WASTE STREAM **2X124 Pile Fuel Cladding Silo Retrievals Project LLW**

SITE Sellafield

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Sellafield Limited

WASTE TYPE LLW

WASTE VOLUMES

Stocks:	At 1.4.2013.....	0 m³
Future arisings -	1.4.2013 - 31.3.2023.....	~1525.6 m³
	1.4.2023 - 31.3.2025.....	~305.1 m³
Total future arisings:		1830.7 m³
Total waste volume:		1830.7 m³

Comment on volumes: As the work enters different phases the type and amount of work undertaken will change which will increase or decrease the amount of waste produced during that year. The figures given are a smoothed profile of waste generation.Due to the previous 3 years disposals being predominantly during a construction phase then the waste generation rates have been based on 01 april 2007 to 31 march 2010 The profile of waste arings over time is determined by the programmes for retrieval of wastes from a number of facilities. These programmes are currently under development and the profile is likely to change as development proceeds.

Uncertainity factors on volumes:

Stock (upper):	x	Arisings (upper)	x 1.5
Stock (lower):	x	Arisings (lower)	x 0.5

WASTE SOURCE General operations in preparation for waste retrieval up to 2017 and retrieval operations to 2023.

PHYSICAL CHARACTERISTICS

General description: Mixed waste of metals, plastics, paper and cloth. Some large items are expected. The waste has not undergone any change since it was generated.

Physical components (%wt): Metals (15%), Soil/Rubble (60%), Soft Organics (7%), Plastics/Rubbers (13%), Wood (3%), Others (2%).

Bulk density (t/m³): 0.5

Comment on density: The bulk density value has been taken from the current 2x124/1 WSCD.

CHEMICAL COMPOSITION

General description and components (%wt): Metals (15%), Soil/Rubble (60%), Soft Organics (7%), Plastics/Rubbers (13%), Wood (3%), Others (2%).

Chemical state: The waste is neutral and neither oxidising nor reducing.

Chemical form of radionuclides:
H-3: Unknown.
C-14: Not present.
Cl-36: Not present.
Se-79: Not present.
Tc-99: Not present.
I-129: Unknown.
Ra: Not present.
Th: Not present.
U: Unknown.
Np: Not present.
Pu: Unknown.

Metals and alloys (%wt): Various grades of steels used within the building. Proportion of sheet and bulk metal unknown.

Stainless steel.....		Bronze.....	
Other ferrous metals.....		Inconel.....	
Aluminium.....		Nimonic.....	
Copper.....		Stellite.....	
Lead.....	P	Boral.....	
Zinc.....		Dural.....	
Magnox/Magnesium.....		Monel.....	
Zircaloy.....		Uranium.....	
Brass.....		Beryllium.....	
		Other metals (below).....	

Other metals: Other metals not specified.

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Inorganic anions (%wt): Trace quantities of chloride, hydroxide and nitrate ions. Less than 0.1% wt.

Fluoride.....	Nitrate.....
Chloride.....	Nitrite.....
Iodide.....	Phosphate.....
Cyanide.....	Sulphate.....
Carbonate.....	Sulphide.....

Listed substances: Lead in the form of shielding and asbestos from cement asbestos cladding and lagging materials

Hazardous and problematic materials (%wt): -

Combustible metals.....		Strong oxidising agents.....	
Low flash point liquids.....		Pyrophoric materials.....	
Explosive materials.....		Generating toxic gases.....	
Phosphorus.....		Reacting with water.....	
Hydrides.....		Asbestos.....	P
Putrescible wastes.....		Free aqueous liquids.....	
Biological etc. materials.....		Free non-aqueous liquids.....	
Powder.....			

Asbestos types and proportions: Asbestos will be in the form of cement asbestos sheet and also asbestos pipe lagging.

Complexing agents (%wt): N10 cream. Trace amounts (~0.1%).

Complexing agents.....	~0.10

Organics (%wt): -

Total cellulosics.....	
Paper, cotton.....	
Wood.....	3.0
Halogenated plastics	
Total non-halogenated plastics....	
Condensation polymers.....	
Others.....	
Organic ion exchange materials...	
Total rubber.....	
Halogenated rubber	
Non-halogenated rubber.....	
Other organics.....	

Halogenated plastics and rubber (%wt): PVC and neoprene.

Other materials (%wt): Soil from excavations around the building. Rubble from various refurbishment operations on the plants.

Inorganic ion exchange materials..	
Inorganic sludges and flocs.....	
Soil.....	
Rubble.....	
Concrete, cement and sand.....	
Glass.....	
Ceramics.....	
Graphite.....	

LLW TREATMENT AND DISPOSAL

Status of waste: Routinely consigned to the LLWR.

Waste Characterisation Form (WCF): The waste meets the LLWR's Waste Acceptance Criteria (WAC). The waste has a current WCF. Inventory information is consistent with the WCF.

Waste consigned in year of generation: Yes.

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Treatments already carried out:

Treatment	Waste treated (%vol)	Volume change factor
Low force compaction		
Supercompaction (HFC)		
Incineration		
Encapsulation		
Metal decontamination		
Metal melting		
Other		
None	100.0	

Comment on treatments already carried out: -

Further treatments planned:

Treatment	Waste treated (%vol)	Volume change factor
Low force compaction		
Supercompaction (HFC)		
Incineration		
Encapsulation		
Metal decontamination	~5.0	0.0
Metal melting	~5.0	0.0
Other		
None	~90.0	

Comment on further treatments: The incineration route is currently under development, so no waste from this stream has currently been disposed of via this route, but it will be supercompacted if not sent for incineration

Category of waste after further planned treatments:

Category	Waste (%vol)
High force compactable waste	~74.7
Uncompactable waste in disposal containers	~15.3
Large items for direct in-vault grouting	
Not yet determined	

Comment on category of waste: High force compactable includes residues for incineration when used.

High Force Compactable Waste

Density bands:

Waste density (t/m³)	Waste (%vol)	
	200-litre drums	Loose
< 0.25		
0.25 - 0.5		
0.5 - 1.2		
> 1.2		
Not analysed by density	74.7	

Other information: Soft wastes are not analysed by density

Uncompactable Waste in Disposal Containers

Disposal container type:

Container	Waste (%vol)	Waste loading (m³)
Third height ISO		
Half height ISO	15.3	10.0
4m box (no shielding)		
2m box (no shielding)		
Other		

Inaccessible voidage: Innacessible voidage is minimised.

Other information: -

Large Items For Direct In-Vault Grouting (Not applicable to this waste stream)

Bounding cuboidal volume (m³): -

Inaccessible voidage: -

Other information: -

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RADIOACTIVITY

Source:	2X124 covers the original dry storage silo for pile fuel. The activity on the waste arises from contamination from fuel and reprocessing.
Accuracy:	Data based on fingerprint in current 2X124/1 WSCD. This is last time period where access to the silo contents was possible before construction phase.
Definition of total alpha and total beta/gamma:	Totals shown on table of radionuclide activities are the sums of the listed alpha or beta/gamma emitting radionuclides plus 'other alpha' or 'other beta/gamma.'
Measurement of specific activities:	-
Other information:	All radionuclides listed.

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Nuclide	Average specific activity, TBq/m³ Waste at 1.4.2013	Bands and Code	Future arisings	Bands and Code	Nuclide	Average specific activity, TBq/m³ Waste at 1.4.2013	Bands and Code	Future arisings	Bands and Code
H 3			3.85E-08	C B 2	Ho 163				
Be 10					Ho 166m				
C 14					Tm 170				
Cl 36					Tm 171				
Ar 39					Lu 174				
Ar 42					Lu 176				
K 40					Hf 178n				
Ca 41					Hf 182				
Mn 53					Pt 193				
Mn 54					Tl 204				
Fe 55					Pb 205				
Co 60					Pb 210				
Ni 59					Bi 208				
Ni 63					Bi 210m				
Zn 65					Po 210				
Se 79					Ra 223				
Kr 81					Ra 225				
Kr 85					Ra 226				
Rb 87					Ra 228				
Sr 90			1.40E-06	C B	Ac 227				
Zr 93					Th 227				
Nb 91					Th 228				
Nb 92					Th 229				
Nb 93m					Th 230				
Nb 94					Th 232				
Mo 93					Th 234				
Tc 97					Pa 231				
Tc 99					Pa 233				
Ru 106					U 232				
Pd 107					U 233				
Ag 108m					U 234			2.33E-09	C B
Ag 110m					U 235				
Cd 109					U 236				
Cd 113m					U 238			3.50E-09	C B
Sn 119m					Np 237				
Sn 121m					Pu 236				
Sn 123					Pu 238			7.35E-08	C B
Sn 126					Pu 239			1.24E-07	C B
Sb 125					Pu 240			1.58E-07	C B
Sb 126					Pu 241			1.36E-06	C B
Te 125m					Pu 242				
Te 127m					Am 241			4.92E-07	C B
I 129			3.50E-09	C B 2	Am 242m				
Cs 134			1.17E-08	C B 2	Am 243				
Cs 135					Cm 242				
Cs 137			7.95E-06	C B	Cm 243			1.17E-09	C B 2
Ba 133					Cm 244			8.17E-09	C B 2
La 137					Cm 245				
La 138					Cm 246				
Ce 144					Cm 248				
Pm 145					Cf 249				
Pm 147			1.17E-09	C B	Cf 250				
Sm 147					Cf 251				
Sm 151					Cf 252				
Eu 152					Other a				
Eu 154			2.92E-08	C B	Other b/g				
Eu 155			1.05E-08	C B	**Total a**	**0**		**8.62E-07**	**C B 2**
Gd 153					**Total b/g**	**0**		**1.08E-05**	**C B 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 the average specific activity.

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