

WASTE STREAM	9A47	FED Stainless Steel
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SITE Berkeley

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Nuclear Restoration Services Ltd (NRS)

WASTE TYPE ILW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025	= 0.3		
Future arisings:				
Total future arisings:		0.0		
Total waste volume:		0.3		

Number of waste packages in stock: At 1.4.2025..... - packages

Comment on arising rates: -

Additional information on quantities: Station operation ceased in March 1989. This waste stream was accumulated between May 1964 and December 1967. The stainless steel was used for flux flattening and was replaced by zirconium on later elements as fuel irradiation had increased and flux flattening by the stainless steel was not required. The volume quoted is the estimated bulk volume of the waste if separated from other wastes with which it is mixed.

Uncertainty factors on volumes: Stock (upper): x 1.10 Arisings (upper): x -
Stock (lower): x 0.90 Arisings (lower): x -

WASTE SOURCE The source of the waste is the removal of graphite struts and associated zirconium and stainless steel bridge pieces from fuel elements prior to dispatch of the elements to Sellafield.

PHYSICAL CHARACTERISTICS

General description: The waste comprises predominantly stainless steel bridge pieces. The bridge pieces may still be connected to the graphite struts (see waste stream 9A31). Approximately 38% of fuel elements used stainless steel top support bridges, (with the rest being zirconium). There will also be a small quantity of nimonic springs, which may be attached to thermocouple wires. A stainless steel top support bridge is 127mm in length and weighs approximately 26g and a Nimonic spring weighs approximately 5g. The thermocouple wires are approximately 380mm in length. It is unlikely that there will be any large items which will require special handling. The waste is loose in the vaults.

Changes since waste generated: -

Bulk density (t/m³): = 2.6

Comment on density: The average bulk density 2.6 t/m³ assumes a packing factor to give an overall volume of about three times the displacement volume of the waste.

CHEMICAL COMPOSITION

General description and components (%wt): Stainless steel will account for more than 98.5% of the waste, with 0.75% Nimonic and 0.25% alumina, magnesia and other minor constituents. The stainless steel may be contaminated with fission products, actinides and graphite.

Chemical state: Neutral

Sheet metal proportion / thickness: -

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	~ 99.0	-	99.0
Other ferrous metals.....	= 0	-	
Iron.....	-	-	
Aluminium.....	= 0	-	
Beryllium.....	0	-	
Cobalt.....	-	-	
Copper.....	= 0	-	
Lead.....	= 0	-	
Magnox/Magnesium.....	= 0	-	
Nickel.....	~ 0.75	Nimonic.	
Titanium.....	-	-	
Uranium.....	-	-	
Zinc.....	= 0	-	
Zircaloy/Zirconium.....	= 0	-	
Other metals.....	= 0	No "other" metals have been identified.	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulotics.....	= 0	-	
Paper, cotton.....	= 0	-	
Wood.....	= 0	-	
Halogenated plastics.....	= 0	-	
Total non-halogenated plastics.....	= 0	-	
Condensation polymers.....	= 0	-	
Others.....	= 0	-	
Organic ion exchange materials.....	TR	-	
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):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	TR	-	
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	-	
Free non-aqueous liquids.....	= 0	-	
Powder/Ash.....	P	-	

COMPONENTS OF MATERIALS, WASTE PROPERTIES, MATERIALS NOT CONTRIBUTING TO MASS

Inorganic anions (%wt):

	(%wt)	Type(s) and comment
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:

	(%wt)	Type(s) and comment
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.....	-	-
Corrosive materials.....	= 0	-
Pyrophoric materials.....	= 0	-
Generating toxic gases.....	= 0	-
Reacting with water.....	= 0	-
Higher activity particles.....	-	-
Soluble solids as bulk chemical compounds.....	-	-

Hazardous substances / non hazardous pollutants:

	(%wt)	Type(s) and comment
Acrylamide.....	0	-
Benzene.....		-
Chlorinated solvents.....		-
Formaldehyde.....		-
Organometallics.....		-
Phenol.....		-
Styrene.....		-
Tri-butyl phosphate.....		-
Other organophosphates.....		-
Vinyl chloride.....		-
Arsenic.....		-
Barium.....		-
Boron.....		-
Boron (in Boral).....		-
Boron (non-Boral).....		-
Cadmium.....		-
Caesium.....		-
Selenium.....		-
Chromium.....		-
Molybdenum.....		-
Thallium.....		-
Tin.....		-
Vanadium.....		-
Mercury compounds.....		-
Others.....		-

Complexing agents (%wt):

Yes		
	(%wt)	Type(s) and comment
EDTA.....	TR	-
DPTA.....		-
NTA.....		-
Polycarboxylic acids.....		-
Other organic complexants.....		-
Total complexing agents.....	TR	-

Physical components:

	Number	Type(s) and comment
Sources.....		-
Electronic & Electrical Equipment (EEE)		-
EEE Type 1.....		-
EEE Type 2.....		-
EEE Type 3.....		-
EEE Type 4.....		-
EEE Type 5.....		-

TREATMENT, PACKAGING AND DISPOSAL

Planned on-site / off-site treatment(s):

Treatment	On-site / Off-site	Stream volume %
Size reduction Decay storage Low force compaction Supercompaction (HFC) Incineration Drying/dewatering/liquid separation Tie down/fixatives/strippable coating/painting application Decontamination Metal treatment Recycling / reuse Thermal treatment, including vitrification Encapsulation Polymer encapsulation Other physical treatment Other chemical treatment Containerisation Treatment not yet determined None		

Comments on planned treatments:

-

Conditioning method:

This stream will be co-packaged with 9A25, 9A31, 9A39, 9A52, 9A60 and 9A66 in Type VI DCIC containers. Remainder of vault 1 waste streams will be co-packaged together in Concrete boxes (9A61, 9A62, 9A67, 9A32, 9A40, 9A48, 9A53, 9A73) Packages for vault 1 are assigned to 9A25, 9A32 & 9A73.

Conditioning plants:

Plant Name	Location

Likely conditioning matrix:

-

Further information on the conditioning matrix:

-

Waste Packaging:

Likely container type:

Container	Waste packaged (vol%)	Waste loading (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
-	-	-	-	-	-

Range in container waste loading: -

Other information on packaging and conditioning:

-

Conditioned density (t/m³):

-

Conditioned density comment:

-

Management Routes:

Disposal Route	Stream volume %	Raw density t/m³	Start date
Expected to be consigned to a Near Site, Near Surface Disposal Facility (Scotland)			
Expected to be Non-NSD HAW managed under Scottish Government's policy			
Expected to be disposed to LLW Vaults NRS Dounreay			
Expected to be consigned to the Geological Disposal Facility			
Expected to be consigned to a Near Surface Disposal Facility			
Expected to be consigned to the LLW Repository			
Expected to be consigned to a Landfill Facility			
Expected to be disposed On-Site			
Expected to be managed by In-Situ Disposal			
Expected to be consigned to an Incineration Facility			
Expected to be consigned to a Metal Treatment Facility			
Expected to be Out of Scope			
Expected to be recycled / reused			
Disposal route not known			

Classification codes for waste expected to be consigned to a landfill facility:

Opportunities for alternative disposal routing: No

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
-	-	-	-	-

RADIOACTIVITY

Source: Activation when the associated fuel elements were irradiated, of nuclides incorporated into the stainless steel. 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.

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.

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 may be present as carbon incorporated in the stainless steel and is likely to be 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 technetium content is insignificant
I-129: -
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 neptunium content is insignificant.
Pu: Chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

WASTE STREAM			9A47		FED Stainless Steel				
Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code		Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code
H 3	2.18E-03	B B 1			Gd 153		8		
Be 10					Ho 163		8		
C 14	3.00E-01	B B 1			Ho 166m		8		
Na 22					Tm 170		8		
Al 26	2.00E-06	B B 1			Tm 171		8		
Cl 36	7.00E-06	B B 1			Lu 174		8		
Ar 39					Lu 176		8		
Ar 42					Hf 178n		8		
K 40					Hf 182		8		
Ca 41					Pt 193		8		
Mn 53					Ti 204		8		
Mn 54					Pb 205		8		
Fe 55	2.05E-03	B B 1			Pb 210		8		
Co 60	2.81E-01	B B 1			Bi 208		8		
Ni 59	8.00E-01	B B 1			Bi 210m		8		
Ni 63	7.06E+01	B B 1			Po 210		8		
Zn 65					Ra 223		8		
Se 79					Ra 225		8		
Kr 81					Ra 226		8		
Kr 85					Ra 228		8		
Rb 87					Ac 227		8		
Sr 90	3.26E-04	B B 1			Th 227		8		
Zr 93	4.00E-08	B B 1			Th 228		8		
Nb 91					Th 229		8		
Nb 92	6.00E-08	B B 1			Th 230		8		
Nb 93m	2.33E-01	B B 1			Th 232		8		
Nb 94	4.00E-03	B B 1			Th 234	7.00E-07	B B 1		
Mo 93	3.99E-03	B B 1			Pa 231		8		
Tc 97					Pa 233	4.25E-08	B B 1		
Tc 99	7.00E-04	B B 1			U 232		8		
Ru 106					U 233		8		
Pd 107					U 234	6.05E-07	B B 1		
Ag 108m	7.76E-03	B B 1			U 235	2.00E-08	B B 1		
Ag 110m					U 236	5.00E-08	B B 1		
Cd 109					U 238	7.00E-07	B B 1		
Cd 113m	1.22E-09	B B 1			Np 237	4.25E-08	B B 1		
Sn 119m					Pu 236		8		
Sn 121m					Pu 238	6.94E-05	B B 1		
Sn 123					Pu 239	2.00E-04	B B 1		
Sn 126	3.04E-09	B B 1			Pu 240	2.00E-04	B B 1		
Sb 125					Pu 241	1.27E-03	B B 1		
Sb 126					Pu 242	6.00E-08	B B 1		
Te 125m					Am 241	4.45E-04	B B 1		
Te 127m					Am 242m	3.65E-07	B B 1		
I 129					Am 243	8.00E-08	B B 1		
Cs 134					Cm 242	3.01E-07	B B 1		
Cs 135	6.00E-09	B B 1			Cm 243	3.31E-08	B B 1		
Cs 137	3.97E-04	B B 1			Cm 244	2.00E-07	B B 1		
Ba 133					Cm 245		8		
La 137					Cm 246		8		
La 138					Cm 248		8		
Ce 144					Cf 249		8		
Pm 145					Cf 250		8		
Pm 147					Cf 251		8		
Sm 147					Cf 252		8		
Sm 151	1.74E-06	B B 1			Unsp a				
Eu 152	7.87E-09	B B 1			Unsp b/g				
Eu 154	4.67E-07	B B 1			Total a	9.17E-04	*	0	*
Eu 155	7.76E-09	B B 1			Total b/g	7.22E+01	*	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 the 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
* Total calculated from the 114 declared radionuclides