WASTE STREAM 2C28 Miscellaneous Reactor Components stored wet

SITE	Chapelcross
SITE OWNER	Nuclear Decommissioning Authority
WASTE CUSTODIAN	Magnox Limited
WASTE TYPE	ILW
Is the waste subject to Scottish Policy:	Yes

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	5.0 m^3
Total future arisings:		0 m^3
Total waste volume:		5.0 m^3

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 compenents. The waste is stored underwater (termed wet waste). 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 wet 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/m^3): 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 wet 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.....			
Copper.....	NE		
Lead.....	NE		

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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 cellulosics	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			
Asbestos	0		
Non/low friable			

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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.....		
Benzene.....		
Chlorinated solvents.....		

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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

Conditioning method: -

Plant Name: -

Location: Chapelcross.

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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
500 l RS drum (70mm Pb)	~50.0	~0.84	0.267	3
500 l RS drum (120mm Pb)	~50.0	~0.84	0.166	3

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: -

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

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/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		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	B B 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	B D 2			Pb 205		8		
Fe 55	9.46E-02	B D 2			Pb 210		4		
Co 60	8.27E-02	B D 2			Bi 208		8		
Ni 59	4E-04	B D 2			Bi 210m		8		
Ni 63	3.68E-02	B D 2			Po 210		4		
Zn 65	1.59E-08	B D 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**	**B D 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