

WASTE STREAM	2F21/C	Encapsulated Maintenance Scrap
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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

		Conditioned	Packaged
Stocks:	At 1.4.2022.....	103.0m ³	117.6m ³
Total future arisings:		0 m ³	0 m ³
Total waste volume:		103.0m ³	117.6m ³
Number of waste packages in stock:	At 1.4.2022.....	206 package(s)	

Comment on volumes: Stocks of THORP scrap held within THORP post completion of shearing in 2018. No additional information available. The uncertainty on the volumes is expected to be +/- a factor of 1.1.

Uncertainty factors on volumes:	Stock (upper):	x 1.1	Arisings (upper)	x
	Stock (lower):	x 0.9	Arisings (lower)	x

WASTE SOURCE Scrap equipment from shearing operations in THORP.

PHYSICAL CHARACTERISTICS

General description: Scrap equipment from shear cave maintenance, basket handling cave crane maintenance and miscellaneous items. This is then encapsulated in grout. The waste has not undergone any change since it was generated.

Physical components (%wt): Shear blades, screws, crane lifting chains and lockers, other items of equipment (all totalling 15.6 wt%). These are contained in mild steel baskets (8.4 wt%), grout (76 wt%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 2.6

Comment on density: Density of conditioned waste. Raw waste density ~ 1.6 t/m³.

CHEMICAL COMPOSITION

General description and components (%wt): Stainless steel (13%), tool steel/mild steel (11%), grout (76%).

Chemical state: Alkali

Chemical form of radionuclides: H-3: Not estimated.
 C-14: Not estimated.
 Cl-36: Present as trace amounts of clathrate compounds of metallic salts readily lost to aqueous solution.
 Se-79: Not estimated.
 Tc-99: Not estimated.
 I-129: Present as trace amounts of clathrate compounds of metallic salts readily lost to aqueous solution.
 Ra: Not estimated.
 Th: Not estimated.
 U: UO₂.
 Np: Not estimated.
 Pu: PuO₂.

Metals and alloys (%wt): The size and shape of scrap is very variable, depending on the operations being carried out. 75% of other ferrous metals comprises baskets.

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	13.0	Grades 316L and 304.	
Other ferrous metals.....	11.0	Tool steel, mild steel.	
Iron.....			
Aluminium.....	0		
Beryllium.....	TR		
Cobalt.....	0		
Copper.....	0		
Lead.....	0		
Magnox/Magnesium.....	0		
Nickel.....	0		
Titanium.....			
Uranium.....	<0.01		
Zinc.....	0		
Zircaloy/Zirconium.....	TR		
Other metals.....	0		

Organics (%wt): There are no organic materials present except for nylon and polyurethane or hydrogenated nitrile rubber (from grout pigs) in very small amounts in drums of encapsulated product. Hydrogenated nitrile rubber and /or polyurethane.

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

Other materials (%wt): Matrix grout makes approx 76% of immobilised package.

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	(%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.....	76.0		
Sand.....	0	No sand is present in encapsulation grout.	
Glass/Ceramics.....	0		
Graphite.....	0		
Desiccants/Catalysts.....			
Asbestos.....	0		
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		

Inorganic anions (%wt): Anions are mostly nitrates, others may be present.

	(%wt)	Type(s) and comment
Fluoride.....	NE	
Chloride.....	NE	
Iodide.....	NE	
Cyanide.....	NE	
Carbonate.....	NE	
Nitrate.....	P	
Nitrite.....	TR	
Phosphate.....	NE	
Sulphate.....	NE	
Sulphide.....	NE	

Materials of interest for waste acceptance criteria: Small quantities of Zircaloy fines will be present on some items, but will not constitute a hazard.

	(%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.....		

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Corrosive materials.....	0	
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	0	
Higher activity particles.....	P	Small fraction immobilised in grout.
Soluble solids as bulk chemical compounds.....	P	Some calcium compounds from grout.

Hazardous substances / Toxic metals are not expected to be present.
non hazardous pollutants:

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....	0	
Chlorinated solvents.....		
Formaldehyde.....		
Organometallics.....		
Phenol.....	0	
Styrene.....		
Tri-butyl phosphate.....	0	
Other organophosphates.....		
Vinyl chloride.....	0	
Arsenic.....	0	
Barium.....		
Boron.....	0	
Boron (in Boral).....		
Boron (non-Boral).....		
Cadmium.....	0	
Caesium.....		
Selenium.....	0	
Chromium.....	P	Small amount present in encapsulation grout OPC.
Molybdenum.....	0	
Thallium.....		
Tin.....	P	Trace amount in encapsulation grout OPC.
Vanadium.....	0	
Mercury compounds.....		
Others.....	0	
Electronic Electrical Equipment (EEE)		
EEE Type 1.....		
EEE Type 2.....		
EEE Type 3.....		
EEE Type 4.....		
EEE Type 5.....		

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Complexing agents (%wt): No

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids.....		
Other organic complexants.....	0	No complexing agents are present.
Total complexing agents.....	0	

Potential for the waste to contain discrete items: No.

PACKAGING AND CONDITIONING

Container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Number of packages
	500 l drum	100.0	0.5	0.5	206

Container type comment: Conditioning factor is 1, packaging factor is 1.14.

Range in container waste volume: Volume will be dependant on items in drum prior to conditioning, however, optimum packing fraction will be attempted in all cases.

Other information on containers: 500 litre 3mm stainless steel drums (1192mm x 800mm) fitted with a lid that contains a filter.

Conditioned density (t/m³): ~2.6

Conditioned density comment: -

Other information on conditioning: The waste is already conditioned.

RADIOACTIVITY

Source: The main source of activity is fuel dust contamination.

Uncertainty: -

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: The activities are calculated.

Other information: Other alpha and other beta/gamma not specified.

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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		5			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		5		
Co 60					Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210		5		
Zn 65					Ra 223		5		
Se 79		5			Ra 225		5		
Kr 81					Ra 226		5		
Kr 85					Ra 228		5		
Rb 87					Ac 227		5		
Sr 90	7.06E-02	CC 2			Th 227		5		
Zr 93		5			Th 228		5		
Nb 91					Th 229		5		
Nb 92					Th 230		5		
Nb 93m		5			Th 232		5		
Nb 94		5			Th 234		5		
Mo 93					Pa 231		5		
Tc 97					Pa 233	2.06E-08	CC 2		
Tc 99		5			U 232				
Ru 106	3.19E-05	CC 2			U 233		5		
Pd 107		5			U 234	1.62E-07	CC 2		
Ag 108m		5			U 235		5		
Ag 110m					U 236	4.59E-10	CC 2		
Cd 109					U 238		5		
Cd 113m					Np 237	2.08E-08	CC 2		
Sn 119m					Pu 236				
Sn 121m					Pu 238	3.54E-03	CC 2		
Sn 123					Pu 239	8.00E-04	CC 2		
Sn 126	1.00E-06	CC 2			Pu 240	1.00E-03	CC 2		
Sb 125					Pu 241	5.19E-02	CC 2		
Sb 126	1.40E-07	CC 2			Pu 242	3.00E-06	CC 2		
Te 125m					Am 241	4.50E-03	CC 2		
Te 127m					Am 242m	9.27E-06	CC 2		
I 129		5			Am 243	2.00E-05	CC 2		
Cs 134	8.09E-04	CC 2			Cm 242	7.66E-06	CC 2		
Cs 135		5			Cm 243	1.43E-05	CC 2		
Cs 137	1.43E-01	CC 2			Cm 244	5.85E-04	CC 2		
Ba 133					Cm 245		5		
La 137					Cm 246		5		
La 138					Cm 248				
Ce 144		5			Cf 249				
Pm 145					Cf 250				
Pm 147	2.61E-03	CC 2			Cf 251				
Sm 147		5			Cf 252				
Sm 151		5			Other a	1.00E-03	CC 2		
Eu 152	3.49E-06	CC 2			Other b/g				
Eu 154	2.22E-03	CC 2			Total a	1.15E-02	CC 2	0	
Eu 155	6.97E-04	CC 2			Total b/g	2.71E-01	CC 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