WASTE STREAM 2C38 Miscellaneous Activated Reactor Components

SITE Chapelcross

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW; SPD3

Is the waste subject to Scottish Policy: Yes

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	18.6 m^3
Total future arisings:		0 m^3
Total waste volume:		18.6 m^3

Comment on volumes: The four reactors at Chapelcross ceased generating in the period from August 2001(R1) to February 2004 (R2). There will be no further waste arisings. 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 Miscellaneous reactor components stored within the reactor mortuary holes.

PHYSICAL CHARACTERISTICS

General description: The waste is comprised of activated reactor components e.g flux scanner tubes, control rods, etc. There are no large items that require special handling.

Physical components (%vol): Miscellaneous reactor components, including boron steel control rods, flux scanner tubes, etc.

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): Mild Steel, Stainless Steel, Boron Steel.

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.....	NE		
Other ferrous metals.....	NE	Nickel and molybdenum are present in boron steel and stainless steel.	
Iron.....			
Aluminium.....	NE		
Beryllium.....			
Cobalt.....			
Copper.....	NE		

WASTE STREAM 2C38 Miscellaneous Activated Reactor Components

Lead	NE
Magnox/Magnesium	0
Nickel	
Titanium	
Uranium	
Zinc	NE
Zircaloy/Zirconium	0
Other metals	0

Organics (%wt): Organic materials present as cellulose.

	(%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			
Glass/Ceramics	0		
Graphite	0		
Desiccants/Catalysts			
Asbestos	0		

WASTE STREAM 2C38 Miscellaneous Activated Reactor Components

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

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: -

	(%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.....		
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: None expected

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

WASTE STREAM 2C38 Miscellaneous Activated Reactor Components

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.....
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.

PACKAGING AND CONDITIONING

Conditioning method: Conditioning treatment to be determined.

Plant Name: -

Location: -

WASTE STREAM 2C38 Miscellaneous Activated Reactor Components

Plant startup date: 2089

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

Target start date for packaging this stream: 2089

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

Other information: Not yet established.

Likely container type:

Container	Waste packaged (%vol)	Waste loading (m^3)	Payload (m^3)	Number of packages
4m box (no shielding)	100.0	16.2	18.9	2

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: Activities have been estimated from non-active characterisation and modelling assessment.

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: -

Other information: Other beta/gamma not specified.

WASTE STREAM 2C38 Miscellaneous Activated Reactor Components

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	6E-05	B D 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	1.20E-07	B D 2			Pb 205		8		
Fe 55	4.72E-02	B D 2			Pb 210		4		
Co 60	4.14E-02	B D 2			Bi 208		8		
Ni 59	1E-04	B D 2			Bi 210m		8		
Ni 63	9.20E-03	B D 2			Po 210		4		
Zn 65	7.94E-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**	**9.79E-02**	**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