

<b>WASTE STREAM</b>	<b>9E43</b>	<b>FED Nimonic</b>
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**SITE** Oldbury  
**SITE OWNER** Nuclear Decommissioning Authority  
**WASTE CUSTODIAN** Magnox Limited  
**WASTE TYPE** ILW

**WASTE VOLUMES**

Stocks: At 1.4.2013..... 0.1 m<sup>3</sup>  
 Total future arisings: 0 m<sup>3</sup>  
 Total waste volume: 0.1 m<sup>3</sup>

Comment on volumes: Fuel element spiders (to which Nimonic springs are attached) have not been accumulated on site in significant numbers since the commissioning of a new desplitting machine in 1983. Fuel elements are now sent to Sellafield with the spiders, containing Nimonic springs, attached.

Uncertainty factors on volumes: Stock (upper): x 1.2 Arisings (upper) x  
 Stock (lower): x 0.8 Arisings (lower) x

**WASTE SOURCE** Nimonic springs from polyzonal Magnox fuel elements.

**PHYSICAL CHARACTERISTICS**

General description: Nimonic springs originally incorporated into Magnox fuel element top end fittings and removed during fuel element desplitting. There are no large items present in the waste which may require special handling.

Physical components (%vol): Nimonic springs (~100 vol%).

Bulk density (t/m<sup>3</sup>): 1.5

Comment on density: The density given is based on a packing factor of 5 times the displacement volume of the material. (The density will be only 0.4 t/m<sup>3</sup> assuming a packing factor of 5 times the cylindrical volume of a spring). The density range is not estimated.

**CHEMICAL COMPOSITION**

General description and components (%wt): Activated Nimonic (~100%) which may be contaminated by fission products and actinides.

Chemical state: The waste is neither acid nor alkaline and neither oxidising or reducing.

Chemical form of radionuclides: H-3: Trace amounts of tritium will be present as surface contamination.  
 C-14: Trace amounts of carbon 14 will be present as graphite.  
 Cl-36: Trace amounts of chlorine 36 will be present in graphite.  
 Se-79: The selenium content is insignificant.  
 Tc-99: The technetium content is insignificant.  
 Ra: Radium isotope content is insignificant.  
 Th: Thorium isotope content is insignificant.  
 U: Trace contamination possibly as uranium metal or uranium oxides.  
 Np: The neptunium content is insignificant.  
 Pu: Trace contamination possibly as plutonium oxides.

Metals and alloys (%wt): 100% Nimonic 80A. No bulk or sheet metal items present.

Stainless steel.....	0	Bronze.....	0
Other ferrous metals.....	0	Inconel.....	0
Aluminium.....	0	Nimonic.....	100.0
Copper.....	0	Stellite.....	0
Lead.....	0	Boral.....	0
Zinc.....	0	Dural.....	0
Magnox/Magnesium.....	TR	Monel.....	0
Zircaloy.....	0	Uranium.....	0
Brass.....	0	Beryllium.....	0
		Other metals (below).....	0

Other metals: No "other" metals present.

Inorganic anions (%wt): None of the inorganic anions in the table is expected to be present at greater than trace concentrations.

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

Listed substances: Not present.

Hazardous and problematic materials (%wt): No materials likely to pose a fire or other non-radiological hazard have been identified.

Combustible metals.....	TR	Strong oxidising agents.....	0
Low flash point liquids.....	0	Pyrophoric materials.....	0
Explosive materials.....	0	Generating toxic gases.....	0
Phosphorus.....	0	Reacting with water.....	TR
Hydrides.....	0	Asbestos.....	0
Putrescible wastes.....	0	Free aqueous liquids.....	TR
Biological etc. materials.....	0	Free non-aqueous liquids.....	0
Powder.....	0		

Asbestos types and proportions: -

Complexing agents (%wt): Not yet determined. Expect only trace quantities, if any.

Complexing agents..... TR

Organics (%wt): Organics may be present in trace quantities.

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
Other organics.....	TR

Halogenated plastics and rubber (%wt): Halogenated plastics or rubbers are not present.

Other materials (%wt): Some graphite contamination is expected.

Inorganic ion exchange materials..	0
Inorganic sludges and flocs.....	0
Soil.....	0
Rubble.....	0
Concrete, cement and sand.....	0
Glass.....	0
Ceramics.....	0
Graphite.....	TR

**PACKAGING AND CONDITIONING**

Conditioning method: -

Plant Name: -

Location: Oldbury Power Station

Plant startup date: 2023

Total capacity (m<sup>3</sup>/y incoming waste): -

Target start date for packaging this stream: 2020

Throughput for this stream (m<sup>3</sup>/y incoming waste): -

Other information: -

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Likely container type:	Container	Waste packaged (%vol)	Waste loading (m <sup>3</sup> )	Payload (m <sup>3</sup> )	Container displacement volume (m <sup>3</sup> )
	Other (MOSAİK with 60mm shielding. Displacement volume 1.32m <sup>3</sup> .)	100.0	0.262	0.291	

Likely container type comment: There are 115,000 Nimonic springs in total split between waste streams 9E40/41/43 which will be transferred into Mosaik DCICs. To ensure the IAEA Transport Regulations are met and the annual worker dose rate of 1mSv is not exceeded, 5 Mosaik II flasks with a 6cm sheilding will be required. Each flask will contain approx 23688 Nimonic springs. Waste streams 9E40, 9E41 & 9E43 will be packaged together.

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: -

**RADIOACTIVITY**

Source: Nimonic springs originally incorporated into Magnox fuel element top end fittings and removed during fuel element desplittering. There will be activation products in the Nimonic and contamination by fission products and actinides.

Accuracy: Specific activity is a function of Station operating history. The values quoted are indicative of the activities that might be expected.

Definition of total alpha and total beta/gamma: Totals shown on table of radionuclide activities are the sums of the listed alpha or beta/gamma emitting radionuclides plus 'other alpha' or 'other beta/gamma.'

Measurement of specific activities: Induced activity has been calculated and fission product and actinide contamination levels have been based upon measurements of the activity of Magnox samples.

Other information: The Nimonic springs are expected to be of high activity.

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Nuclide	Average specific activity, TBq/m <sup>3</sup>		Future arisings	Bands and Code	Nuclide	Average specific activity, TBq/m <sup>3</sup>		Future arisings	Bands and Code
	Waste at 1.4.2013	Bands and Code				Waste at 1.4.2013	Bands and Code		
H 3	2.53E-03	CC 2			Ho 163		8		
Be 10	2E-07	CC 2			Ho 166m		8		
C 14	3E-06	CC 2			Tm 170		8		
Cl 36	2E-04	CC 2			Tm 171		8		
Ar 39		8			Lu 174		8		
Ar 42		8			Lu 176		8		
K 40		8			Hf 178n		8		
Ca 41		8			Hf 182		8		
Mn 53		8			Pt 193		8		
Mn 54		8			Tl 204		8		
Fe 55	4.17E-02	CC 2			Pb 205		8		
Co 60	2.02E+02	CC 2			Pb 210		8		
Ni 59	1E+01	CC 2			Bi 208		8		
Ni 63	1.96E+03	CC 2			Bi 210m		8		
Zn 65		8			Po 210		8		
Se 79		8			Ra 223		8		
Kr 81		8			Ra 225		8		
Kr 85		8			Ra 226		8		
Rb 87		8			Ra 228		8		
Sr 90	3.72E-05	CC 2			Ac 227		8		
Zr 93	2E-09	CC 2			Th 227		8		
Nb 91		8			Th 228		8		
Nb 92		8			Th 229		8		
Nb 93m		8			Th 230		8		
Nb 94		8			Th 232		8		
Mo 93		8			Th 234	3E-08	CC 2		
Tc 97		8			Pa 231		8		
Tc 99	1E-08	CC 2			Pa 233	4.04E-09	CC 2		
Ru 106		8			U 232		8		
Pd 107		8			U 233		8		
Ag 108m		8			U 234	3.02E-08	CC 2		
Ag 110m		8			U 235		8		
Cd 109		8			U 236	4E-09	CC 2		
Cd 113m		8			U 238	3E-08	CC 2		
Sn 119m		8			Np 237	4.04E-09	CC 2		
Sn 121m		8			Pu 236		8		
Sn 123		8			Pu 238	1.95E-05	CC 2		
Sn 126		8			Pu 239	1E-05	CC 2		
Sb 125		8			Pu 240	2E-05	CC 2		
Sb 126		8			Pu 241	5.19E-04	CC 2		
Te 125m		8			Pu 242	1E-08	CC 2		
Te 127m		8			Am 241	4.25E-05	CC 2		
I 129		8			Am 242m	8.87E-08	CC 2		
Cs 134	1.46E-09	CC 2			Am 243	3E-08	CC 2		
Cs 135		8			Cm 242	7.32E-08	CC 2		
Cs 137	5.6E-05	CC 2			Cm 243	2.8E-08	CC 2		
Ba 133		8			Cm 244	3.57E-07	CC 2		
La 137		8			Cm 245		8		
La 138		8			Cm 246		8		
Ce 144		8			Cm 248		8		
Pm 145		8			Cf 249		8		
Pm 147	4.07E-08	CC 2			Cf 250		8		
Sm 147		8			Cf 251		8		
Sm 151	8.79E-08	CC 2			Cf 252		8		
Eu 152	1.71E-09	CC 2			Other a		8		
Eu 154	1.57E-07	CC 2			Other b/g	4E-04	CC 2		
Eu 155	1.31E-08	CC 2			<b>Total a</b>	<b>9.26E-05</b>	<b>CC 2</b>		
Gd 153		8			<b>Total b/g</b>	<b>2.17E+03</b>	<b>CC 2</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 the average specific activity.

**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