WASTE STREAM 9E40 FED Nimonic

SITE Oldbury

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	0.1 m³
Total future arisings:		0 m³
Total waste volume:		0.1 m³

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 desplittering machine in 1983. Following this date Fuel elements were then 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 desplittering. There are no large items present in the waste which may require special handling.

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

Sealed sources: -

Bulk density (t/m³): 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 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: Neutral

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): No bulk or sheet metallic items present.

Stainless steel.....	0
Other ferrous metals.....	0
Iron.....	
Aluminium.....	0
Beryllium.....	0
Cobalt.....	
Copper.....	0
Lead.....	0
Magnox/Magnesium.....	TR

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	Nickel	~100.0	100% present as Nimonic alloy (type 80A).
	Titanium		
	Uranium		
	Zinc	0	
	Zircaloy/Zirconium	0	
	Other metals	0	No "other" metals present.
Organics (%wt):	Organics may be present in trace quantities. Halogenated plastics or rubbers are not present.		
	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	TR	
Other materials (%wt):	Some graphite contamination is expected.		
	Inorganic ion exchange materials.	0	
	Inorganic sludges and flocs	0	
	Soil	0	
	Brick/Stone/Rubble	0	
	Cementitious material	0	
	Sand		
	Glass/Ceramics	0	
	Graphite	TR	
	Desiccants/Catalysts		
	Asbestos	0	
	Non/low friable		
	Moderately friable		
	Highly friable		
	Free aqueous liquids	TR	

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Free non-aqueous liquids	0
Powder/Ash	0

Inorganic anions (%wt): None of the inorganic anions in the table is 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: No materials likely to pose a fire or other non-radiological hazard have been identified.

Combustible metals	TR
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	TR
Active particles	
Soluble solids as bulk chemical compounds	

Hazardous substances / non hazardous pollutants: None expected.

Acrylamide	
Benzene	
Chlorinated solvents	
Formaldehyde	
Organometallics	
Phenol	
Styrene	
Tri-butyl phosphate	
Other organophosphates	
Vinyl chloride	

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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: -

Plant Name: -

Location: Oldbury Power Station

Plant startup date: 2023

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

Target start date for packaging this stream: 2023

Throughput for this stream (m^3/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 (120mm Pb)	100.0	0.025	0.166	4

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Likely container type comment:	There are estimated to be 115,000 Nimonic springs in total split between waste streams 9E40/41/43 which will be transferred into Mosaik DCICs. Waste streams 9E40, 9E41 & 9E43 will be packaged together.
Range in container waste volume:	-
Other information on containers:	Waste container and box numbers have been updated to reflect the information in LTP. However this is under review and will be updated when more data is supplied by the ILW team.
Likely conditioning matrix:	
Other information:	-
Conditioned density (t/m³):	-
Conditioned density comment:	-
Other information on conditioning:	-
Opportunities for alternative disposal routing:	

Treatment	Stream volume (%)	Comment
-	-	-

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.
Uncertainty:	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:	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:	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	Mean radioactivity, TBq/m³ Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code
H 3	1.21E-03	C C 2			Gd 153		8		
Be 10	2E-07	C C 2			Ho 163		8		
C 14	3.00E-06	C C 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26	4E-04	C C 2			Tm 171		8		
Cl 36	2E-04	C C 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		8			Pb 205		8		
Fe 55	9.12E-04	C C 2			Pb 210		8		
Co 60	2.14E+01	C C 2			Bi 208		8		
Ni 59	1E+01	C C 2			Bi 210m		8		
Ni 63	9.39E+02	C C 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	2.42E-05	C C 2			Th 227		8		
Zr 93	2E-09	C C 2			Th 228		8		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m		8			Th 232		8		
Nb 94		8			Th 234	3E-08	C C 2		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233	4.15E-09	C C 2		
Tc 99	1E-08	C C 2			U 232		8		
Ru 106		8			U 233		8		
Pd 107		8			U 234	3.06E-08	C C 2		
Ag 108m		8			U 235		8		
Ag 110m		8			U 236	4.00E-09	C C 2		
Cd 109		8			U 238	3E-08	C C 2		
Cd 113m		8			Np 237	4.15E-09	C C 2		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	1.86E-05	C C 2		
Sn 123		8			Pu 239	1.00E-05	C C 2		
Sn 126		8			Pu 240	2.00E-05	C C 2		
Sb 125		8			Pu 241	1.95E-04	C C 2		
Sb 126		8			Pu 242	1E-08	C C 2		
Te 125m		8			Am 241	5.28E-05	C C 2		
Te 127m		8			Am 242m	8.61E-08	C C 2		
I 129		8			Am 243	3.00E-08	C C 2		
Cs 134		8			Cm 242	7.11E-08	C C 2		
Cs 135		8			Cm 243	1.62E-08	C C 2		
Cs 137	4.07E-05	C C 2			Cm 244	2.12E-07	C C 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		8			Cf 250		8		
Pm 147		8			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	7.46E-08	C C 2			Other a				
Eu 152		8			Other b/g				
Eu 154	9.66E-08	C C 2			**Total a**	**1.02E-04**	**C C 2**	**0**	
Eu 155	1.39E-09	C C 2			**Total b/g**	**9.71E+02**	**C C 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