WASTE STREAM 2S11 Windscale Uranic Residues

SITE	Windscale
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.....	0.2 m^3
Future arisings -	1.4.2022 - 31.3.2120.....	0 m^3
Total future arisings:		0 m^3
Total waste volume:		0.2 m^3

Comment on volumes: Volume calculated from mass and text density of U and UO2 (17 te/m^3). The volume and mass data do not include the cladding or packaging -they are just for the uranium material. Where possible, alternatives to disposal will be explored.

Uncertainty factors on volumes:

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

WASTE SOURCE Samples from PWR, CAGRs, WAGR, SGHWR and CANDU fuels. Fuels not destined for reprocessing. Unirradiated uranic materials, e.g. DU shielding.

PHYSICAL CHARACTERISTICS

General description: Various irradiated and unirradiated uranium metal and oxide fuel samples from a number of reactors. Depleted uranium and magnox fuel elements.

Physical components (%wt): Irradiated uranium samples (2%), irradiated uranium oxide samples (17%), unirradiated depleted uranium items (35%), unirradiated magnox fuel samples (41%), unirradiated uranium oxide samples (1%), irradiated magnox uranium (TR), unirradiated natural uranium items (2%), unirradiated piles fuel (2%).

Sealed sources: -

Bulk density (t/m^3): ~17

Comment on density: Volume calculated from mass and text density of U and UO2 (17 te/m^3). The volume and mass data do not include the cladding or any packaging i.e. it is just for the uranium material.

CHEMICAL COMPOSITION

General description and components (%wt): Depleted uranium metal (35%), other uranium metal (6%), uranium oxide (18%), Magnox fuel uranium (41%).

Chemical state: -

Chemical form of radionuclides: U: Principally metal and oxide, trace amounts carbide.

Metals and alloys (%wt): Magnox metal is expected to be present as fuel clad but no data is available on the fuel clad at present.

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

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Magnox/Magnesium	P
Nickel	
Titanium	
Uranium	~82.0
Zinc	0
Zircaloy/Zirconium	0
Other metals	0

Organics (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	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			
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	0		
Graphite	0		
Desiccants/Catalysts			
Asbestos	NE		
Non/low friable			

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Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	0
Free non-aqueous liquids.....	0
Powder/Ash.....	P

Inorganic anions (%wt): -

	(%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: Combustible uranium metal and depleted uranium have the potential to be pyrophoric if finely-divided or hydrided. However, no significant amounts are expected to be in such a state.

	(%wt)	Type(s) and comment
Combustible metals.....	P	82% uranium.
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	
Hydrides.....	0	
Biological etc. materials.....	0	
Biodegradable materials.....	NE	
Putrescible wastes.....	0	
Non-putrescible wastes.....	NE	
Corrosive materials.....	0	
Pyrophoric materials.....		
Generating toxic gases.....	0	
Reacting with water.....	0	
Higher activity particles.....	NE	
Soluble solids as bulk chemical compounds.....	NE	

Hazardous substances / non hazardous pollutants: -

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

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Formaldehyde.....	
Organometallics.....	
Phenol.....	NE
Styrene.....	
Tri-butyl phosphate.....	NE
Other organophosphates.....	
Vinyl chloride.....	NE
Arsenic.....	NE
Barium.....	
Boron.....	NE
Boron (in Boral).....	
Boron (non-Boral).....	
Cadmium.....	NE
Caesium.....	
Selenium.....	NE
Chromium.....	NE
Molybdenum.....	NE
Thallium.....	
Tin.....	NE
Vanadium.....	NE
Mercury compounds.....	
Others.....	NE
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 contain discrete items: Yes. Discrete sealed cans may be included in this waste stream.

PACKAGING AND CONDITIONING

Conditioning method: The type of treatment and conditioning of the waste has not been decided upon, possibilities being explored include sending the material to another NDA site.

Plant Name: -

Location: Windscale.

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Plant startup date: -

Total capacity (m^3/y incoming waste): -

Target start date for packaging this stream: -

Throughput for this stream (m^3/y incoming waste): -

Other information: -

Likely container type:

Container	Waste packaged (%vol)	Waste loading (m^3)	Payload (m^3)	Number of packages
Not specified	100.0	NE	NE	NE

Likely container type comment: -

Range in container waste volume: -

Other information on containers: -

Likely conditioning matrix: Not specified

Other information: -

Conditioned density (t/m^3): NE

Conditioned density comment: -

Other information on conditioning: -

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
-	-	-	-	-	-

RADIOACTIVITY

Source: Irradiated uranium fuels, and unirradiated uranic materials. Activation products arising from the fuel cladding will be present but have not been quantified.

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: Nuclear materials inventory, based on masses and stated enrichments of fuel items.

Other information: Fission product radionuclides will be associated with some of the fuel.

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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		6		
Ru 106					U 233		6		
Pd 107					U 234		6		
Ag 108m					U 235	1.06E-02	B B 2		
Ag 110m					U 236		6		
Cd 109					U 238	2.05E-01	B B 2		
Cd 113m					Np 237				
Sn 119m					Pu 236		6		
Sn 121m					Pu 238		6		
Sn 123					Pu 239		6		
Sn 126					Pu 240		6		
Sb 125					Pu 241		6		
Sb 126					Pu 242		6		
Te 125m					Am 241		6		
Te 127m					Am 242m				
I 129					Am 243				
Cs 134		6			Cm 242				
Cs 135					Cm 243				
Cs 137		6			Cm 244		6		
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144		6			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**	**2.16E-01**		**0**	
Eu 155					**Total b/g**	**NE**		**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