

WASTE STREAM**2C28/C****Miscellaneous Reactor Components**

SITE Chapelcross
SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW

Is the waste subject to Scottish Policy: Yes

WASTE VOLUMES

		Conditioned	Packaged
Stocks:	At 1.4.2022.....	2.0 m ³	25.1 m ³
Total future arisings:		0 m ³	0 m ³
Total waste volume:		2.0 m ³	25.1 m ³
Number of waste packages in stock:	At 1.4.2022.....	19 package(s)	

Comment on volumes: There will be no further waste arisings.

Uncertainty factors on volumes:
 Stock (upper): x 1.2 Arisings (upper) x
 Stock (lower): x 0.8 Arisings (lower) x

WASTE SOURCE The waste is comprised of activated reactor components. There are no items that require special handling.

PHYSICAL CHARACTERISTICS

General description: Miscellaneous reactor components, including whole catchpots, light weight absorber cartridges, holding down weights, dummy cartridges and support struts.

Physical components (%vol): The composition of the waste has not been determined however will mainly comprise of steel (~90%) and Magnox (~10%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 0.3

Comment on density: The density ranges from 0.2 to 0.6 t/m³, with an average density of 0.3 t/m³.

CHEMICAL COMPOSITION

General description and components (%wt): The composition of the waste has not been determined however will mainly comprise of steel (90%) and Magnox (10%).

Chemical state: Neutral

Chemical form of radionuclides:
 H-3: Not determined
 C-14: Not determined
 Se-79: Not determined
 Tc-99: Not determined
 Ra: Not present
 Th: Not present
 U: Not present
 Np: Not present
 Pu: Not present

Metals and alloys (%wt): -

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	~90.0	Nickel and molybdenum are present in boron steel and stainless steel.	
Other ferrous metals.....	P		
Iron.....			
Aluminium.....	NE		
Beryllium.....	NE		
Cobalt.....			

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Copper.....	NE	
Lead.....	NE	
Magnox/Magnesium.....	10.0	
Nickel.....	P	Nickel and molybdenum are present in boron steel and stainless steel.
Titanium.....		
Uranium.....		
Zinc.....	NE	
Zircaloy/Zirconium.....	NE	
Other metals.....	0	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	1.0		
Paper, cotton.....	0		
Wood.....	<1.0		
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.....	0		
Graphite.....	0		
Desiccants/Catalysts.....			

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

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: Magnox (10%) is present.

	(%wt)	Type(s) and comment
Combustible metals.....	10.0	
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.....	10.0	
Higher activity particles.....		
Soluble solids as bulk chemical compounds.....		

Hazardous substances / non hazardous pollutants: Magnox is present.

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

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Benzene.....
 Chlorinated solvents.....
 Formaldehyde.....
 Organometallics.....
 Phenol.....
 Styrene.....
 Tri-butyl phosphate.....
 Other organophosphates.....
 Vinyl chloride.....
 Arsenic.....
 Barium.....
 Boron..... 0
 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 contain discrete items: Yes. Large Metal Items (LMIs)/"substantial" thickness items considered "durable" assumed DIs; Stainless items assumed DIs (MAC also includes nimonics, known DIs)

PACKAGING AND CONDITIONING

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Container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Number of packages
	500 l RS drum (70mm Pb)	~100.0	~0.105	0.10474	19

Container type comment: -

Range in container waste volume: -

Other information on containers: -

Conditioned density (t/m³): NE

Conditioned density comment: -

Other information on conditioning: -

RADIOACTIVITY

Source: The main sources of activity are activated steels from reactor components containing Co-60.

Uncertainty: The banding and code of the stock activities are best estimate limit values, within a factor of 3 (upper limit) and 100 (lower limit).

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 of the stocks have been estimated from limited information.

Other information: -

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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		8		
Be 10		8			Ho 163		8		
C 14		6			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	1E-04	BB 2			Lu 174		8		
Ar 39		8			Lu 176		8		
Ar 42		8			Hf 178n		8		
K 40		8			Hf 182		8		
Ca 41		8			Pt 193		8		
Mn 53		8			Tl 204		8		
Mn 54	5.37E-08	BD 2			Pb 205		8		
Fe 55	9.46E-02	BD 2			Pb 210		4		
Co 60	8.27E-02	BD 2			Bi 208		8		
Ni 59	4E-04	BD 2			Bi 210m		8		
Ni 63	3.68E-02	BD 2			Po 210		4		
Zn 65	1.59E-08	BD 2			Ra 223		8		
Se 79		4			Ra 225		8		
Kr 81		8			Ra 226		4		
Kr 85		8			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90		4			Th 227		8		
Zr 93		4			Th 228		8		
Nb 91		8			Th 229		4		
Nb 92		8			Th 230		4		
Nb 93m		4			Th 232		4		
Nb 94		5			Th 234		8		
Mo 93		5			Pa 231		4		
Tc 97		8			Pa 233		8		
Tc 99		5			U 232		8		
Ru 106		5			U 233		8		
Pd 107		5			U 234		8		
Ag 108m		5			U 235		8		
Ag 110m		8			U 236		8		
Cd 109		8			U 238		8		
Cd 113m		8			Np 237		8		
Sn 119m		8			Pu 236		8		
Sn 121m		5			Pu 238		8		
Sn 123		8			Pu 239		8		
Sn 126		5			Pu 240		8		
Sb 125		8			Pu 241		8		
Sb 126		8			Pu 242		8		
Te 125m		8			Am 241		8		
Te 127m		8			Am 242m		8		
I 129		5			Am 243		8		
Cs 134		5			Cm 242		8		
Cs 135		5			Cm 243		8		
Cs 137		5			Cm 244		8		
Ba 133		8			Cm 245		8		
La 137		8			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144		5			Cf 249		8		
Pm 145		8			Cf 250		8		
Pm 147		5			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151		5			Other a				
Eu 152		5			Other b/g				
Eu 154		5			Total a	0			0
Eu 155		5			Total b/g	2.15E-01	BD 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