

WASTE STREAM

2F03/C

Encapsulated AGR Cladding

	Stainless steel.....	~21.9	Type 20/25 Nb.
	Other ferrous metals.....	0	
	Iron.....		
	Aluminium.....		
	Beryllium.....	TR	
	Cobalt.....	0	
	Copper.....		
	Lead.....	0	
	Magnox/Magnesium.....	0	
	Nickel.....		
	Titanium.....	NE	
	Uranium.....	<0.10	Insoluble fission product residue and fines.
	Zinc.....	0	
	Zircaloy/Zirconium.....	0	
	Other metals.....	0	
Organics (%wt):	There are no organic materials present except for nylon and polyurethane or hydrogenated nitrile rubber (from grout pigs) in very small amounts in drums of encapsulated product. Hydrogenated nitrile rubber and/or polyurethane.		
	Total cellulosics.....	0	
	Paper, cotton.....	0	
	Wood.....	0	
	Halogenated plastics	0	
	Total non-halogenated plastics.....	TR	
	Condensation polymers.....	TR	
	Others.....	TR	
	Organic ion exchange materials....	0	
	Total rubber.....	TR	
	Halogenated rubber	0	
	Non-halogenated rubber.....	TR	
	Hydrocarbons.....		
	Oil or grease		
	Fuel.....		
	Asphalt/Tarmac (cont.coal tar)...		
	Asphalt/Tarmac (no coal tar)....		
	Bitumen.....		
	Others.....		
	Other organics.....	0	
Other materials (%wt):	Sintox (0.9%)		
	Inorganic ion exchange materials.	0	
	Inorganic sludges and flocs.....	0	
	Soil.....	0	
	Brick/Stone/Rubble.....	0	
	Cementitious material.....	~77.0	No sand is present in

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encapsulation grout.

Sand.....	0
Glass/Ceramics.....	1.0
Graphite.....	0
Desiccants/Catalysts.....	0
Asbestos.....	0
Non/low friable.....	
Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	0
Free non-aqueous liquids.....	0
Powder/Ash.....	0

No asbestos present in this waste.

Inorganic anions (%wt):

No inorganic anions are present, except for minor traces of nitrate.

Fluoride.....	0
Chloride.....	0
Iodide.....	0
Cyanide.....	0
Carbonate.....	0
Nitrate.....	TR
Nitrite.....	TR
Phosphate.....	0
Sulphate.....	0
Sulphide.....	0

Materials of interest for waste acceptance criteria:

No fire hazards or non-radioactive hazards are present.

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.....	0
Corrosive materials.....	P
Pyrophoric materials.....	0
Generating toxic gases.....	0
Reacting with water.....	0
Active particles.....	NE
Soluble solids as bulk chemical compounds.....	P

Alkaline encapsulation grout.

Small fraction bound by encapsulation grout.

Some sodium and calcium compounds.

WASTE STREAM**2F03/C****Encapsulated AGR Cladding**Hazardous substances /
non hazardous pollutants:

-

Acrylamide.....

Benzene..... 0

Chlorinated solvents.....

Formaldehyde.....

Organometallics.....

Phenol..... 0

Styrene.....

Tri-butyl phosphate..... 0

Other organophosphates.....

Vinyl chloride..... 0

Arsenic..... 0

Barium.....

Boron..... 0

Cadmium..... 0

Caesium.....

Selenium..... 0

Chromium..... P

Small amount is encapsulation
grout OPC.

Molybdenum..... 0

Thallium.....

Tin..... P

Trace amount in encapsulation
grout OPC.

Vanadium..... 0

Mercury compounds.....

Others..... 0

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

WASTE STREAM	2F03/C	Encapsulated AGR Cladding
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Container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Number of packages
	500 l drum	100.0	0.508	0.508	3937

Container type comment: Packaging factor 1.12.

Range in container waste volume: Volume may change if shearing cut size changes from original cutting programme.

Other information on containers: Stainless steel drums nominally filled to 508 litres capacity of conditioned waste.

Conditioned density (t/m³): 2.3

Conditioned density comment: -

Other information on conditioning: The waste is already conditioned.

RADIOACTIVITY

Source: Fission product carry-over and activation products will be present in the chopped and leached fuel pin debris. Cobalt-60 will be dominant.

Uncertainty: -

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 are calculated, based on characteristics of AGR fuel reprocessed to date for stocks and that still to be reprocessed for arisings.

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	1.20E-02	BB 2	2.47E-02	BB 2	Gd 153	1.11E-08	BB 2	2.00E-07	BB 2
Be 10	1.65E-08	BB 2	2.09E-08	BB 2	Ho 163	3.62E-12	BB 2	4.71E-12	BB 2
C 14	1.60E-02	BB 2	1.92E-02	BB 2	Ho 166m	1.50E-07	BB 2	2.47E-07	BB 2
Na 22		8		8	Tm 170	3.83E-15	BB 2	1.28E-13	BB 2
Al 26		8		8	Tm 171	3.32E-07	BB 2	2.31E-06	BB 2
Cl 36	1.81E-05	BB 2	2.15E-05	BB 2	Lu 174		8		8
Ar 39	3.21E-04	BB 2	3.88E-04	BB 2	Lu 176		8		8
Ar 42		8		8	Hf 178n		8		8
K 40	1.37E-09	BB 2	1.61E-09	BB 2	Hf 182	1.24E-16	BB 2	1.74E-16	BB 2
Ca 41	2.36E-05	BB 2	2.82E-05	BB 2	Pt 193		8		8
Mn 53	1.65E-15	BB 2	2.07E-15	BB 2	Tl 204		8		8
Mn 54	1.56E-02	BB 1	2.19E-01	BB 1	Pb 205		5		5
Fe 55	5.80E+01	BB 2	3.05E+02	BB 2	Pb 210	3.63E-11	BB 2	6.81E-12	BB 2
Co 60	3.05E+00	BB 1	8.56E+00	BB 1	Bi 208		8		8
Ni 59	1.10E+00	BB 2	1.29E+00	BB 2	Bi 210m		5		5
Ni 63	1.13E+02	BB 2	1.43E+02	BB 2	Po 210	3.43E-11	BB 2	6.06E-12	BB 2
Zn 65	8.52E-03	BB 1	1.51E-01	BB 1	Ra 223	1.11E-09	BB 2	7.53E-10	BB 2
Se 79	4.37E-06	BB 2	5.59E-06	BB 2	Ra 225	9.85E-12	BB 2	1.32E-11	BB 2
Kr 81	7.99E-12	BB 2	1.12E-11	BB 2	Ra 226	1.64E-10	BB 2	5.46E-11	BB 2
Kr 85	2.47E-01	BB 2	5.37E-01	BB 2	Ra 228	2.38E-14	BB 2	1.05E-14	BB 2
Rb 87	1.63E-09	BB 2	2.09E-09	BB 2	Ac 227	1.12E-09	BB 2	7.51E-10	BB 2
Sr 90	3.78E+00	BB 2	5.98E+00	BB 2	Th 227	1.10E-09	BB 2	7.43E-10	BB 2
Zr 93	1.39E-04	BB 2	1.77E-04	BB 2	Th 228	7.75E-07	BB 2	1.14E-06	BB 2
Nb 91	9.48E-18	BB 2	1.60E-17	BB 2	Th 229	9.86E-12	BB 2	1.32E-11	BB 2
Nb 92	4.08E-16	BB 2	5.27E-16	BB 2	Th 230	3.12E-08	BB 2	1.91E-08	BB 2
Nb 93m	7.75E-05	BB 2	6.47E-05	BB 2	Th 232	3.64E-14	BB 2	2.24E-14	BB 2
Nb 94	6.37E-02	BB 2	7.83E-02	BB 2	Th 234	4.54E-05	BB 2	4.27E-05	BB 2
Mo 93		8		8	Pa 231	2.97E-09	BB 2	3.15E-09	BB 2
Tc 97	1.19E-14	BB 2	1.54E-14	BB 2	Pa 233	1.52E-05	BB 2	1.90E-05	BB 2
Tc 99	1.07E-03	BB 2	1.36E-03	BB 2	U 232	7.60E-07	BB 1	1.09E-06	BB 1
Ru 106	5.07E-01	BB 1	6.10E+00	BB 1	U 233	2.03E-09	BB 1	1.59E-09	BB 1
Pd 107	6.38E-06	BB 2	8.34E-06	BB 2	U 234	1.48E-04	BB 1	1.42E-04	BB 1
Ag 108m	4.41E-01	BB 1	4.32E-01	BB 1	U 235	2.39E-06	BB 1	1.91E-06	BB 1
Ag 110m	3.53E-04	BB 1	6.12E-03	BB 1	U 236	3.38E-05	BB 1	3.39E-05	BB 1
Cd 109	3.51E-11	BB 2	3.45E-10	BB 2	U 238	4.54E-05	BB 1	3.76E-05	BB 1
Cd 113m	7.73E-04	BB 2	1.56E-03	BB 2	Np 237	1.52E-05	BB 2	1.90E-05	BB 2
Sn 119m	6.53E-08	BB 2	9.72E-07	BB 2	Pu 236	3.94E-07	BB 2	2.01E-06	BB 2
Sn 121m	1.43E-03	BB 2	2.07E-03	BB 2	Pu 238	8.90E-02	BB 1	1.23E-01	BB 1
Sn 123	2.67E-10	BB 2	8.87E-09	BB 2	Pu 239	2.13E-02	BB 1	1.79E-02	BB 1
Sn 126	2.20E-05	BB 2	2.85E-05	BB 2	Pu 240	4.54E-02	BB 1	4.59E-02	BB 1
Sb 125	1.37E+00	BB 1	6.82E+00	BB 1	Pu 241	2.42E+00	BB 1	4.07E+00	BB 1
Sb 126	3.09E-06	BB 2	9.17E-06	BB 2	Pu 242	7.82E-05	BB 1	1.00E-04	BB 1
Te 125m	3.20E-01	BB 2	2.71E-02	BB 2	Am 241	1.24E-01	BB 2	9.67E-02	BB 2
Te 127m	7.24E-11	8	2.85E-09	BB 2	Am 242m	2.89E-04	BB 2	4.01E-04	BB 2
I 129	2.23E-06	BB 2	2.86E-06	BB 2	Am 243	4.48E-04	BB 2	7.22E-04	BB 2
Cs 134	2.39E-02	BB 1	1.22E-01	BB 1	Cm 242	2.39E-04	BB 2	3.38E-04	BB 2
Cs 135	3.94E-05	BB 2	4.97E-05	BB 2	Cm 243	3.18E-04	BB 2	6.07E-04	BB 2
Cs 137	3.65E+00	BB 1	4.25E+00	BB 1	Cm 244	1.17E-02	BB 1	1.73E-02	BB 1
Ba 133	1.62E-10	BB 2	3.58E-10	BB 2	Cm 245	1.71E-06	BB 2	3.10E-06	BB 2
La 137	2.01E-10	BB 2	2.59E-10	BB 2	Cm 246	2.57E-07	BB 2	4.82E-07	BB 2
La 138	1.09E-14	BB 2	1.57E-14	BB 2	Cm 248	5.87E-13	BB 2	1.14E-12	BB 2
Ce 144	4.21E-03	BB 1	6.43E-02	BB 1	Cf 249	2.86E-12	BB 2	5.66E-12	BB 2
Pm 145	2.16E-11	BB 2	4.50E-11	BB 2	Cf 250	8.48E-12	BB 2	2.21E-11	BB 2
Pm 147	3.52E-01	BB 2	1.91E+00	BB 2	Cf 251	7.34E-14	BB 2	1.45E-13	BB 2
Sm 147	6.04E-10	BB 2	7.05E-10	BB 2	Cf 252	4.84E-13	BB 2	2.67E-12	BB 2
Sm 151	2.00E-02	BB 2	2.46E-02	BB 2	Other a	7.30E-05	BB 2	1.36E-04	BB 2
Eu 152	8.02E-03	BB 1	6.92E-03	BB 1	Other b/g	2.29E-02	BB 2	2.63E-02	BB 2
Eu 154	4.37E-02	BB 1	8.13E-02	BB 1	Total a	2.93E-01	BB 2	3.03E-01	BB 2
Eu 155	1.49E-02	BB 2	5.20E-02	BB 2	Total b/g	1.88E+02	BB 2	4.89E+02	BB 2

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