WASTE STREAM	9B29	Miscellaneous Activated Components - R2

SITE Bradwell

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Nuclear Restoration Services Ltd (NRS)

WASTE TYPE ILW

WASTE VOLUMES

	Reported (m^3)
Stocks: At 1.4.2025	= 81.0
Future arisings:	
Total future arisings:	**0.0**
Total waste volume:	**81.0**

OR

Conditioned (m^3)	Packaged (m^3)

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

Comment on arising rates: -

Additional information on quantities: The contents of some of the accumulation facilities have been estimated from photographs and the volumes represent upper limits.

Uncertainty factors on volumes:

Stock (upper):	x 1.20	Arisings (upper):	x -
Stock (lower):	x 0.80	Arisings (lower):	x -

WASTE SOURCE Redundant or defective components and equipment that have been removed from reactor core and fuelling machines.

PHYSICAL CHARACTERISTICS

General description: Components such as control rods, absorber bars, thermocouples, fuelling machine grabs, and hoist cables. The possibility of large items which may need special handling has not been assessed.

Changes since waste generated: -

Bulk density (t/m³): ~ 1.0

Comment on density: The assumption of 1 t/m3 as the average bulk density may be subject to revision.

CHEMICAL COMPOSITION

General description and components (%wt): The waste is predominantly steel and boron steel.

Chemical state: Neutral

Sheet metal proportion / thickness: Predominantly bulk metal items on average between 5 and 30 mm in thickness.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel……	P	BS970 EN58 stainless steel.	
Other ferrous metals……	~ 90.0	Control rods are boron steel, absorber components are 0.1% Mn mild steel, other metals possibly present.	
Iron……		-	
Aluminium……	NE	-	
Beryllium……	NE	-	
Cobalt……	< 0.02	Greatest measured value from the various components.	
Copper……	< 0.02	-	
Lead……	NE	-	
Magnox/Magnesium……	NE	-	
Nickel……	~ 0.07	Greatest measured value from the various components.	
Titanium……		-	
Uranium……		-	
Zinc……	NE	-	
Zircaloy/Zirconium……	NE	-	
Other metals……	TR	Silver and niobium.	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
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	NE	-	

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		-	
Glass/Ceramics	= 0	-	
Graphite	TR	-	
Desiccants/Catalysts		-	
Asbestos	= 0	-	
Non/low friable		-	
Moderately friable		-	
Highly friable		-	
Free aqueous liquids	= 0	-	
Free non-aqueous liquids	TR	-	
Powder/Ash	TR	-	

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

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		-
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		-
Benzene		-
Chlorinated solvents		-
Formaldehyde		-
Organometallics		-
Phenol		-
Styrene		-
Tri-butyl phosphate		-
Other organophosphates		-
Vinyl chloride		-
Arsenic		-
Barium		-
Boron	0	-
Boron (in Boral)		-
Boron (non-Boral)		-
Cadmium		-
Caesium		-
Selenium		-
Chromium		-
Molybdenum	< 0.30	Greatest measured value from the various components.
Thallium		-
Tin		-
Vanadium		-
Mercury compounds		-
Others		-

Complexing agents (%wt): No

	(%wt)	Type(s) and comment
EDTA		-
DPTA		-
NTA		-
Polycarboxylic acids		-
Other organic complexants		-
Total complexing agents	= 0	-

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	On-site	100.0
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		

Comments on planned treatments: -

Conditioning method: The current proposal is to store the waste as at present until reactor dismantling. All waste is expected to be retrieved and conditioned when the conditioning campaign is undertaken The waste is not expected to be supercompacted. The treatment envisaged is the placement of the waste in baskets followed by encapsulation. Container choice may be influenced by Transport Regulations.

Conditioning plants:

Plant Name	Location
RDC Encap BRD	Bradwell

Likely conditioning matrix: Unknown

Further information on the conditioning matrix: The waste is assumed to be encapsulated.

Waste Packaging:

Likely container type:

Container	Waste packaged (vol%)	Waste loading (m^3)	Payload (m^3)	Number of packages	Estimated start date for packaging
4 m box (100 mm concrete shielding)	100.0	12.3	14.3	7	-

Range in container waste loading: No significant variability is expected.

Other information on packaging and conditioning: The container material is expected to be stainless steel. The waste will be in baskets placed in the waste packages. Baskets of different Final Dismantling ILW wastes may be in the same waste packages. The encapsulation matrix would be likely to be BFS/OPC. The density of the encapsulated waste would probably be about 3 t/m3.

Conditioned density (t/m^3): ~ 3.0
Conditioned density comment: The conditioned waste density assumes that the waste will be encapsulated.

Management Routes:

Disposal Route	Stream volume %	Raw density t/m^3	Start date
Expected to be consigned to a Near Site, Near Surface Disposal Facility (Scotland)	100.0		
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: Irradiated components removed from the reactor. Absorber bars and control rods are likely to be components of high activity, the majority of the activity coming from their activation.

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

Measurement of radioactivities: Estimates are based upon theoretical assessments.

Chemical form of radionuclides:

H-3: Chemical form of tritium has not been determined but is probably present as surface contamination.
C-14: The chemical form of carbon 14 has not been determined but is probably present as graphite.
Cl-36: The chemical form of chlorine 36 has not been determined.
Se-79: -
Tc-99: -
I-129: -
Ra: -
Th: -
U: The chemical form of uranium isotopes has not been determined but may be present as uranium oxides.
Np: -
Pu: The chemical form of plutonium isotopes has not been determined but may be present as plutonium oxides.

WASTE STREAM **9B29** **Miscellaneous Activated Components - R2**

Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code
H 3	< 1.09E+00	D 3			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	2.00E-02	C D 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	3.00E-05	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	1.38E-08	C D 2			Pb 205		8		
Fe 55	9.22E-01	C D 2			Pb 210		8		
Co 60	9.38E-01	C D 2			Bi 208		8		
Ni 59	4.00E-02	C D 2			Bi 210m		8		
Ni 63	3.53E+00	C D 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	< 3.26E-05	D 3			Th 227		8		
Zr 93		8			Th 228		8		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m		8			Th 232		8		
Nb 94	4.00E-05	C D 2			Th 234	7.00E-09	C C 2		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233		8		
Tc 99	< 1.00E-08	D 3			U 232		8		
Ru 106		8			U 233		8		
Pd 107		8			U 234	< 6.14E-09	D 3		
Ag 108m	3.88E-05	C D 2			U 235		8		
Ag 110m		8			U 236		8		
Cd 109		8			U 238	< 7.00E-09	D 3		
Cd 113m		8			Np 237		8		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	< 2.60E-06	D 3		
Sn 123		8			Pu 239	< 3.00E-06	D 3		
Sn 126		8			Pu 240	< 4.00E-06	D 3		
Sb 125		8			Pu 241	< 3.78E-05	D 3		
Sb 126		8			Pu 242	< 2.00E-09	D 3		
Te 125m		8			Am 241	< 8.50E-06	D 3		
Te 127m		8			Am 242m	< 1.83E-08	D 3		
I 129		8			Am 243	< 5.99E-09	D 3		
Cs 134	< 4.74E-09	D 3			Cm 242	< 1.51E-08	D 3		
Cs 135		8			Cm 243	< 3.31E-09	D 3		
Cs 137	< 1.32E-04	D 3			Cm 244	< 4.51E-08	D 3		
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	< 3.44E-08	D 3			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	< 7.83E-07	D 3			Unsp a				
Eu 152	7.88E-06	C D 2			Unsp b/g				
Eu 154	4.67E-06	C D 2			**Total a**	**1.82E-05**	*	**0**	*
Eu 155		8			**Total b/g**	**6.54E+00**	*	**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