

WASTE STREAM	2D45	Magnox Fuel End Crops
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SITE Sellafield
SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Sellafield Limited

WASTE TYPE ILW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	27.7 m ³
Total future arisings:		0 m ³
Total waste volume:		27.7 m ³

Comment on volumes: End-cropping of Tokai Mura fuel in FHP has now been completed. No further arisings are expected. TMECs will be removed from the pond after 2035. Volume known precisely as it is a static stock, but some uncertainty present due to unknown carry of inventory from end cropping process.

Uncertainty factors on volumes:	Stock (upper):	x 1.05	Arisings (upper)	x
	Stock (lower):	x 0.95	Arisings (lower)	x

WASTE SOURCE End crops from Magnox fuel elements.

PHYSICAL CHARACTERISTICS

General description: End crops comprise a cylinder (~50 x 50mm) composed of uranium and Magnox and containing a small disc of sintered alumina and a small zirconium plug. There are no large items present. The waste has not undergone any change since it was generated.

Physical components (%wt): Uranium annuli (60 wt%), Magnox cladding and end fittings (25 wt%), sintox (alumina) discs (7 wt%), zirconium plugs (8 wt%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 1.54

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): Magnox (25%), uranium (60%), zirconium (8%) and alumina (7%).

Chemical state: Neutral

Chemical form of radionuclides: H-3: Present in elemental and reacted forms.
 C-14: Present in elemental and reacted forms.
 Cl-36: Unknown.
 Se-79: Present in elemental and reacted forms.
 Tc-99: Present in elemental and reacted forms.
 I-129: Unknown.
 Ra: Ra isotopes will exist in the metallic and oxide fuel.
 U: Present in metallic and reacted forms (oxides and hydrides).
 Np: Present in metallic and reacted forms.
 Pu: Present in metallic and reacted forms.

Metals and alloys (%wt): No sheet metal. Bulk metal in the form of cylinders 50mm x 50mm.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	0		
Other ferrous metals.....	0		
Iron.....	0		
Aluminium.....	0		
Beryllium.....	0		
Cobalt.....	0		

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Copper.....	0
Lead.....	0
Magnox/Magnesium.....	25.0
Nickel.....	0
Titanium.....	0
Uranium.....	60.0
Zinc.....	0
Zircaloy/Zirconium.....	8.0
Other metals.....	0

Organics (%wt): No organic materials are present. None present.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	0		
Paper, cotton.....	0		
Wood.....	0		
Halogenated plastics	0		
Total non-halogenated plastics.....	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			
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.....	0		
Glass/Ceramics.....	7.0		
Graphite.....	0		
Desiccants/Catalysts.....	0		

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Asbestos.....	0
Non/low friable.....	
Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	0
Free non-aqueous liquids.....	0
Powder/Ash.....	0

Inorganic anions (%wt): No inorganic anions are 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: The waste contains Magnox and uranium hydride.

	(%wt)	Type(s) and comment
Combustible metals.....	25.0	
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.....	25.0	
Higher activity particles.....	0	
Soluble solids as bulk chemical compounds.....	0	

Hazardous substances / non hazardous pollutants: -

	(%wt)	Type(s) and comment
Acrylamide.....	0	

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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).....	
Boron (non-Boral).....	
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.....	
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.....	

Potential for the waste to contain discrete items: Not yet determined. Conditioning and waste packaging to be determined.

PACKAGING AND CONDITIONING

Conditioning method: To be determined.

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Plant Name: Bulk Uranics Fuel Treatment (BUFT) capability.
 Location: Sellafield.
 Plant startup date: 2038
 Total capacity (m³/y incoming waste): -
 Target start date for packaging this stream: 2043
 Throughput for this stream (m³/y incoming waste): -
 Other information: BUFT is a notional capability at this stage rather than a defined facility.

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Number of packages
	Sellafield enhanced 3m ³ box	100.0	NE	2.15	NE

Likely container type comment: -
 Range in container waste volume: -
 Other information on containers: -
 Likely conditioning matrix:
 Other information: -
 Conditioned density (t/m³): NE
 Conditioned density comment: -
 Other information on conditioning: -
 Opportunities for alternative disposal routing: No

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

RADIOACTIVITY

Source: Fission products and actinides.
 Uncertainty: The activity is calculated and is estimated to be within a factor of 50%.
 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: -
 Other information: The specific activities are at the time of arising. "Other alpha" is U-235m.

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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	3.04E-01	AA 2			Gd 153				
Be 10					Ho 163				
C 14	1.05E-03	AA 2			Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36	1.41E-03	BB 2			Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41	2.47E-03	AA 2			Pt 193				
Mn 53					Tl 204				
Mn 54	1.97E-10	AA 2			Pb 205				
Fe 55	2.30E-03	AA 2			Pb 210	6.21E-09	AA 2		
Co 60	1.81E-01	AA 2			Bi 208				
Ni 59	1.06E-04	AA 2			Bi 210m				
Ni 63	1.14E-02	AA 2			Po 210	5.94E-09	AA 2		
Zn 65	6.25E-11	AA 2			Ra 223	1.20E-07	AA 2		
Se 79					Ra 225	5.41E-11	AA 2		
Kr 81					Ra 226	2.34E-08	AA 2		
Kr 85	4.74E+00	AA 2			Ra 228	9.88E-13	AA 2		
Rb 87					Ac 227	1.20E-07	AA 2		
Sr 90	1.34E+02	AA 2			Th 227	1.18E-07	AA 2		
Zr 93	7.75E-03	AA 2			Th 228	8.57E-13	AA 2		
Nb 91					Th 229	5.43E-11	AA 2		
Nb 92					Th 230	3.25E-06	AA 2		
Nb 93m	5.36E-03	AA 2			Th 232	1.39E-12	AA 2		
Nb 94	1.47E-09	AA 2			Th 234	1.13E-02	AA 2		
Mo 93					Pa 231	2.85E-07	AA 2		
Tc 97					Pa 233	3.76E-04	AA 2		
Tc 99	5.43E-02	AA 2			U 232				
Ru 106	2.90E-05	AA 2			U 233	4.23E-08	AA 2		
Pd 107					U 234	1.02E-02	AA 2		
Ag 108m					U 235	3.17E-04	AA 2		
Ag 110m	8.38E-11	AA 2			U 236	1.01E-03	AA 2		
Cd 109					U 238	1.13E-02	AA 2		
Cd 113m					Np 237	3.76E-04	AA 2		
Sn 119m					Pu 236				
Sn 121m	1.47E-03	AA 2			Pu 238	8.75E-01	AA 2		
Sn 123	8.05E-19	AA 2			Pu 239	3.68E+00	AA 2		
Sn 126					Pu 240	3.43E+00	AA 2		
Sb 125	1.50E-02	AA 2			Pu 241	6.46E+01	AA 2		
Sb 126					Pu 242	1.23E-03	AA 2		
Te 125m	3.75E-03	AA 2			Am 241	7.19E+00	AA 2		
Te 127m	2.47E-23	AA 2			Am 242m	1.02E-02	AA 2		
I 129	9.68E-05	AA 2			Am 243	2.10E-03	AA 2		
Cs 134	5.88E-03	AA 2			Cm 242	8.43E-03	AA 2		
Cs 135					Cm 243				
Cs 137	1.84E+02	AA 2			Cm 244	1.16E-02	AA 2		
Ba 133					Cm 245	5.19E-07	AA 2		
La 137					Cm 246				
La 138					Cm 248				
Ce 144	1.35E-06	AA 2			Cf 249				
Pm 145					Cf 250				
Pm 147	3.78E-01	AA 2			Cf 251				
Sm 147	1.26E-08	AA 2			Cf 252				
Sm 151	1.10E+00	AA 2			Other a	3.67E+00	AA 2		
Eu 152	2.15E-02	AA 2			Other b/g	5.37E+01	AA 2		
Eu 154	6.24E-01	AA 2			Total a	1.89E+01	AA 2		0
Eu 155	2.42E-01	AA 2			Total b/g	4.44E+02	AA 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