	NE	

Materials of interest for waste acceptance criteria: The waste is unlikely to present a fire hazard but this requires confirmation. There might be trace quantities of biological material.

	(%wt)	Type(s) and comment
Combustible metals.....	TR	
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	
Hydrides.....	0	
Biological etc. materials.....	TR	
Biodegradable materials.....	0	
Putrescible wastes.....	0	
Non-putrescible wastes.....		

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Corrosive materials.....	0
Pyrophoric materials.....	0
Generating toxic gases.....	0
Reacting with water.....	TR
Higher activity particles.....	
Soluble solids as bulk chemical compounds.....	

Hazardous substances / non hazardous pollutants: None expected.

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....		
Chlorinated solvents.....		
Formaldehyde.....		
Organometallics.....		
Phenol.....		
Styrene.....		
Tri-butyl phosphate.....		
Other organophosphates.....		
Vinyl chloride.....		
Arsenic.....		
Barium.....		
Boron.....	0	
Boron (in Boral).....		
Boron (non-Boral).....		
Cadmium.....		
Caesium.....		
Selenium.....		
Chromium.....		
Molybdenum.....		
Thallium.....		
Tin.....		
Vanadium.....		
Mercury compounds.....		
Others.....		
Electronic Electrical Equipment (EEE)		
EEE Type 1.....		
EEE Type 2.....		
EEE Type 3.....		
EEE Type 4.....		
EEE Type 5.....		

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Complexing agents (%wt): Yes

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids…….		
Other organic complexants.....		
Total complexing agents.....	TR	

Potential for the waste to contain discrete items: No. In & of itself not a DI; assumed not likely to contain any "rogue" items that could be.

PACKAGING AND CONDITIONING

Conditioning method: This stream is to be co-packaged with 9A36, 9A37, 9A38, 9A58, 9A59, 9A65, 9A68, 9A69, 9A70, 9A71, 9A72, 9A75, 9A77, 9A78, 9A82. Packages are assigned to 9A68, 9A71 & 9A75.

Plant Name: -

Location: Berkeley Site

Plant startup date: -

Total capacity (m^3/y incoming waste): -

Target start date for packaging this stream: -

Throughput for this stream (m^3/y incoming waste): -

Other information: -

Likely container type:

Container	Waste packaged (%vol)	Waste loading (m^3)	Payload (m^3)	Number of packages

Likely container type comment: -

Range in container waste volume: -

Other information on containers: -

Likely conditioning matrix:

Other information: -

Conditioned density (t/m^3): -

Conditioned density comment: -

Other information on conditioning: -

Opportunities for alternative disposal routing: -

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Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
Disposal at a Geological Disposal Facility	Disposal at LLWR	64.0	2025	Low	There is a possibility that some of the Celite can be retrieved from the vault and segregated for disposal as LLW

RADIOACTIVITY

Source:	Dried sludge contaminated by fission products and activation products including actinides.
Uncertainty:	Specific activity is a function of operating history. The values quoted are indicative of the activities that might be expected.
Definition of total alpha and total beta/gamma:	Where totals are shown on the table of radionuclide activities they are the sums of the listed alpha or beta/gamma emitting radionuclides plus 'other alpha' or 'other beta/gamma'.
Measurement of radioactivities:	Activities have been estimated.
Other information:	This waste stream includes some drums known to be of comparatively high activity so that the average activity may approach the ILW/LLW limit. The error bands are intended to allow for the potential influence of these higher activity drums.

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3	<8.63E-05	D 3			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	6.00E-07	C D 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	6E-09	C D 2			Lu 174		8		
Ar 39		8			Lu 176		8		
Ar 42		8			Hf 178n		8		
K 40		8			Hf 182		8		
Ca 41		8			Pt 193		8		
Mn 53		8			Tl 204		8		
Mn 54		8			Pb 205		8		
Fe 55	1.97E-08	C D 2			Pb 210		8		
Co 60	2.78E-06	C D 2			Bi 208		8		
Ni 59	1E-07	C D 2			Bi 210m		8		
Ni 63	7.21E-06	C D 2			Po 210		8		
Zn 65		8			Ra 223		8		
Se 79	1E-08	C D 2			Ra 225		8		
Kr 81		8			Ra 226		8		
Kr 85		8			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	4.89E-04	C D 2			Th 227		8		
Zr 93		8			Th 228		8		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m		8			Th 232		8		
Nb 94		8			Th 234	1E-07	C C 2		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233	1.05E-08	C C 2		
Tc 99	2E-07	C D 2			U 232		8		
Ru 106		8			U 233		8		
Pd 107		8			U 234	1.00E-07	C D 2		
Ag 108m		8			U 235	3E-09	C D 2		
Ag 110m		8			U 236	1.00E-08	C D 2		
Cd 109		8			U 238	1E-07	C D 2		
Cd 113m		8			Np 237	1.05E-08	C D 2		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	3.56E-05	C D 2		
Sn 123		8			Pu 239	5E-05	C D 2		
Sn 126	1E-08	C D 2			Pu 240	6.00E-05	C D 2		
Sb 125		8			Pu 241	3.40E-04	C D 2		
Sb 126	1.4E-09	C C 2			Pu 242	5E-08	C D 2		
Te 125m		8			Am 241	1.10E-04	C D 2		
Te 127m		8			Am 242m	2.80E-07	C D 2		
I 129		8			Am 243	1.00E-07	C D 2		
Cs 134		8			Cm 242	2.31E-07	C D 2		
Cs 135	1E-08	C D 2			Cm 243	4.95E-08	C D 2		
Cs 137	4.95E-04	C D 2			Cm 244	3.94E-07	C D 2		
Ba 133		8			Cm 245		8		
La 137		8			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144		8			Cf 249		8		
Pm 145		8			Cf 250		8		
Pm 147	3.81E-09	C D 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	1.78E-06	C D 2			Other a				
Eu 152	3.22E-08	C D 2			Other b/g				
Eu 154	8.95E-07	C D 2			**Total a**	**2.56E-04**	**C D 2**	**0**	
Eu 155	5.98E-08	C D 2			**Total b/g**	**1.42E-03**	**C D 2**	**0**	

Bands (Upper and Lower)

A a factor of 1.5
B a factor of 3
C a factor of 10
D a factor of 100
E a factor of 1000

Note: Bands quantify uncertainty in mean radioactivity.

Code

1 Measured activity
2 Derived activity (best estimate)
3 Derived activity (upper limit)
4 Not present
5 Present but not significant
6 Likely to be present but not assessed
7 Present in significant quantities but not determined
8 Not expected to be present in significant quantity