

<b>WASTE STREAM</b>	<b>2E15</b>	<b>Drummed Waste for Disposal at LLW Repository</b>
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**SITE** Springfield

**SITE OWNER** Nuclear Decommissioning Authority

**WASTE CUSTODIAN** Springfields Fuels Limited

**WASTE TYPE** LLW

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2019.....	~0 m <sup>3</sup>
Future arisings -	1.4.2019 - 31.3.2031.....	NE m <sup>3</sup>
Total future arisings:		0 m <sup>3</sup>
Total waste volume:		0 m <sup>3</sup>

Comment on volumes: This stream covers existing legacy materials and there are expected to be limited arisings in this category. No LLW has been disposed of at LLWR since 2007. SFL minimise disposals of LLW by pursuing alternative processing routes. However future arisings unsuitable for decontamination may require disposal as LLW. The stock volumes within this waste stream have reduced since the 2010 inventory due to the work done in re-evaluating material against the new disposal authorisation at Clifton Marsh Landfill Site (CMLFS).

Uncertainty factors on volumes:

Stock (upper):	x	Arisings (upper)	x 10.0
Stock (lower):	x	Arisings (lower)	x 0.1

**WASTE SOURCE** Made up of items including: Broken silica crucibles containing samples of fused uranium/tungsten mixture from Chemical and Metallurgical Services Dept. Some of the uranium is enriched, estimated average 3% U235; and broken sheet asbestos from Magnox metal casting facilities contaminated with mainly natural uranium metal or oxide.

**PHYSICAL CHARACTERISTICS**

General description: The waste is comprised of inert materials - plastic, glassware/ceramic, asbestos in addition to the radioactive contaminant. The waste has not undergone any change since it was generated.

Physical components (%wt): Asbestos (80%), ceramic/glass (10%), plastic (5%) and radioactive contaminant (5%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): ~1.25

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): Asbestos (80%), ceramic/glass (10%), plastic (5%) and radioactive contaminant (5%).

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.  
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): There is the potential that the 200 litre metal drum in which the waste is currently stored may become part of the waste stream. However, this is not currently accounted for in the composition.

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	Stainless steel.....	0
	Other ferrous metals.....	0
	Iron.....	0
	Aluminium.....	0
	Beryllium.....	0
	Cobalt.....	0
	Copper.....	0
	Lead.....	0
	Magnox/Magnesium.....	0
	Nickel.....	0
	Titanium.....	0
	Uranium.....	<1.0
	Zinc.....	0
	Zircaloy/Zirconium.....	0
	Other metals.....	0
Organics (%wt):	-	
	Total cellulose.....	0
	Paper, cotton.....	0
	Wood.....	0
	Halogenated plastics .....	0
	Total non-halogenated plastics.....	<5.0
	Condensation polymers.....	0
	Others.....	0
	Organic ion exchange materials....	0
	Total rubber.....	0
	Halogenated rubber .....	0
	Non-halogenated rubber.....	0
	Hydrocarbons.....	0
	Oil or grease .....	0
	Fuel.....	0
	Asphalt/Tarmac (cont.coal tar)...	0
	Asphalt/Tarmac (no coal tar)....	0
	Bitumen.....	0
	Others.....	0
	Other organics.....	0
Other materials (%wt):	The ceramic material is broken silica crucibles.	
	Inorganic ion exchange materials.	0
	Inorganic sludges and flocs.....	0
	Soil.....	0
	Brick/Stone/Rubble.....	0
	Cementitious material.....	0
	Sand.....	0
	Glass/Ceramics.....	10.0

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	Graphite.....	0
	Desiccants/Catalysts.....	0
	Asbestos.....	80.0
	Non/low friable.....	~40.0
	Moderately friable.....	~40.0
	Highly friable.....	0
	Free aqueous liquids.....	0
	Free non-aqueous liquids.....	0
	Powder/Ash.....	0
Inorganic anions (%wt):	No inorganic anions are expected to be present.	
	Fluoride.....	0
	Chloride.....	0
	Iodide.....	0
	Cyanide.....	0
	Carbonate.....	0
	Nitrate.....	0
	Nitrite.....	0
	Phosphate.....	0
	Sulphate.....	0
	Sulphide.....	0
Materials of interest for waste acceptance criteria:	-	
	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
	Non-putrescible wastes.....	0
	Corrosive materials.....	0
	Pyrophoric materials.....	0
	Generating toxic gases.....	0
	Reacting with water.....	0
	Active particles.....	0
	Soluble solids as bulk chemical compounds.....	0
Hazardous substances / non hazardous pollutants:	The waste contains asbestos.	
	Acrylamide.....	0
	Benzene.....	0
	Chlorinated solvents.....	0

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Formaldehyde.....	0
Organometallics.....	0
Phenol.....	0
Styrene.....	0
Tri-butyl phosphate.....	0
Other organophosphates.....	0
Vinyl chloride.....	0
Arsenic.....	0
Barium.....	0
Boron.....	0
Cadmium.....	0
Caesium.....	0
Selenium.....	0
Chromium.....	0
Molybdenum.....	0
Thallium.....	0
Tin.....	0
Vanadium.....	0
Mercury compounds.....	0
Others.....	0
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):	No
EDTA.....	
DPTA.....	
NTA.....	
Polycarboxylic acids.....	
Other organic complexants.....	
Total complexing agents.....	0

None expected to be present.

**TREATMENT, PACKAGING AND DISPOSAL**

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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:

The waste will need to be properly assessed and discussed with LLW disposal technical staff to determine whether any pre-treatment is necessary.

**Disposal Routes:**

Disposal Route	Stream volume %
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	100.0

**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 m <sup>3</sup>	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	100.0	NE	NE

Other information:

Not yet assessed

**Waste Planned for Disposal at the LLW Repository:**

Container voidage:

Not yet assessed

Waste Characterisation Form (WCH):

The waste does not meet the LLWR's Waste Acceptance Criteria (WAC).  
The waste does not have a current WCH.

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There are a number of issues relating to whether this waste stream is suitable for disposal at the LLWR (eg. due to U content) and hence these require resolution before an accurate plan of the disposal regime can be finalised.

Waste consigned for disposal to LLWR in year of generation:

No. Wastes are stored pending work on decontamination methods or the development of waste stream characterisation fingerprints. The timescales for qualifying waste types for disposal mean that some wastes are not disposed of in the year of arising.

Potential for the waste to contain discrete items:

No

**Non-Containerised Waste for In-Vault Grouting:**

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.

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 3000Bq/g therefore this is split equally between alpha and beta/ gamma activity.

Measurement of radioactivities:

The estimated activity concentration values for uranium (the main radiological component) have been confirmed by an data audit review conducted in 2002 for the Company Waste Inventory.

Other information:

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Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	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					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					<b>Total a</b>	<b>0</b>	<b>-1.8E-03</b>	<b>BB 2</b>	
Eu 155					<b>Total b/g</b>	<b>0</b>	<b>-1.8E-03</b>	<b>BB 2</b>	

**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