WASTE STREAM 2S309 AGR Examination Caves LLW

SITE	Windscale
SITE OWNER	Nuclear Decommissioning Authority
WASTE CUSTODIAN	Sellafield Limited
WASTE TYPE	LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	0 m³
Future arisings -	1.4.2040 - 31.3.2050.....	457.8 m³
Total future arisings:		457.8 m³
Total waste volume:		457.8 m³
Comment on volumes:	-	
Uncertainty factors on volumes:	Stock (upper): x	Arisings (upper) x 1.5
	Stock (lower): x	Arisings (lower) x 0.5

WASTE SOURCE Decommissioning of PIE facilities.

PHYSICAL CHARACTERISTICS

General description:	Examination caves and associated equipment. The gamma scan rig containment vessel will require a suitably-sized container for disposal. It is likely that disposal of the 10t and 35t cranes will require the removal of the Gantry Hall and Loading Bay roofs respectively.
Physical components (%vol):	Carousel storage facility, caves, ventilation plant. % breakdown not yet known but will be assessed as part of the decommissioning strategy.
Sealed sources:	-
Bulk density (t/m³):	>0.5
Comment on density:	Waste is a mixture of concrete and steel items. This figure is an estimate of in-situ density.

CHEMICAL COMPOSITION

General description and components (%wt):	Steel (71%), lead (7%), concrete (4%), other materials (18%) e.g. PVC, plastics, lead, glass. Estimate based on theoretical density and percentage breakdown by volume.
Chemical state:	-
Chemical form of radionuclides:	-
Metals and alloys (%wt):	-

Stainless steel.....	NE	
Other ferrous metals.....	71.0	
Iron.....		
Aluminium.....	P	
Beryllium.....		
Cobalt.....	0	
Copper.....	P	
Lead.....	~7.0	
Magnox/Magnesium.....	0	
Nickel.....		
Titanium.....		
Uranium.....	P	
Zinc.....	0	
Zircaloy/Zirconium.....	0	
Other metals.....	<1.0	Other metals include tungsten at <1% by weight.

WASTE STREAM 2S309 AGR Examination Caves LLW

Organics (%wt): Cellulosic materials include Sisal Kraft paper and wood. Halogenated plastics include PVC. Halogenated rubber present in the form of neoprene tong gaiters.

Total cellulosics	<1.0
Paper, cotton	P
Wood	P
Halogenated plastics	<1.0
Total non-halogenated plastics	<1.0
Condensation polymers	NE
Others	NE
Organic ion exchange materials	0
Total rubber	NE
Halogenated rubber	<1.0
Non-halogenated rubber	NE
Hydrocarbons	
Oil or grease	
Fuel	
Asphalt/Tarmac (cont.coal tar)	
Asphalt/Tarmac (no coal tar)	
Bitumen	
Others	
Other organics	NE

Other materials (%wt): -

Inorganic ion exchange materials.	0
Inorganic sludges and flocs	0
Soil	0
Brick/Stone/Rubble	0
Cementitious material	~4.0
Sand	
Glass/Ceramics	NE
Graphite	0
Desiccants/Catalysts	
Asbestos	NE
Non/low friable	
Moderately friable	
Highly friable	
Free aqueous liquids	0
Free non-aqueous liquids	0
Powder/Ash	NE

Inorganic anions (%wt): Carbonates and some other anions will be present in concrete.

Fluoride	0
Chloride	0
Iodide	0
Cyanide	0
Carbonate	P
Nitrate	0
Nitrite	0
Phosphate	0
Sulphate	0
Sulphide	0

Materials of interest for waste acceptance criteria: Powder may be generated by operations such as scabbling.

Combustible metals	0
Low flash point liquids	0
Explosive materials	0
Phosphorus	0
Hydrides	0
Biological etc. materials	0
Biodegradable materials	NE
Putrescible wastes	0
Non-putrescible wastes	NE
Corrosive materials	0
Pyrophoric materials	0
Generating toxic gases	0
Reacting with water	0
Active particles	NE
Soluble solids as bulk chemical compounds	NE

Hazardous substances / non hazardous pollutants: Asbestos and heavy metals may be present.

Acrylamide	
Benzene	NE
Chlorinated solvents	
Formaldehyde	
Organometallics	
Phenol	NE
Styrene	
Tri-butyl phosphate	NE
Other organophosphates	
Vinyl chloride	NE
Arsenic	NE
Barium	
Boron	NE

Cadmium..... NE

Caesium.....

Selenium..... NE

Chromium..... NE

Molybdenum..... NE

Thallium.....

Tin..... NE

Vanadium..... NE

Mercury compounds.....

Others..... NE

Electronic Electrical Equipment (EEE)

EEE Type 1.....

EEE Type 2.....

EEE Type 3.....

EEE Type 4.....

EEE Type 5.....

Complexing agents (%wt): No

EDTA.....

DPTA.....

NTA.....

Polycarboxylic acids……

Other organic complexants.....

Total complexing agents..... 0

TREATMENT, PACKAGING AND DISPOSAL

Planned on-site / off-site treatment(s):

Treatment	On-site / Off site	Stream volume %
Low force compaction		
Supercompaction (HFC)	On-site	3.0
Incineration		
Solidification		
Decontamination		
Metal treatment		63.2
Size reduction		
Decay storage		
Recyling / reuse		
Other / various		
None		33.8

Comment on planned treatments: It is possible that soft wastes will be low-force compacted.

WASTE STREAM 2S309 AGR Examination Caves LLW

Disposal Routes:

Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	36.8
Expected to be consigned to a Landfill Facility	
Expected to be consigned to an On-Site Disposal Facility	
Expected to be consigned to an Incineration Facility	
Expected to be consigned to a Metal Treatment Facility	63.2
Expected to be consigned as Out of Scope	
Expected to be recycled / reused	
Disposal route not known	

Upcoming (2019/20-2021/22) Waste Routing (if expected to change from above):

Disposal Route	Stream volume %		
	2019/20	2020/21	2021/22
Expected to be consigned to the LLW Repository			
Expected to be consigned to a Landfill Facility			
Expected to be consigned to an On-Site Disposal Facility			
Expected to be consigned to an Incineration Facility			
Expected to be consigned to a Metal Treatment Facility			
Expected to be consigned as Out of Scope			
Expected to be recycled / reused			
Disposal route not known			

Waste Packaging for Disposal:

Container	Stream volume %	Waste loading m³	Number of packages
1/3 Height IP-1 ISO			
2/3 Height IP-2 ISO			
1/2 Height WAMAC IP-2 ISO	3.0	59.28	< 1
1/2 Height IP-2 Disposal/Re-usable ISO	33.8	10	16
2m box (no shielding)			
4m box (no shielding)			
Other			

Other information: -

Waste Planned for Disposal at the LLW Repository:

Container voidage: Inaccessible voidage will be <10%.

Waste Characterisation Form (WCH): The waste meets the LLWR's Waste Acceptance Criteria (WAC).
The waste does not have a current WCH.

WSCD for past disposals of LLW does not relate to future arisings from the decommissioning of the AGR Examination Caves.

Waste consigned for disposal to LLWR in year of generation: Yes.

Potential for the waste to contain discrete items: Potentially - this will be clarified during the characterisation process

Non-Containerised Waste for In-Vault Grouting:

Stream volume (%): -

Waste stream variation: -

Bounding cuboidal volume:

Inaccessible voidage: -

Other information: -

WASTE STREAM 2S309 AGR Examination Caves LLW

RADIOACTIVITY

Source:	The principal sources of radioactivity are fission products (e.g. Cs-137) with a smaller contribution from activation products (e.g. Co-60).
Uncertainty:	Data will be clarified upon characterisation.
Definition of total alpha and total beta/gamma:	Activity data from previous waste stream 5F307 (Windscale B52 Demolition HVLA).
Measurement of radioactivities:	The only radioactivity data available are estimates of beta/gamma contamination (in TBq/m²) on the cave floor and inventories of the fuel types handled. The list of principal nuclides present has been compiled from fuel type and previous inventory which relates to steel cladding.
Other information:	.

WASTE STREAM 2S309 AGR Examination Caves LLW

Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code
H 3					Gd 153				
Be 10					Ho 163				
C 14					Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36					Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54				6	Pb 205				
Fe 55					Pb 210				
Co 60				6	Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90				6	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106				6	U 233				6
Pd 107					U 234				6
Ag 108m					U 235				6
Ag 110m					U 236				6
Cd 109					U 238				6
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238				6
Sn 123					Pu 239				6
Sn 126					Pu 240				6
Sb 125					Pu 241				6
Sb 126					Pu 242				
Te 125m					Am 241				6
Te 127m					Am 242m				6
I 129					Am 243				6
Cs 134				6	Cm 242				6
Cs 135					Cm 243				6
Cs 137				6	Cm 244				6
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144				6	Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252				
Sm 151					Other a				
Eu 152					Other b/g				
Eu 154				6	**Total a**	**0**		**NE**	
Eu 155				6	**Total b/g**	**0**		**NE**	

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