

WASTE STREAM	2F40	Fuel Support Frames
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SITE Sellafield
SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Sellafield Limited

WASTE TYPE LLW; SPD1

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	17.7 m ³
Total future arisings:		0 m ³
Total waste volume:		17.7 m ³

Comment on volumes: Assumes a medium term strategy for decommissioning the Hokkaido Baskets. The total number of support frames (Hokkaido Baskets) is 6. Baskets currently stored inside Excellox 4 flasks undercover at Sellafield. The volume declared is the volume of the support frames however, it is planned to decontaminate and recycle the metal. If this is successful only small amounts of residues will arise for disposal. A study is currently being carried out to consider options for decommissioning the PNTL (Japanese owned flasks on the Sellafield site) which may influence the overall decommissioning strategy for the support frames.

Uncertainty factors on volumes:

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

WASTE SOURCE Transport of LWR fuel assemblies from a reactor site in Japan to a reprocessing plant in France.

PHYSICAL CHARACTERISTICS

General description: Open frames used to hold LWR fuel assemblies inside Excellox transport flasks. Frames are large (4.86m long by 0.88m diameter) and heavy (4.4te). The waste has not undergone any changes since it was generated.

Physical components (%vol): Stainless steel fuel support frames (100%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~1.49

Comment on density: The density is the mass divided by the envelope volume.

CHEMICAL COMPOSITION

General description and components (%wt): Stainless steel (~ 100%), Traffolite (trace). Likely to be 304L Stainless Steel.

Chemical state: Neutral

Chemical form of radionuclides: C-14: Oxides.
Tc-99: Oxides.
U: Oxides.
Pu: Oxides.

Metals and alloys (%wt): Mostly sheet metal.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	~100.0	Likely 304L.	
Other ferrous metals.....	0		
Iron.....			
Aluminium.....			
Beryllium.....			
Cobalt.....	0		
Copper.....			
Lead.....	0		

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Magnox/Magnesium.....	0
Nickel.....	
Titanium.....	
Uranium.....	
Zinc.....	0
Zircaloy/Zirconium.....	0
Other metals.....	0

Organics (%wt): Trace amounts of Traffolite (phenolic resin) are present as identification plates on the frames.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	0		
Paper, cotton.....	0		
Wood.....	0		
Halogenated plastics	0		
Total non-halogenated plastics.....	TR		
Condensation polymers.....	TR		
Others.....	0		
Organic ion exchange materials....	0		
Total rubber.....	0		
Halogenated rubber	0		
Non-halogenated rubber.....	0		
Hydrocarbons.....			
Oil or grease			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....	0		

Other materials (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	0		
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	0		
Sand.....			
Glass/Ceramics.....			
Graphite.....	0		
Desiccants/Catalysts.....			
Asbestos.....	0		
Non/low friable.....			

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Moderately friable.....

Highly friable.....

Free aqueous liquids..... 0

Free non-aqueous liquids..... 0

Powder/Ash..... 0

Inorganic anions (%wt): The listed anions are unlikely to be present.

	(%wt)	Type(s) and comment
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: No materials likely to pose a fire or other non-radiological hazard have been identified.

	(%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	
Non-putrescible wastes.....	0	
Corrosive materials.....	0	
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	0	
Higher activity particles.....		
Soluble solids as bulk chemical compounds.....		

Hazardous substances / non hazardous pollutants: -

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....		
Chlorinated solvents.....		

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Formaldehyde.....

Organometallics.....

Phenol.....

Styrene.....

Tri-butyl phosphate.....

Other organophosphates.....

Vinyl chloride.....

Arsenic.....

Barium.....

Boron.....

Boron (in Boral).....

Boron (non-Boral).....

Cadmium.....

Caesium.....

Selenium.....

Chromium.....

Molybdenum.....

Thallium.....

Tin.....

Vanadium.....

Mercury compounds.....

Others.....

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 Yes. Waste itself could be a discrete item
contain discrete items:**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		100.0
Supercompaction (HFC)		
Incineration		
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None		

Comment on planned treatments:

Treatment will be via size reduction and decontamination, with an anticipated maximum of 5% of the basket assumed to be disposed of to the LLWR as LLW. The remainder is anticipated to be free release scrap.

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	5.0	1.5
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	95.0	1.5
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):

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: -

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

Waste Packaging for Disposal:

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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	5.0	10	< 1

Other information: -

Waste Planned for Disposal at the LLW Repository:

Container voidage: -

Waste Characterisation Form (WCH): It is not yet determined if the waste meets LLWR's Waste Acceptance Criteria (WAC).
The waste does not have a current WCH.

No WCH currently in place for this waste. It will be developed at the time for disposal of the flasks and frames.

Waste consigned for disposal to LLWR in year of generation: No. The waste is stored inside Excellox 4 transport flasks at present and will be dealt with when the flasks are decommissioned. This is dependent on work load and NDA strategy.

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 activity arises from a) corrosion products in the reactor cooling circuit adhering to the fuel and being dislodged and b) contamination from pond water.

Uncertainty: The activity depends on the quality of fuel and the length of time the fuel has been in the frame, and the time since removal of the fuel.

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: Individual nuclide activities have not been determined, but the nuclides listed are based on those present in Multi Element Bottles (MEBs).

Other information: Beta/gamma activity dominant.

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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		6			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		6			Pb 205				
Fe 55		6			Pb 210				
Co 60		6			Bi 208				
Ni 59		6			Bi 210m				
Ni 63		6			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		6			U 232				
Ru 106					U 233				
Pd 107					U 234		6		
Ag 108m					U 235				
Ag 110m					U 236		6		
Cd 109					U 238		6		
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238		6		
Sn 123					Pu 239		6		
Sn 126					Pu 240				
Sb 125					Pu 241		6		
Sb 126					Pu 242				
Te 125m					Am 241		6		
Te 127m					Am 242m				
I 129		6			Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243		6		
Cs 137		6			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	NE		0	
Eu 155					Total b/g	1.50E-02	BC 2	0	

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