

WASTE STREAM	9G40	FED Nimonic
---------------------	-------------	--------------------

SITE Trawsfynydd
SITE OWNER Nuclear Decommissioning Authority
WASTE CUSTODIAN Magnox Limited
WASTE TYPE ILW; SPD1

WASTE VOLUMES

Stocks: At 1.4.2013..... 0.2 m³
 Total future arisings: 0 m³
 Total waste volume: 0.2 m³

Comment on volumes: There will be no further arisings of this waste stream. Any arisings from April 1990 have been dispatched to Sellafield apart from small numbers of springs associated with waste stream 9G15. The station ceased generation on 20/07/1993. Defuelling was completed on 31/08/1995.

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

WASTE SOURCE Nimonic springs originally incorporated into Magnox fuel element top end fittings, and accumulated as waste when the top end fittings were removed from fuel elements during desplittering operations.

PHYSICAL CHARACTERISTICS

General description: The original BNL type desplittering machine used to remove the fittings containing the Nimonic springs. Since 1981 modified desplittering machines using a split-die system have been used. This system does not remove any part of the top end fitting and hence Nimonic springs are normally retained on the fuel element for despatch off-site. Springs are about 33 mm long, 10 mm in diameter and weigh about 5 g. There are no large items present in the waste which may require special handling.

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

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 t/m³ 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): Nimonic (~100%). No other constituent identified.

Chemical state: The waste is not oxidising, reducing, acidic nor alkaline.

Chemical form of radionuclides: H-3: Tritium will probably be present as surface contamination, possibly as water or perhaps as other inorganic or organic compounds.
 C-14: Carbon 14 is likely to be present in the form of graphite contamination.
 Cl-36: Chlorine 36 will probably be present in surface contamination.
 Se-79: The selenium content is insignificant.
 Tc-99: The chemical form of technetium has not been determined.
 Ra: Radium isotope content is insignificant.
 Th: The thorium isotope content is insignificant.
 U: Chemical form of uranium isotopes has not been determined but may be uranium oxides.
 Np: The chemical form of neptunium has not been determined.
 Pu: Chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

Metals and alloys (%wt): No sheet metal items present.

WASTE STREAM	9G40	FED Nimonic
---------------------	-------------	--------------------

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.....	0	Monel.....	0
Zircaloy.....	0	Uranium.....	0
Brass.....	0	Beryllium.....	0
		Other metals (below).....	0

Other metals: No "other" metals present.

Inorganic anions (%wt): Inorganic anions are not expected to be present at greater than trace concentrations.

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.....	0	Strong oxidising agents.....	0
Low flash point liquids.....	0	Pyrophoric materials.....	0
Explosive materials.....	0	Generating toxic gases.....	0
Phosphorus.....	0	Reacting with water.....	0
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.

Complexing agents..... NE

Organics (%wt): There may be organic materials 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): There are no halogenated plastics or rubbers present with the waste.

Other materials (%wt): -

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

WASTE STREAM	9G40	FED Nimonic
---------------------	-------------	--------------------

Conditioning method: Waste will be encapsulated in BFS/OPC. Waste will include FED Magnox waste stream 9G34.

Plant Name: FED Retrieval and Processing Plant

Location: Trawsfynydd Decommissioning Site

Plant startup date: 2004

Total capacity (m³/y incoming waste): ~200.0

Target start date for packaging this stream: 2009

Throughput for this stream (m³/y incoming waste): <0.1

Other information: Waste is combined with Magnox (stream 9G34), retrieved, packaged and encapsulated in 3m³ boxes. The waste is stored to ensure package dose rates do not exceed specified on-site handling limits. All the Nimonic is being stored in a steel pot, the plan is to concentrate the Nimonic into one or two boxes not into every box.

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Container displacement volume (m ³)
	3m ³ box (round corners)	100.0	3.05	2.7	3.273

Likely container type comment: -

Range in container waste volume: Not yet determined. No significant variability is expected.

Other information on containers: The container material is expected to be stainless steel.

Likely conditioning matrix: BFS/OPC

Other information: The encapsulation matrix will be 3:1 BFS/OPC.

Conditioned density (t/m³): 1.9

Conditioned density comment: The density is expected to be in the range of 1.85 to 1.95 t/m³.

Other information on conditioning: Waste streams 9G34 and 9G40 will be processed as a single waste for disposal as ILW. The wastes will be sorted to ensure an approximately equal distribution of Nimonic springs between waste packages. Springs will be selected from the waste during sorting and packed in the centre of each 3m³ box prior to encapsulation to ensure package dose rates do not exceed specified on site handling limits.

RADIOACTIVITY

Source: Nimonic springs originally incorporated into Magnox fuel element top end fittings and removed during fuel element desplitting. 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: The Nimonic springs are expected to be of high activity. 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: Other beta/gamma nuclides include (in TBq/m³) : Al26 (2E-4).

WASTE STREAM 9G40 FED Nimonic

Nuclide	Average specific activity, TBq/m ³		Future arisings	Bands and Code	Nuclide	Average specific activity, TBq/m ³		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		8			Ho 166m		8		
C 14	6E-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	9.26E-02	CC 2			Pb 205		8		
Co 60	2.02E+01	CC 2			Pb 210		8		
Ni 59	1E+01	CC 2			Bi 208		8		
Ni 63	9.79E+02	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	2.79E-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	4.05E-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	4.05E-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	2.6E-04	CC 2		
Te 125m		8			Pu 242	1E-08	CC 2		
Te 127m		8			Am 241	5.11E-05	CC 2		
I 129		8			Am 242m	8.87E-08	CC 2		
Cs 134		8			Am 243	3E-08	CC 2		
Cs 135		8			Cm 242	7.25E-08	CC 2		
Cs 137	4.67E-05	CC 2			Cm 243	1.87E-08	CC 2		
Ba 133		8			Cm 244	2.67E-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	9.05E-09	CC 2			Cf 250		8		
Sm 147		8			Cf 251		8		
Sm 151	7.81E-08	CC 2			Cf 252		8		
Eu 152		8			Other a		8		
Eu 154	1.57E-07	CC 2			Other b/g	2E-04	CC 2		
Eu 155	4.6E-09	CC 2			Total a	1.01E-04	CC 2		
Gd 153		8			Total b/g	1.01E+03	CC 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 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