

WASTE STREAM**2E90****General Waste for Clifton Marsh Disposal**

SITE Springfield

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Springfield Fuels Limited

WASTE TYPE LLW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	1000.0 m ³
Future arisings -	1.4.2022 - 31.3.2025.....	~28000.0 m ³
	1.4.2025 - 31.3.2030.....	~28000.0 m ³
	1.4.2030 - 31.3.2040.....	28000.0 m ³
	1.4.2040 - 31.3.2050.....	15000.0 m ³
Total future arisings:		99000.0 m ³
Total waste volume:		100000.0 m ³

Comment on volumes: It is anticipated that waste disposals will be in line with plant operations and associated waste generation, and this usually occurs in the year of generation. It is the intention to continue with the policy of minimising arisings and pursuing processing routes to avoid generation of LLW. The radwaste disposals that Springfields make to the Clifton Marsh Landfill Site have changed with the issue to SITA (UK) Ltd (the site operator) of a new disposal authorisation to support the UK radwaste strategy. The activity concentrations limits within the new authorisation are higher within the scope of LLW than in previous authorisations. Uranium is the predominant disposal radionuclide in Springfields disposals to CMLFS; the site is authorised to accept material for disposal up to concentrations around the 200Bq/g level (0.2GBq/tonne). This clearly straddles the formally accepted definitions of VLLW and into the lower reaches of LLW. Springfields will continue to operate BAT principles in assessing the need to pre-treat any waste stream, hence the overall low activity concentration of this waste stream.

Uncertainty factors on volumes:	Stock (upper):	x 1.0	Arisings (upper)	x 1.25
	Stock (lower):	x 0.1	Arisings (lower)	x 0.75

WASTE SOURCE Wastes are from the manufacture of nuclear fuel and uranium intermediates at Springfields and include general lightly contaminated wastes including plastics, clothing, rubble etc.

PHYSICAL CHARACTERISTICS

General description: The RSA authorisation does not require subdivision of this general waste stream and hence no detailed information regarding composition is available. However, it is estimated that the waste stream includes general operational wastes contaminated with U, including scrap metal, plastics, glass, clothing. The waste has not undergone any change since it was generated.

Physical components (%wt): Plastics / rubber (30%), metal (9%), rubble/ concrete (30%), fabric (25%), putrescible (5%) and asbestos (building repairs) (1%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~0.25

Comment on density: The density is that of the drummed waste in storage and is based on nuclear material inventory data and the type of containment.

CHEMICAL COMPOSITION

General description and components (%wt): Plastics / rubber (30%), metal (9%), rubble/ concrete (30%), fabric (25%), putrescible (5%) and asbestos (building repairs) (1%).

Chemical state: Neutral

Chemical form of radionuclides: H-3: Not expected to be present.
C-14: Not expected to be present.
Cl-36: Not expected to be present.
Se-79: Not expected to be present.
Tc-99: Not expected to be present.
I-129: Not expected to be present.
Ra: Not expected to be present.

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Th: Not expected to be present.
 U: Oxides of uranium.
 Np: Not expected to be present.
 Pu: Not expected to be present.

Metals and alloys (%wt): Amounts of metals within the waste stream have been estimated as detailed figures are currently unavailable.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	~1.0	This is a varied waste stream so specific breakdown is not available	
Other ferrous metals.....	~4.0		
Iron.....	~1.0		
Aluminium.....	<0.50		
Beryllium.....	0		
Cobalt.....	0		
Copper.....	<1.5		
Lead.....	<0.50		
Magnox/Magnesium.....	0		
Nickel.....	0		
Titanium.....	0		
Uranium.....	<0.02		
Zinc.....	<0.50		
Zircaloy/Zirconium.....	0		
Other metals.....	0		

Organics (%wt): It is noted that a detailed composition of this general waste stream is currently unavailable and therefore these figures have been estimated.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	~10.0	This is a varied waste stream so specific breakdown is not available	
Paper, cotton.....	~8.0		
Wood.....	~2.0		
Halogenated plastics	~10.0		
Total non-halogenated plastics.....	~10.0		
Condensation polymers.....	~5.0		
Others.....	~5.0		
Organic ion exchange materials....	0		
Total rubber.....	~15.0		
Halogenated rubber	~15.0		
Non-halogenated rubber.....	0		
Hydrocarbons.....	~5.0		
Oil or grease	0		
Fuel.....	0		
Asphalt/Tarmac (cont.coal tar)...	0		
Asphalt/Tarmac (no coal tar).....	~5.0		
Bitumen.....	0		
Others.....	0		

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Other organics.....	10.0		
Other materials (%wt):	-		
	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..		This is a varied waste stream so specific breakdown is not available	
Inorganic sludges and flocs.....			
Soil.....	6.0		
Brick/Stone/Rubble.....	10.0		
Cementitious material.....	8.0		
Sand.....			
Glass/Ceramics.....	6.0		
Graphite.....			
Desiccants/Catalysts.....			
Asbestos.....	~1.0	Mostly building fabric in sheet form some old lagging from process vessels and may be either Amosite, Chrysotile or Crocidolite, all will be consigned to a purpose built mono cell.	
Non/low friable.....	~1.0		
Moderately friable.....	0		
Highly friable.....	0		
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		
Inorganic anions (%wt):	-		
	(%wt)	Type(s) and comment	
Fluoride.....			
Chloride.....			
Iodide.....			
Cyanide.....			
Carbonate.....			
Nitrate.....			
Nitrite.....			
Phosphate.....			
Sulphate.....			
Sulphide.....			
Materials of interest for waste acceptance criteria:		This is a varied waste stream so specific breakdown is not available	

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	(%wt)	Type(s) and comment
Combustible metals.....	P	This is a varied waste stream so specific breakdown is not available
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	
Hydrides.....	0	
Biological etc. materials.....	0	
Biodegradable materials.....	~5.0	
Putrescible wastes.....	~5.0	
Non-putrescible wastes.....	P	This is a varied waste stream so specific breakdown is not available
Corrosive materials.....	0	
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	0	
Higher activity particles.....	0	
Soluble solids as bulk chemical compounds.....	P	This is a varied waste stream so specific breakdown is not available

Hazardous substances / Asbestos ~1%.
non hazardous pollutants:

	(%wt)	Type(s) and comment
Acrylamide.....	0	
Benzene.....	0	
Chlorinated solvents.....	0	
Formaldehyde.....	0	
Organometallics.....	0	
Phenol.....	0	
Styrene.....	0	
Tri-butyl phosphate.....	NE	
Other organophosphates.....	0	
Vinyl chloride.....	NE	This is a varied waste stream so specific breakdown is not available
Arsenic.....	0	
Barium.....	0	
Boron.....	0	
Boron (in Boral).....	0	
Boron (non-Boral).....	0	
Cadmium.....	0	
Caesium.....	0	
Selenium.....	0	
Chromium.....	NE	
Molybdenum.....	0	

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Thallium.....	0
Tin.....	NE
Vanadium.....	NE
Mercury compounds.....	0
Others.....	NE
Electronic Electrical Equipment (EEE)	
EEE Type 1.....	0
EEE Type 2.....	0
EEE Type 3.....	0
EEE Type 4.....	0
EEE Type 5.....	0

Complexing agents (%wt): Not yet determined

(%wt) Type(s) and comment

EDTA.....
DPTA.....
NTA.....
Polycarboxylic acids.....
Other organic complexants.....
Total complexing agents.....

Potential for the waste to contain discrete items: No.

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		
Recycling / reuse		
Other / various		
None		100.0

Comment on planned treatments:

A lot of work goes on before material is classified into this waste stream, once it is classified no further segregation / treatment is appropriate.

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	100.0	-0.25
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		

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

This waste stream consists of mixed municipal waste from plant operations (paper, plastic, polly, building and maintenance wastes.

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

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: Not yet determined

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

Waste Packaging for Disposal: (Not applicable to this waste stream)

Container	Stream volume %	Waste loading m ³	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 (Skips / Drums)			

Other information: Waste stream loaded into 14 and 33 M3 skips and 210L drums.

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: The main source of activity is contamination by uranium and its daughters. The waste becomes contaminated from contact with intermediate uranium compounds during the fuel

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	manufacturing process.
Uncertainty:	Activities are estimated on the basis that site processes a mixture of natural and enriched material.
Definition of total alpha and total beta/gamma:	The waste stream is contaminated by coming in contact with Uranium and its intermediate products (oxides). The uranium is from a series of enrichments with a Site mean of 3.2%U235, it is assumed that the uranium is not irradiated therefore contains no reactor products and is aged to a point of equilibrium. This waste stream typically has an activity concentration of 25Bq/g therefore this is split equally between alpha and beta/ gamma activity.
Measurement of radioactivities:	by chemical analysis and direct monitoring
Other information:	A total activity is assumed in the Radionuclide tab based on the site generic fingerprint and has been assumed a 50:50 split between alpha and b/g.

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2022	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					Pb 205				
Fe 55					Pb 210				
Co 60					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					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					U 233				
Pd 107					U 234				
Ag 108m					U 235				
Ag 110m					U 236				
Cd 109					U 238				
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238				
Sn 123					Pu 239				
Sn 126					Pu 240				
Sb 125					Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241				
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137					Cm 244				
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					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					Total a	1.25E-05	AA 1	1.25E-05	BB 2
Eu 155					Total b/g	1.25E-05	AA 1	1.25E-05	BB 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