WASTE STREAM 2Y57 Excavated Soil and Putrescible Waste - High Volume Very Low Level Waste (HVVLLW)

SITE	Sellafield
SITE OWNER	Nuclear Decommissioning Authority
WASTE CUSTODIAN	Sellafield Limited
WASTE TYPE	VLLW
Is the waste subject to Scottish Policy:	No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	0 m^3
Future arisings -	1.4.2022 - 31.3.2023.....	5207.0 m^3
	1.4.2023 - 31.3.2024.....	5207.0 m^3
	1.4.2024 - 31.3.2025.....	5207.0 m^3
	1.4.2025 - 31.3.2026.....	5207.0 m^3
	1.4.2026 - 31.3.2027.....	5207.0 m^3
	1.4.2027 - 31.3.2028.....	5207.0 m^3
	1.4.2028 - 31.3.2029.....	5207.0 m^3
	1.4.2029 - 31.3.2030.....	5207.0 m^3
	1.4.2030 - 31.3.2031.....	5207.0 m^3
	1.4.2031 - 31.3.2032.....	739.0 m^3
Total future arisings:		47602.0 m^3
Total waste volume:		47602.0 m^3

Comment on volumes: Arisings compiled from predominantly excavated spoil from construction and demolition concrete / rubble, with smaller amounts of putrescible wastes including roof waste [vegetation], timber, sewage solids, road sweepings and bird / animal carcasses. From the historical arisings, the average annual volume of waste disposed at CLESA was calculated at 5207m3 and was used as the annual arising volume for each year until the capacity of CLESA was reached (120,000 m3) from 2022 through 2031. During the year of 2031, 739 m3 of waste will be required to be disposed of to reach the volume capacity limit for CLESA. The average of 5207m3 does not include the data for 2020 as the Covid-19 pandemic caused a significant reduction in waste disposals on site that year. Uncertainties based upon the remaining volume in CLESA. Volumes are delivered as raw volumes (unpackaged), and are expected to be compacted, so could be uncertain by 10%. For annual arisings an upper uncertainty of 2 and a lower of 0.5 would be reasonable based upon the range of the values from previous annual disposals.

Uncertainty factors on volumes:

Stock (upper):	x	Arisings (upper)	x 1.1
Stock (lower):	x	Arisings (lower)	x 1.0

WASTE SOURCE This waste stream is predominantly excavated spoil from construction and demolition concrete / rubble, with smaller amounts of putrescible wastes including roof waste [vegetation], timber, sewage solids, road sweepings and bird/animal carcasses.

PHYSICAL CHARACTERISTICS

General description:	All waste will be "tipped" or emplaced in the disposal facility (as per facility Conditions For Acceptance (CFA)). No disposal containers are used. The only physical/chemical processes applied to the waste are crushing (concrete/demolition rubble) and dewatering in the case of sewage/road sweepings.
Physical components (%wt):	Miscellaneous construction and demolition materials (96.12%),Organic Material (3.49%) Insulation Materials (MMMF) (0.06%), Mixed Municipal Wastes (0.17%) and Wood (0.16%).
Sealed sources:	The waste does not contain sealed sources.
Bulk density (t/m^3):	~2
Comment on density:	The bulk density ranges from 0.05 to 2.4 t/m^3.

CHEMICAL COMPOSITION

General description and components (%wt):	Miscellaneous construction and demolition materials (96.12%),Organic Material (3.49%) Insulation Materials (MMMF) (0.06%), Mixed Municipal Wastes (0.17%) and Wood (0.16%).

WASTE STREAM 2Y57 Excavated Soil and Putrescible Waste - High Volume Very Low Level Waste (HVVLLW)

Chemical state: Alkali

Chemical form of radionuclides: -

Metals and alloys (%wt): Mild steel present in the form of reinforcing bar within concrete, where not practicable to remove.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel	TR		
Other ferrous metals	TR	Mild steel present in the form of reinforcing bar within concrete, where not practicable to remove.	
Iron			
Aluminium	0		
Beryllium	0		
Cobalt	0		
Copper	0		
Lead	0		
Magnox/Magnesium	0		
Nickel	0		
Titanium	0		
Uranium	0		
Zinc	TR		
Zircaloy/Zirconium	0		
Other metals	0		

Organics (%wt): Halogenated/non-halogenated plastics present - to cover "packaging" of some wastes e.g. bird/animal carcasses.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	0.16		
Paper, cotton	TR		
Wood	0.16	Small quantities of wood / timber.	
Halogenated plastics	<0.01		
Total non-halogenated plastics	TR		
Condensation polymers	TR		
Others	TR		
Organic ion exchange materials	0		
Total rubber	TR		
Halogenated rubber	TR		
Non-halogenated rubber	TR		
Hydrocarbons	0.84		
Oil or grease			
Fuel			
Asphalt/Tarmac (cont.coal tar)			
Asphalt/Tarmac (no coal tar)	0.84		
Bitumen			
Others			

WASTE STREAM	2Y57	Excavated Soil and Putrescible Waste - High Volume Very Low Level Waste (HVVLLW)

Other organics.....	3.7	Includes mixed municipal wastes and organic material "coke". Includes biodegradable wastes.

Other materials (%wt): 81.13 wt% in soil is actually soil and stone combined.

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	0		
Soil.....	81.1		
Brick/Stone/Rubble.....	4.4	Includes mixed demolition and mixed construction wastes. Includes MMMF.	
Cementitious material.....	9.8		
Sand.....	0.01		
Glass/Ceramics.....	<0.01		
Graphite.....	TR		
Desiccants/Catalysts.....			
Asbestos.....	TR		
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....	P		
Free non-aqueous liquids.....	TR		
Powder/Ash.....			

Inorganic anions (%wt): Derived from hydro-geological risk assesment.

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

Materials of interest for waste acceptance criteria: Putrescible waste (~1 w%). The waste is deemed to be inert or non-hazardous under landfill legislation.
The concrete arisings can be alkaline in nature, and give rise to alkaline leachate from the landfill (CLESA) [pH 9 - 12]. Acid dosing of leachate no longer required.

	(%wt)	Type(s) and comment
Combustible metals.....	0	
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	

WASTE STREAM	2Y57	Excavated Soil and Putrescible Waste - High Volume Very Low Level Waste (HVVLLW)

Hydrides	0	
Biological etc. materials	0	
Biodegradable materials	3.4	
Putrescible wastes	2.3	
Non-putrescible wastes	1.2	
Corrosive materials	0	
Pyrophoric materials	0	
Generating toxic gases	P	~~1% putrescible may give rise to methane and CO2.
Reacting with water	0	
Higher activity particles	0	Active particles unlikely to be present.
Soluble solids as bulk chemical compounds	0	

Hazardous substances / non hazardous pollutants: -

	(%wt)	Type(s) and comment
Acrylamide		
Benzene	NE	Possible as a trace contaminant.
Chlorinated solvents		
Formaldehyde		
Organometallics		
Phenol	NE	Possible as a trace contaminant.
Styrene		
Tri-butyl phosphate	NE	Possible as a trace contaminant.
Other organophosphates		
Vinyl chloride	P	Plastic packaging materials can contain vinyl chloride.
Arsenic	P	Can be present in contaminated soils, but below the level that would make the waste hazardous.
Barium		
Boron	P	Can be present in contaminated soils, but below the level that would make the waste hazardous.
Boron (in Boral)		
Boron (non-Boral)		
Cadmium	P	Can be present in contaminated soils, but below the level that would make the waste hazardous.
Caesium		
Selenium	P	Can be present in contaminated soils, but below the level that would make the waste hazardous.
Chromium	P	Can be present in contaminated soils, but below the level that would make the waste Hazardous.
Molybdenum	P	Can be present in contaminated soils, but below the level that would make the waste hazardous.
Thallium		
Tin	P	Can be present in contaminated soils, but below the level that would make the waste hazardous.

Vanadium.....	P	Can be present in contaminated soils, but below the level that would make the waste hazardous.
Mercury compounds.....		
Others.....	P	
Electronic Electrical Equipment (EEE)		
EEE Type 1.....		
EEE Type 2.....		
EEE Type 3.....		
EEE Type 4.....		
EEE Type 5.....		

Complexing agents (%wt): No

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids…….		
Other organic complexants.....		
Total complexing agents.....	0	

Potential for the waste to contain discrete items: Yes.

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction		
Supercompaction (HFC)		
Incineration		
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recyling / reuse		
Other / various		
None		100.0

Comment on planned treatments: None planned currently.

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
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	100.0	2.0
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		

Classification codes for waste expected to be consigned to a landfill facility: -

Upcoming (2022/23-2024/25) Waste Routing (if expected to change from above):

WASTE STREAM 2Y57 Excavated Soil and Putrescible Waste - High Volume Very Low Level Waste (HVVLLW)

Disposal Route	Stream volume %		
	2022/23	2023/24	2024/25
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			

Opportunities for alternative disposal routing: No

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
-	-	-	-	-	-

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			
1/2 Height IP-2 Disposal/Re-usable ISO			
2m box (no shielding)			
4m box (no shielding)			
Other (Onsite disposal (HVVLLW uncontainerised))	100.0		

Other information: Waste is largely uncompactable and is disposed of as HVVLLW uncontainerised.

Waste Planned for Disposal at the LLW Repository: (Not applicable to this waste stream)

Container voidage: -

Waste Characterisation Form (WCH): -

Waste consigned for disposal to LLWR in year of generation: -

Non-Containerised Waste for In-Vault Grouting: (Not applicable to this waste stream)

Stream volume (%): -

Waste stream variation: -

Bounding cuboidal volume:

Inaccessible voidage: -

Other information: -

RADIOACTIVITY

Source: Dependant on plant of origin. May include activation products, fission products, and/or fuel contamination.

Uncertainty: The average specific activities are calculated from characterisation of sentenced arisings, the values differ for each project/location, and can be highly variable.

WASTE STREAM	2Y57	Excavated Soil and Putrescible Waste - High Volume Very Low Level Waste (HVVLLW)

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:	The specific activity of future arisings has been calculated from arisings to date, incorporated with detailed radionuclide fingerprints for the plants of origin and and including any anticipated future waste which significantly differs from historic and current arisings .
Other information:	Figures based on declared waste stream fingerprints for donor plants for the specific arisings.

WASTE STREAM 2Y57 Excavated Soil and Putrescible Waste - High Volume Very Low Level Waste (HVVLLW)

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			6.77E-06	C C 2	Gd 153				
Be 10					Ho 163				
C 14			3.17E-07	C C 2	Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36			2.77E-07	C C 2	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54			3.95E-09	C C 2	Pb 205				
Fe 55			1.72E-06	C C 2	Pb 210				
Co 60			2.57E-07	C C 2	Bi 208				
Ni 59					Bi 210m				
Ni 63			2.85E-07	C C 2	Po 210				
Zn 65			6.47E-11	C C 2	Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226			2.57E-07	C C 2
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90			2.55E-06	C C 2	Th 227				
Zr 93					Th 228			1.80E-08	C C 2
Nb 91					Th 229				
Nb 92					Th 230			3.10E-08	C C 2
Nb 93m					Th 232			1.78E-08	C C 2
Nb 94					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99			3.01E-07	C C 2	U 232			8.92E-09	C C 2
Ru 106			5.35E-08	C C 2	U 233			4.89E-07	C C 2
Pd 107					U 234			2.42E-06	C C 2
Ag 108m					U 235			4.34E-07	C C 2
Ag 110m			4.34E-11	C C 2	U 236			2.74E-07	C C 2
Cd 109					U 238			2.89E-06	C C 2
Cd 113m					Np 237			9.15E-08	C C 2
Sn 119m					Pu 236				
Sn 121m					Pu 238			1.14E-07	C C 2
Sn 123					Pu 239			2.35E-07	C C 2
Sn 126					Pu 240			2.21E-07	C C 2
Sb 125			1.53E-08	C C 2	Pu 241			1.61E-06	C C 2
Sb 126					Pu 242			4.58E-09	C C 2
Te 125m					Am 241			2.29E-07	C C 2
Te 127m					Am 242m				
I 129			9.73E-08	C C 2	Am 243				
Cs 134			3.76E-08	C C 2	Cm 242			2.09E-09	C C 2
Cs 135					Cm 243			1.51E-09	C C 2
Cs 137			3.43E-05	C C 2	Cm 244			3.00E-08	C C 2
Ba 133					Cm 245			2.66E-07	C C 2
La 137					Cm 246				
La 138					Cm 248				
Ce 144			6.51E-08	C C 2	Cf 249				
Pm 145					Cf 250				
Pm 147			1.23E-07	C C 2	Cf 251				
Sm 147					Cf 252				
Sm 151			8.96E-10	C C 2	Other a				
Eu 152			7.72E-11	C C 2	Other b/g				
Eu 154			7.13E-09	C C 2	**Total a**	**0**		**8.04E-06**	**C C 2**
Eu 155			8.76E-09	C C 2	**Total b/g**	**0**		**4.88E-05**	**C C 2**

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