

WASTE STREAM	6N101	Decommissioning Near Beam Metallic
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SITE Rutherford Appleton Laboratory

SITE OWNER Minor Waste Producers

WASTE CUSTODIAN Minor Waste Producers

WASTE TYPE ILW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	0 m ³
Future arisings -	1.4.2037 - 31.3.2050.....	~26.0 m ³
Total future arisings:		26.0 m ³
Total waste volume:		26.0 m ³

Comment on volumes: Currently no detailed plan for decommissioning but waste shall arise during 2037-2050. Volumes are estimated from current ISIS machine envelope and on the assumption that 5% of machine will be ILW. This fraction is based on current arisings but is uncertain.

Uncertainty factors on volumes: Stock (upper): x Arisings (upper) x 2.0
 Stock (lower): x Arisings (lower) x 0.5

WASTE SOURCE Decommissioning of the ISIS neutron spallation activation from areas close to the target and the high-energy proton beam.

PHYSICAL CHARACTERISTICS

General description: Mixed highly activated metal components. Mostly structural steel components. Very small contribution of graphite from intermediate targets used for muon production. These are a separately stored sub-wastestream. Metallic solids

Physical components (%wt): stainless steel (81%), mild steel (14%), copper (4.5%), aluminium (0.5%) and other metals (phosphor bronze) (0.5%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~7.8

Comment on density: Mostly steel

CHEMICAL COMPOSITION

General description and components (%wt): -

Chemical state: Neutral

Chemical form of radionuclides: H-3: produced within metals
 C-14: produced within metals

Metals and alloys (%wt): 100% present as bulk items, dimensions in each dimension range from a few centimeters to a few meters.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	~81.0	304	
Other ferrous metals.....	~14.0		
Iron.....	0		
Aluminium.....	~0.50	5083	
Beryllium.....	0		
Cobalt.....	0		
Copper.....	~4.0		
Lead.....	0		
Magnox/Magnesium.....	0		

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Nickel.....	0		
Titanium.....	0		
Uranium.....	0		
Zinc.....	0		
Zircaloy/Zirconium.....	0		
Other metals.....	~~0.50	Phosphor bronze	
Organics (%wt):	-		
	(%wt)	Type(s) and comment	% of total C14 activity
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.....	0.01		
Halogenated rubber	0		
Non-halogenated rubber.....	0.01	EPDM rubber seals & Silicon-rubber seals	
Hydrocarbons.....	0		
Oil or grease	0		
Fuel.....	0		
Asphalt/Tarmac (cont.coal tar)...	0		
Asphalt/Tarmac (no coal tar)....	0		
Bitumen.....	0		
Others.....	0		
Other organics.....	0		
Other materials (%wt):	-		
	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	0		
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	0		
Sand.....	0		
Glass/Ceramics.....	~~0.50	ceramic insulators	
Graphite.....	<0.01		
Desiccants/Catalysts.....	0		
Asbestos.....	TR		
Non/low friable.....	TR		
Moderately friable.....	0		

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Highly friable.....	0
Free aqueous liquids.....	0
Free non-aqueous liquids.....	0
Powder/Ash.....	0

Inorganic anions (%wt): -

	(%wt)	Type(s) and comment
Fluoride.....	0	
Chloride.....	0	
Iodide.....	0	
Cyanide.....	0	
Carbonate.....	0	
Nitrate.....	0	
Nitrite.....	0	
Phosphate.....	0	
Sulphate.....	0	
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.....	0	
Corrosive materials.....	0	
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	0	
Higher activity particles.....	0	
Soluble solids as bulk chemical compounds.....	0	

Hazardous substances / non hazardous pollutants: -

	(%wt)	Type(s) and comment
Acrylamide.....	0	
Benzene.....	0	
Chlorinated solvents.....	0	
Formaldehyde.....	0	

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Organometallics.....	0
Phenol.....	0
Styrene.....	0
Tri-butyl phosphate.....	0
Other organophosphates.....	0
Vinyl chloride.....	0
Arsenic.....	0
Barium.....	0
Boron.....	0
Boron (in Boral).....	0
Boron (non-Boral).....	0
Cadmium.....	~~0.01
Caesium.....	0
Selenium.....	0
Chromium.....	0
Molybdenum.....	0
Thallium.....	0
Tin.....	0
Vanadium.....	0
Mercury compounds.....	0
Others.....	0
Electronic Electrical Equipment (EEE)	
EEE Type 1.....	0
EEE Type 2.....	0
EEE Type 3.....	0
EEE Type 4.....	0
EEE Type 5.....	0

Complexing agents (%wt): No

(%wt) Type(s) and comment

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

Potential for the waste to contain discrete items: Yes. Various stainless steel, steel and copper (resistant) components which are of irregular design.

PACKAGING AND CONDITIONING

Conditioning method: Not yet determined
Plant Name: -
Location: -
Plant startup date: -

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Total capacity (m³/y incoming waste): -

Target start date for packaging this stream: -

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

Other information: -

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

Likely container type comment: -

Range in container waste volume: -

Other information on containers: -

Likely conditioning matrix:
Other information: -

Conditioned density (t/m³): -

Conditioned density comment: -

Other information on conditioning: -

Opportunities for alternative disposal routing: -

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
-	-	-	-	-	-

RADIOACTIVITY

Source: Activation

Uncertainty: Uncertainty arises due to a range of possible activation identified by activation calculations and there is ongoing work to improve estimates.

Definition of total alpha and total beta/gamma: Not all nuclides present in the fingerprint are listed.

Measurement of radioactivities: Activity concentration of a subset of the wastes measured and taken to be representative of total waste stream. Co-60 measured through dose rate measurements, remaining nuclides modelled and inferred through the Co-60 assessment based on dose rate of current arisings of this waste type.

Other information: Other nuclides >1% concentration include Cr-51, Co-56, Co-58, V-49, Ce-141, Sc-46, W-185 and Be-7.

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3			1.16E+01	DB 2	Gd 153				8
Be 10				4	Ho 163				4
C 14				6	Ho 166m				4
Na 22				8	Tm 170				4
Al 26				4	Tm 171				4
Cl 36				4	Lu 174				4
Ar 39				4	Lu 176				4
Ar 42				4	Hf 178n				4
K 40				4	Hf 182				4
Ca 41				4	Pt 193				4
Mn 53				4	Tl 204				4
Mn 54			1.8E+02	DC 2	Pb 205				4
Fe 55			4.42E+02	DC 2	Pb 210				4
Co 60			4.25E+01	AA 2	Bi 208				4
Ni 59				4	Bi 210m				4
Ni 63			4.55E+00	DC 2	Po 210				4
Zn 65			1.15E+01	DC 2	Ra 223				4
Se 79				4	Ra 225				4
Kr 81				4	Ra 226				4
Kr 85				4	Ra 228				4
Rb 87				4	Ac 227				4
Sr 90				4	Th 227				4
Zr 93				4	Th 228				4
Nb 91				4	Th 229				4
Nb 92				4	Th 230				4
Nb 93m				4	Th 232				4
Nb 94				4	Th 234				4
Mo 93				4	Pa 231				4
Tc 97				4	Pa 233				4
Tc 99				4	U 232				4
Ru 106				4	U 233				4
Pd 107				4	U 234				4
Ag 108m				8	U 235				4
Ag 110m				8	U 236				4
Cd 109				4	U 238				4
Cd 113m				4	Np 237				4
Sn 119m				4	Pu 236				4
Sn 121m				4	Pu 238				4
Sn 123				4	Pu 239				4
Sn 126				4	Pu 240				4
Sb 125				4	Pu 241				4
Sb 126				4	Pu 242				4
Te 125m				4	Am 241				4
Te 127m				4	Am 242m				4
I 129				4	Am 243				4
Cs 134				4	Cm 242				4
Cs 135				4	Cm 243				4
Cs 137				4	Cm 244				4
Ba 133				4	Cm 245				4
La 137				4	Cm 246				4
La 138				4	Cm 248				4
Ce 144				4	Cf 249				4
Pm 145				4	Cf 250				4
Pm 147				4	Cf 251				4
Sm 147				4	Cf 252				4
Sm 151				4	Other a				8
Eu 152				4	Other b/g		9.9E+01	DC	2
Eu 154				4	Total a	0	0	8	8
Eu 155				4	Total b/g	0	7.91E+02	DC	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 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