WASTE STREAM 2E91 Process Wastes for Clifton Marsh

SITE	Springfields
SITE OWNER	Nuclear Decommissioning Authority
WASTE CUSTODIAN	Springfields Fuels Limited
WASTE TYPE	LLW
Is the waste subject to Scottish Policy:	No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	~30.0 m³
Future arisings -	1.4.2022 - 31.3.2025.....	~64.0 m³
	1.4.2025 - 31.3.2030.....	~30.0 m³
Total future arisings:		94.0 m³
Total waste volume:		124.0 m³

Comment on volumes: Waste disposals are in line with expected plant operations and associated waste generation and usually occur 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 principals in assessing the need to pre-treat any waste stream.

Uncertainty factors on volumes:				
	Stock (upper):	x 1.0	Arisings (upper)	x 2.0
	Stock (lower):	x 1.0	Arisings (lower)	x 0.2

WASTE SOURCE The waste is in the form of waste cakes generated during residues processing activities.

PHYSICAL CHARACTERISTICS

General description:	The wastes are uranic residues from uranium purification residues recovery processes. The wastes will also contain a proportion of silica based filter aid. No items require special handling. The waste does not undergo any change between generation and disposal.
Physical components (%wt):	Acid insoluble mineral compounds (54.8%), finely divided graphite (35%), metal (10%) and uranium content (~ 0.2%).
Sealed sources:	The waste does not contain sealed sources.
Bulk density (t/m³):	~1.5
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):	Acid insoluble mineral compounds (54.8%), finely divided graphite (35%), metal (10%) and uranium content (~ 0.2%).
Chemical state:	Acid
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. 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):	The 200 litre metal drum in which the waste is currently stored will be disposed of as part of the waste stream.

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....			
Other ferrous metals.....	10.0	main constituent the mild steel package	
Iron.....			
Aluminium.....			
Beryllium.....			
Cobalt.....			
Copper.....			
Lead.....			
Magnox/Magnesium.....			
Nickel.....			
Titanium.....			
Uranium.....	~0.20		
Zinc.....			
Zircaloy/Zirconium.....			
Other metals.....			

Organics (%wt): Not estimated.

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

Other materials (%wt): The inorganic sludge is expected to represent the silica based filter aid which is the likely main component.

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	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	54.8		
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	0		
Sand.....	0		
Glass/Ceramics.....	0		
Graphite.....	35.0		
Desiccants/Catalysts.....	0		
Asbestos.....	0	Not expected to be present.	
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		

Inorganic anions (%wt): Nitrates may be present from the residues recovery process. Other anions are not expected to be present.

	(%wt)	Type(s) and comment
Fluoride.....	0	
Chloride.....	0	
Iodide.....	0	
Cyanide.....	0	
Carbonate.....	0	
Nitrate.....	~1.0	
Nitrite.....	0	
Phosphate.....	0	
Sulphate.....	0	
Sulphide.....	0	

Materials of interest for waste acceptance criteria: -

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

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Non-putrescible wastes.....	0	
Corrosive materials.....	P	The process wastes are subject to an acid wash process and hence there is the potential for the wastes to be mildly acidic.
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	0	
Higher activity particles.....	0	
Soluble solids as bulk chemical compounds.....	0	

Hazardous substances / non hazardous pollutants: The process wastes are subject to an acid wash process and hence there is the potential for the wastes to be mildly acidic.

	(%wt)	Type(s) and comment
Acrylamide.....	0	
Benzene.....	0	
Chlorinated solvents.....	0	
Formaldehyde.....	0	
Organometallics.....	0	
Phenol.....	0	
Styrene.....	0	
Tri-butyl phosphate.....	0	
Other organophosphates.....	0	
Vinyl chloride.....	0	
Arsenic.....	0	
Barium.....	0	
Boron.....	0	
Boron (in Boral).....	0	
Boron (non-Boral).....	0	
Cadmium.....	0	
Caesium.....	0	
Selenium.....	0	
Chromium.....	0	
Molybdenum.....	0	
Thallium.....	0	
Tin.....	0	
Vanadium.....	0	
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	

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EEE Type 5..... 0

Complexing agents (%wt): No

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

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		
Recyling / reuse		
Other / various		
None		100.0

Comment on planned treatments: This material is already the result of uranium bearing residues being processed so requires no further treatment.

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	~1.5
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		

Classification codes for waste expected to be consigned to a landfill facility: The wastes are uranic residues from uranium purification residues recovery processes. The wastes will also contain a proportion of silica based filter aid. No items require special handling.

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

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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 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			

Other information: -

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 manufacturing process.

Uncertainty: Activities are estimated on the basis that site processes a mixture of natural and enriched material.

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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 75Bq/g therefore this is split equally between alpha and beta/ gamma activity.
Measurement of radioactivities:	Sample chemical analysis.
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/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					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**	**3.75E-05**	**B B 2**	**3.75E-05**	**B B 2**
Eu 155					**Total b/g**	**3.75E-05**	**B B 2**	**3.75E-05**	**B 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 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