

WASTE STREAM	2C28	Miscellaneous Reactor Components stored wet
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SITE Chapelcross

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	7.0 m ³
Total future arisings:		0 m ³
Total waste volume:		7.0 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 components. 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: -

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 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): -

Stainless steel.....	~90.0
Other ferrous metals.....	P
Iron.....	
Aluminium.....	NE
Beryllium.....	NE
Cobalt.....	
Copper.....	NE
Lead.....	NE
Magnox/Magnesium.....	10.0
Nickel.....	P

Nickel and molybdenum are present in boron steel and stainless steel.

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	Titanium.....	
	Uranium.....	
	Zinc.....	NE
	Zircaloy/Zirconium.....	NE
	Other metals.....	0
Organics (%wt):	-	
	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):	-	
	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.....	
	Moderately friable.....	
	Highly friable.....	
	Free aqueous liquids.....	P
	Free non-aqueous liquids.....	TR
	Powder/Ash.....	P

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Inorganic anions (%wt):	No inorganic anions are present.
	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.
	Combustible metals..... 10.0
	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..... 10.0
	Active particles.....
	Soluble solids as bulk chemical compounds.....

Hazardous substances / non hazardous pollutants:	Magnox is present.
	Acrylamide.....
	Benzene.....
	Chlorinated solvents.....
	Formaldehyde.....
	Organometallics.....
	Phenol.....
	Styrene.....
	Tri-butyl phosphate.....
	Other organophosphates.....
	Vinyl chloride.....
	Arsenic.....
	Barium.....

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Boron.....
 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
 EDTA.....
 DPTA.....
 NTA.....
 Polycarboxylic acids.....
 Other organic complexants.....
 Total complexing agents..... 0

PACKAGING AND CONDITIONING

Conditioning method: -
 Plant Name: -
 Location: Chapelcross.
 Plant startup date: -
 Total capacity (m³/y incoming waste): -
 Target start date for packaging this stream: -
 Throughput for this stream (m³/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)	100.0	~0.28	0.267	25

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Likely container type comment: -

Range in container waste volume: -

Other information on containers: -

Likely conditioning matrix: Not specified

Other information: -

Conditioned density (t/m³): NE

Conditioned density comment: -

Other information on conditioning: -

Opportunities for alternative disposal routing:

Treatment	Stream volume (%)	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: For stocks the total beta/gamma activity is the sum of the listed beta/gamma emitting radionuclide activities, plus other beta/gamma; there is no alpha activity.

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 1.4.2019	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2019	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	6.12E-07	BD 2			Pb 205		8		
Fe 55	2.02E-01	BD 2			Pb 210		4		
Co 60	1.23E-01	BD 2			Bi 208		8		
Ni 59	4E-04	BD 2			Bi 210m		8		
Ni 63	3.76E-02	BD 2			Po 210		4		
Zn 65	3.57E-07	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	3.63E-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