

WASTE STREAM	2C06	Ceramic Pellets
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SITE Chapelcross

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Nuclear Restoration Services Ltd (NRS)

WASTE TYPE ILW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025	= 1.9		
Future arisings:				
Total future arisings:		0.0		
Total waste volume:		1.9		

Number of waste packages in stock: At 1.4.2025..... - packages

Comment on arising rates: There will be no further arisings.

Additional information on quantities: The four reactors at Chapelcross ceased generating in the period from August 2001 (R1) to February 2004 (R2).

Uncertainty factors on volumes:

Stock (upper):	x 1.20	Arisings (upper):	x -
Stock (lower):	x 0.80	Arisings (lower):	x -

WASTE SOURCE Irradiated ceramic pellet waste from post reactor operations.

PHYSICAL CHARACTERISTICS

General description: The waste consists of irradiated ceramic pellet waste. The pellets are whole or fragmented. The pellets are made of Lithium-6 aluminate mixed with a clay binder. They are stored in '304 type' stainless steel cans, which forms part of the waste stream.

Changes since waste generated: -

Bulk density (t/m³): = 1.7

Comment on density: The mean density of 1.72t/m³ refers to the mass of the components divided by the volume as stored.

CHEMICAL COMPOSITION

General description and components (%wt): Ceramic pellets (62.6%), SS Can (37.4%).

Chemical state: Neutral

Sheet metal proportion / thickness: -

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	~ 37.4	-	
Other ferrous metals.....	= 0	-	
Iron.....	-	-	
Aluminium.....	= 0	-	
Beryllium.....	0	-	
Cobalt.....	-	-	
Copper.....	= 0	-	
Lead.....	= 0	-	
Magnox/Magnesium.....	= 0	-	
Nickel.....	-	-	
Titanium.....	-	-	
Uranium.....	-	-	
Zinc.....	= 0	-	
Zircaloy/Zirconium.....	= 0	-	
Other metals.....	= 0	-	

Organics (%wt):

	(%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.....		-	
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.....	= 62.6	ceramic pellets	
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	-	

COMPONENTS OF MATERIALS, WASTE PROPERTIES, MATERIALS NOT CONTRIBUTING TO MASS

Inorganic anions (%wt):

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

Materials of interest for waste acceptance criteria:

	(%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.....		-
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.....	0	-
Benzene.....		-
Chlorinated solvents.....		-
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.....		-

Complexing agents (%wt):

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

Physical components:

	Number	Type(s) and comment
Sources.....		-
Electronic & Electrical Equipment (EEE)		-
EEE Type 1.....		-
EEE Type 2.....		-
EEE Type 3.....		-
EEE Type 4.....		-
EEE Type 5.....		-

TREATMENT, PACKAGING AND DISPOSAL

Planned on-site / off-site treatment(s):

Treatment	On-site / Off-site	Stream volume %
Size reduction		
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration		
Drying/dewatering/liquid separation		
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment		
Recycling / reuse		
Thermal treatment, including vitrification		
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		

Comments on planned treatments:

-

Conditioning method:

The waste is to be stored in the ILW store for at least 80 years in 500 litre drums. Disposal as ILW is the baseline assumption but it is possible that after this time it will have decayed to LLW and be disposed of at the LLWR.

Conditioning plants:

Plant Name	Location

Likely conditioning matrix:

-

Further information on the conditioning matrix:

-

Waste Packaging:

Likely container type:	Container	Waste packaged (vol%)	Waste loading (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
	500 l drum	100.0	0.10	0.47	20	-

Range in container waste loading: -

Other information on packaging and conditioning: -

Conditioned density (t/m³): = 1.7

Conditioned density comment: -

Management Routes:

Disposal Route	Stream volume %	Raw density t/m³	Start date
Expected to be consigned to a Near Site, Near Surface Disposal Facility (Scotland)	NE		
Expected to be Non-NSD HAW managed under Scottish Government's policy	NE		
Expected to be disposed to LLW Vaults NRS Dounreay			
Expected to be consigned to the Geological Disposal Facility			
Expected to be consigned to a Near Surface Disposal Facility			
Expected to be consigned to the LLW Repository			
Expected to be consigned to a Landfill Facility			
Expected to be disposed On-Site			
Expected to be managed by In-Situ Disposal			
Expected to be consigned to an Incineration Facility			
Expected to be consigned to a Metal Treatment Facility			
Expected to be Out of Scope			
Expected to be recycled / reused			
Disposal route not known			

Classification codes for waste expected to be consigned to a landfill facility:

Opportunities for alternative disposal routing: No

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
-	-	-	-	-

RADIOACTIVITY

Source: The material is contaminated, mainly with tritium.

Uncertainty: The activity values are based on sampling and activation calculations. This combined with irradiation histories over a period of 26 years has been used to build up activity data for the stream as a whole.

Measurement of radioactivities: -

Chemical form of radionuclides:

- H-3: Not assessed.
- C-14: Not assessed.
- Cl-36: Not assessed.
- Se-79: Not present.
- Tc-99: Not present.
- I-129: -
- Ra: Not assessed.
- Th: Not assessed.
- U: Not assessed.
- Np: Not present.
- Pu: Not assessed.

WASTE STREAM			2C06		Ceramic Pellets				
Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code		Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code
H 3	1.24E+02	C C 2			Gd 153		8		
Be 10					Ho 163	2.00E-07	C C 2		
C 14	1.41E-04	C C 2			Ho 166m	8.56E-07	C C 2		
Na 22					Tm 170		8		
Al 26					Tm 171	6.16E-07	C C 2		
Cl 36	8.94E-05	C C 2			Lu 174		8		
Ar 39	2.24E-08	C C 2			Lu 176		8		
Ar 42					Hf 178n		8		
K 40	1.69E-08	C C 2			Hf 182		8		
Ca 41	2.82E-05	C C 2			Pt 193	3.21E-05	C C 2		
Mn 53					Tl 204	1.58E-09	C C 2		
Mn 54					Pb 205		8		
Fe 55	4.57E-05	C C 2			Pb 210		8		
Co 60	4.13E-04	C C 2			Bi 208		8		
Ni 59	2.67E-05	C C 2			Bi 210m		8		
Ni 63	2.62E-03	C C 2			Po 210		8		
Zn 65					Ra 223		8		
Se 79					Ra 225		8		
Kr 81					Ra 226		8		
Kr 85	1.94E-07	C C 2			Ra 228		8		
Rb 87	1.03E-09	C C 2			Ac 227		8		
Sr 90	5.16E-06	C C 2			Th 227		8		
Zr 93	7.89E-09	C C 2			Th 228		8		
Nb 91					Th 229		8		
Nb 92					Th 230		8		
Nb 93m	1.20E-07	C C 2			Th 232		8		
Nb 94	1.77E-04	C C 2			Th 234	1.94E-09	C C 2		
Mo 93	1.74E-07	C C 2			Pa 231		8		
Tc 97					Pa 233		8		
Tc 99	1.04E-08	C C 2			U 232		8		
Ru 106					U 233	8.90E-08	C C 2		
Pd 107					U 234	2.14E-09	C C 2		
Ag 108m	1.27E-06	C C 2			U 235		8		
Ag 110m					U 236		8		
Cd 109					U 238	1.94E-09	C C 2		
Cd 113m	9.71E-06	C C 2			Np 237		8		
Sn 119m					Pu 236		8		
Sn 121m	2.00E-06	C C 2			Pu 238		8		
Sn 123					Pu 239	1.70E-07	C C 2		
Sn 126					Pu 240	1.73E-08	C C 2		
Sb 125	8.00E-07	C C 2			Pu 241	2.83E-08	C C 2		
Sb 126					Pu 242		8		
Te 125m	2.00E-07	C C 2			Am 241	3.63E-09	C C 2		
Te 127m					Am 242m		8		
I 129					Am 243		8		
Cs 134	2.37E-06	C C 2			Cm 242		8		
Cs 135					Cm 243		8		
Cs 137	5.40E-06	C C 2			Cm 244		8		
Ba 133	4.99E-06	C C 2			Cm 245		8		
La 137	1.42E-09	C C 2			Cm 246		8		
La 138					Cm 248		8		
Ce 144					Cf 249		8		
Pm 145	7.80E-07	C C 2			Cf 250		8		
Pm 147	2.05E-07	C C 2			Cf 251		8		
Sm 147					Cf 252		8		
Sm 151	6.40E-05	C C 2			Unsp a				
Eu 152	8.32E-04	C C 2			Unsp b/g				
Eu 154	2.13E-04	C C 2			Total a	2.84E-07	*	0	*
Eu 155	1.22E-05	C C 2			Total b/g	1.24E+02	*	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 the 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
* Total calculated from the 114 declared radionuclides