WASTE STREAM 9F26 Miscellaneous Activated Components - R1

SITE	Sizewell A
SITE OWNER	Nuclear Decommissioning Authority
WASTE CUSTODIAN	Magnox Limited
WASTE TYPE	ILW; SPD3
Is the waste subject to Scottish Policy:	No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	142.0 m³
Total future arisings:		0 m³
Total waste volume:		142.0 m³
Comment on volumes:	-	
Uncertainty factors on volumes:	Stock (upper): x 1.2	Arisings (upper) x
	Stock (lower): x 0.8	Arisings (lower) x

WASTE SOURCE Redundant or defective components removed from the reactor cores or fuelling machines / servicing machines.

PHYSICAL CHARACTERISTICS

General description:	Flux flattening elements (absorber bars), fuel element support struts, fuelling machine broken hoses, flux scanning wires, control rods and chains, thermocouple harnesses and cables, charge chute bottom sections and redundant BCD equipment. Special handling will be required for some large items. Control rods and charge chute lengths may be of the order of 6 m long, assuming they have not been cut into sections. Components may weigh up to 1.7 t.
Physical components (%vol):	Control rods (1% vol), absorber bars (10% vol), BCD equipment (1% vol), thermocouples (1% vol) and charge chutes (87% vol).
Sealed sources:	The waste does not contain sealed sources.
Bulk density (t/m³):	<1
Comment on density:	The average density has not been fully assessed but will be less than 1 t/m3.

CHEMICAL COMPOSITION

General description and components (%wt):	Principally mild steel with other wastes containing graphite and stainless steel. Other components that may be present in smaller quantities are copper, boron steel, electrical wire insulation and PVC sheeting used for wrapping contaminated items.
Chemical state:	Neutral
Chemical form of radionuclides:	H-3: The chemical form of tritium has not been determined. C-14: The chemical form of carbon 14 may be graphite. Cl-36: The chemical form of chlorine 36 has not been determined. Se-79: The selenium content is insignificant. Tc-99: The technetium content is insignificant. Ra: The radium isotope content is insignificant. Th: The thorium isotope content is insignificant. U: The uranium isotope content is insignificant. Np: The neptunium content is insignificant. Pu: The chemical form of plutonium isotopes has not been determined but may be in the form of plutonium oxides.
Metals and alloys (%wt):	Approximately 99% bulk metal wastes.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	~7.5	Nickel and chromium will be present as constituents of stainless steel.	
Other ferrous metals.....	~90.0	Generally carbon steels with 300 series stainless steels.	
Iron.....			

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Aluminium	0	
Beryllium	0	
Cobalt		
Copper	<0.10	
Lead	0	
Magnox/Magnesium	TR	
Nickel		
Titanium		
Uranium		
Zinc	0	
Zircaloy/Zirconium	0	
Other metals	NE	Cadmium may be present as an additive in the steel control rods.

Organics (%wt): Trace quantities of oil may exist. No halogenated plastics or rubbers are expected.

	(%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	TR		

Other materials (%wt): Graphite may be present in trace quantities.

	(%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			

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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	0

Inorganic anions (%wt): Not fully assessed.

	(%wt)	Type(s) and comment
Fluoride	NE	
Chloride	NE	
Iodide	NE	
Cyanide	0	
Carbonate	NE	
Nitrate	NE	
Nitrite	NE	
Phosphate	NE	
Sulphate	NE	
Sulphide	NE	

Materials of interest for waste acceptance criteria: -

	(%wt)	Type(s) and comment
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	
Higher activity particles		
Soluble solids as bulk chemical compounds		

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Hazardous substances / non hazardous pollutants: Cadmium may be present as an additive in the steel control rods.

	(%wt)	Type(s) and comment
Acrylamide.....		
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.....		
Electronic Electrical Equipment (EEE)		
EEE Type 1.....		
EEE Type 2.....		
EEE Type 3.....		
EEE Type 4.....		
EEE Type 5.....		

Complexing agents (%wt): No

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

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Potential for the waste to contain discrete items:	Yes. Large Metal Items (LMIs)/"substantial" thickness items considered "durable" assumed DIs; Stainless items assumed DIs.

PACKAGING AND CONDITIONING

Conditioning method:	The waste will be conditioned to satisfy the disposal requirements which are effective at the time of retrieval/conditioning. It is currently assumed that the waste will be placed in baskets in the waste packages and will be encapsulated but not supercompacted.
Plant Name:	None
Location:	Sizewell A Decommissioning Site
Plant startup date:	2092
Total capacity (m^3/y incoming waste):	~5000.0
Target start date for packaging this stream:	2092
Throughput for this stream (m^3/y incoming waste):	~50.0
Other information:	All of the waste is expected to be retrieved and conditioned when a conditioning campaign is undertaken.

Likely container type:

Container	Waste packaged (%vol)	Waste loading (m^3)	Payload (m^3)	Number of packages
4m box (no shielding)	100.0	16.2	18.9	9

Likely container type comment:	It is now assumed that the waste will be placed in baskets in the waste packages and will be encapsulated but not supercompacted. BFS/OPC (possibly PFA/OPC) is the likely encapsulation matrix.
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. The type of container to be used is under review.
Likely conditioning matrix:	
Other information:	BFS/OPC (possibly PFA/OPC) is the likely encapsulation matrix.
Conditioned density (t/m^3):	~3.0
Conditioned density comment:	-
Other information on conditioning:	Waste will be retained on site pending Final Decommissioning and Site Clearance. Appropriate plant to be provided at the Station in accordance with Company strategy. The waste will be in baskets placed in the waste packages. Baskets of different Final Decommissioning ILW wastes may be in the same waste package. The encapsulation matrix is likely to be BFS/OPC (possibly PFA/OPC) and the density of the conditioned waste product would be about 3 t/m3.
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:	Redundant or defective components such as control rods, charge chutes, absorber bars

	and thermocouples removed from reactor cores and fuelling machines/reactor servicing machine.
Uncertainty:	Activity estimates are thought to be accurate within a factor of 10, but could be lower by a factor of 100.
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:	Activities have been calculated from activation calculations with assumptions for contamination.
Other information:	Specific activity is a function of Station operating history. The values quoted are indicative of the activities that might be expected.

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3	8.71E-03	C D 2			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	2.00E-03	C D 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	3E-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	2.90E-09	C D 2			Pb 205		8		
Fe 55	1.95E-04	C D 2			Pb 210		8		
Co 60	4.77E-04	C D 2			Bi 208		8		
Ni 59		8			Bi 210m		8		
Ni 63		8			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	4.21E-05	C D 2			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		8			Th 234		8		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233		8		
Tc 99		8			U 232		8		
Ru 106		8			U 233		8		
Pd 107		8			U 234		8		
Ag 108m		8			U 235		8		
Ag 110m		8			U 236		8		
Cd 109		8			U 238		8		
Cd 113m		8			Np 237		8		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	2.66E-06	C D 2		
Sn 123		8			Pu 239	3E-06	C D 2		
Sn 126		8			Pu 240	4.00E-06	C D 2		
Sb 125		8			Pu 241	2.95E-05	C D 2		
Sb 126		8			Pu 242		8		
Te 125m		8			Am 241	1.08E-05	C D 2		
Te 127m		8			Am 242m		8		
I 129		8			Am 243		8		
Cs 134		8			Cm 242		8		
Cs 135		8			Cm 243	2.13E-08	C D 2		
Cs 137	2.84E-04	C D 2			Cm 244	2.27E-07	C D 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		8			Other a				
Eu 152		8			Other b/g				
Eu 154		8			**Total a**	**2.07E-05**	**C D 2**	**0**	
Eu 155		8			**Total b/g**	**1.18E-02**	**C D 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