



**WASTE STREAM****9A56****FED Zirconium**

Stainless steel.....	0
Other ferrous metals.....	0
Iron.....	
Aluminium.....	0
Beryllium.....	0
Cobalt.....	
Copper.....	0
Lead.....	0
Magnox/Magnesium.....	TR
Nickel.....	
Titanium.....	
Uranium.....	
Zinc.....	0
Zircaloy/Zirconium.....	~100.0
Other metals.....	0

The waste will be zirconium with impurities incorporated in the zirconium.

## Organics (%wt):

The zirconium may be contaminated with trace quantities of organic material.

Total cellulose.....	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.....	TR

## Other materials (%wt):

Graphite contamination.	
Inorganic ion exchange materials.	0
Inorganic sludges and flocs.....	0
Soil.....	0
Brick/Stone/Rubble.....	0
Cementitious material.....	0

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Sand.....

Glass/Ceramics..... 0

Graphite..... TR

Desiccants/Catalysts.....

Asbestos..... 0

    Non/low friable.....

    Moderately friable.....

    Highly friable.....

Free aqueous liquids..... TR

Free non-aqueous liquids..... 0

Powder/Ash..... P

**Inorganic anions (%wt):**

Inorganic anions are not expected to be present at greater than trace concentrations.

Fluoride..... TR

Chloride..... TR

Iodide..... 0

Cyanide..... 0

Carbonate..... TR

Nitrate..... TR

Nitrite..... TR

Phosphate..... TR

Sulphate..... TR

Sulphide..... 0

**Materials of interest for waste acceptance criteria:**

There are no identified materials likely to represent a fire or other non-radiological hazard.

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

Active particles.....

Soluble solids as bulk chemical compounds.....

**WASTE STREAM****9A56****FED Zirconium**Hazardous substances /  
non hazardous pollutants:

None expected.

Acrylamide.....  
 Benzene.....  
 Chlorinated solvents.....  
 Formaldehyde.....  
 Organometallics.....  
 Phenol.....  
 Styrene.....  
 Tri-butyl phosphate.....  
 Other organophosphates.....  
 Vinyl chloride.....  
 Arsenic.....  
 Barium.....  
 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):

Yes  
 EDTA.....  
 DPTA.....  
 NTA.....  
 Polycarboxylic acids.....  
 Other organic complexants.....  
 Total complexing agents..... TR

**PACKAGING AND CONDITIONING**

Conditioning method:

This stream is to be co-packaged with 9A63, 9A64, 9A83, 9A84, 9A33, 9A34, 9A35, 9A41, 9A42, 9A43, 9A49, 9A50, 9A51, 9A54, 9A55, 9A74. Packages are assigned to 9A33/C, 9A34, 9A74.

Plant Name:

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Location:

Berkeley Site

<b>WASTE STREAM</b>	<b>9A56</b>	<b>FED Zirconium</b>
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Plant startup date: -  
 Total capacity (m<sup>3</sup>/y incoming waste): -  
 Target start date for packaging this stream: -  
 Throughput for this stream (m<sup>3</sup>/y incoming waste): -  
 Other information: -

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m <sup>3</sup> )	Payload (m <sup>3</sup> )	Number of packages

Likely container type comment: -  
 Range in container waste volume: -  
 Other information on containers: -  
 Likely conditioning matrix:  
 Other information: -  
 Conditioned density (t/m<sup>3</sup>): -  
 Conditioned density comment: -  
 Other information on conditioning: -  
 Opportunities for alternative disposal routing:

Treatment	Stream volume (%)	Comment
-	-	-

**RADIOACTIVITY**

Source: Activation when the associated fuel elements were irradiated, of nuclides incorporated in the zirconium. Contamination by fission products and actinides when the fuel elements were in the fuel pond.

Uncertainty: The values quoted are indicative of the activities that might be expected.

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: Specific activity is a function of Station operating history. Values were derived from calculations of induced activity and estimates of likely contamination.

Other information: -

**WASTE STREAM**

**9A56**

**FED Zirconium**

Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	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	<2.55E+00	D 3			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	5.00E-02	DD 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26	<1E-06	D 3			Tm 171		8		
Cl 36	<4E-03	C 3			Lu 174		8		
Ar 39		8			Lu 176		8		
Ar 42		8			Hf 178n		8		
K 40		8			Hf 182		8		
Ca 41	<7E-05	D 3			Pt 193		8		
Mn 53		8			Tl 204		8		
Mn 54		8			Pb 205		8		
Fe 55	<4.22E-03	D 3			Pb 210		8		
Co 60	<1.03E+00	D 3			Bi 208		8		
Ni 59	<1E-03	D 3			Bi 210m		8		
Ni 63	3.68E-01	DD 2			Po 210		8		
Zn 65		8			Ra 223		8		
Se 79		8			Ra 225		8		
Kr 81		8			Ra 226		8		
Kr 85		8			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	5.26E-05	CC 2			Th 227		8		
Zr 93	8E-03	CC 2			Th 228		8		
Nb 91		8			Th 229		8		
Nb 92	2E-07	CC 2			Th 230		8		
Nb 93m	6.88E-03	CC 2			Th 232		8		
Nb 94		8			Th 234	5E-08	CC 2		
Mo 93	<9.96E-03	D 3			Pa 231		8		
Tc 97		8			Pa 233	6.29E-09	CC 2		
Tc 99	<2E-03	D 3			U 232		8		
Ru 106		8			U 233		8		
Pd 107		8			U 234	5.08E-08	CC 2		
Ag 108m		8			U 235	1E-09	CC 2		
Ag 110m		8			U 236	7.00E-09	CC 2		
Cd 109		8			U 238	5E-08	CC 2		
Cd 113m	<1.1E-03	D 3			Np 237	6.29E-09	CC 2		
Sn 119m		8			Pu 236		8		
Sn 121m	<3.41E-02	D 3			Pu 238	1.82E-05	CC 2		
Sn 123		8			Pu 239	2E-05	CC 2		
Sn 126		8			Pu 240	3.00E-05	CC 2		
Sb 125	2.41E-04	CC 2			Pu 241	1.13E-03	CC 2		
Sb 126		8			Pu 242	2E-08	CC 2		
Te 125m	6.05E-05	CC 2			Am 241	8.77E-05	CC 2		
Te 127m		8			Am 242m	1.88E-07	CC 2		
I 129		8			Am 243	5.00E-08	CC 2		
Cs 134	1.78E-09	CC 2			Cm 242	1.55E-07	CC 2		
Cs 135		8			Cm 243	4.55E-08	CC 2		
Cs 137	5.30E-05	CC 2			Cm 244	3.79E-07	CC 2		
Ba 133		8			Cm 245		8		
La 137		8			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144		8			Cf 249		8		
Pm 145	2.51E-03	CC 2			Cf 250		8		
Pm 147	8.42E-08	CC 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	<1.82E-02	D 3			Other a	1E-09	CC 2		
Eu 152	<1.62E+00	C 3			Other b/g	1.15E-07	CC 2		
Eu 154	<1.91E+00	C 3			<b>Total a</b>	<b>1.57E-04</b>	<b>CC 2</b>		<b>0</b>
Eu 155	5.51E-02	CC 2			<b>Total b/g</b>	<b>7.68E+00</b>	<b>CC 2</b>		<b>0</b>

**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