WASTE STREAM 9D325 Debris in Debris Removal Ducts R2

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

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	0 m³
Future arisings -	1.4.2085 - 31.3.2088.....	1.0 m³
Total future arisings:		1.0 m³
Total waste volume:		1.0 m³

Comment on volumes: Final Dismantling & Site Clearance is assumed to commence in 2081 and end in 2090. Reactor dismantling will commence in 2085 and last for three years. Volumes and radioactivity have been calculated for 85 years after reactor shutdown, i.e. 2085.

Uncertainty factors on volumes:

Stock (upper):	x	Arisings (upper)	x 1.2
Stock (lower):	x	Arisings (lower)	x 0.8

WASTE SOURCE There are 11 Debris Removal Ducts installed per reactor. These are designed to collect reactor debris such as loose lower tubes from the gag unit assembies and a variety of other items. The Debris Removal Ducts are already included within Final Dismantling & Site Clearance but this new waste stream addresses the debris held in the Debris Removal Ducts.

PHYSICAL CHARACTERISTICS

General description:	Materials known to be present in the Debris Removal Ducts are the lower tubes from the gag unit assemblies (mild steel). Other components could be present.
Physical components (%wt):	Lower Tubes from the gag unit assemblies. Mild steel ~100%.
Sealed sources:	The waste does not contain sealed sources.
Bulk density (t/m³):	~1.4
Comment on density:	-

CHEMICAL COMPOSITION

General description and components (%wt):	Mild steel components present (~100%).
Chemical state:	Neutral
Chemical form of radionuclides:	H-3: The tritium content is insignificant. C-14: The chemical form of the carbon-14 has not been determined. Se-79: The selenium content is insignificant. Tc-99: The chemical form of the technetium has not been determined. Ra: The radium isotopes content is insignificant. Th: The throium isotopes content is insignificant. U: The uraniium isotopes content is insignificant. Np: The neptunium isotopes content is insignificant. Pu: The plutonium isotopes content is insignificant.
Metals and alloys (%wt):	-

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	NE	Other components could be present (mild steel or stainless steel).	
Other ferrous metals.....	~100.0	Lower tubes from the gag unit assemblies are mild steel.	100.0
Iron.....			
Aluminium.....	0		

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Beryllium		
Cobalt		
Copper	0	
Lead	0	
Magnox/Magnesium	0	
Nickel		
Titanium		
Uranium		
Zinc	0	
Zircaloy/Zirconium	0	
Other metals	NE	The variety of other components has not yet been determined.

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	0		

Other materials (%wt): Graphite may be present on the surfaces of any debris.

	(%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		

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Graphite	TR
Desiccants/Catalysts	
Asbestos	0
Non/low friable	
Moderately friable	
Highly friable	
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		
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		

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Hazardous substances / non hazardous pollutants: None expected

	(%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.....		

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Potential for the waste to contain discrete items:	Yes. Large Metal Items (LMIs)/"substantial" thickness items considered "durable" assumed DIs. NB If recycled then DI Limits n/a

PACKAGING AND CONDITIONING

Conditioning method:	The waste is not expected to be supercompacted. It will be placed in baskets in the waste packages and is now assumed to be encapsulated.
Plant Name:	None
Location:	Hinkley Point A Site
Plant startup date:	2085
Total capacity (m^3/y incoming waste):	~5000.0
Target start date for packaging this stream:	2085
Throughput for this stream (m^3/y incoming waste):	~1.0
Other information:	Waste will be conditioned when removed from the reactor.

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	< 1

Likely container type comment:	The waste is assumed to be in baskets in the waste package so the occupied volume in the package is greater than the original waste volume.
Range in container waste volume:	Not yet determined.
Other information on containers:	The container material is expected to be stainless steel.
Likely conditioning matrix:	Not specified
Other information:	It is now expected that the waste will be encapsulated. The matrix could be BFS/OPC.
Conditioned density (t/m^3):	~3.0
Conditioned density comment:	-
Other information on conditioning:	The waste will be in baskets placed in the waste packages. Baskets of different Final Dismantling & Site Clearance ILW wastes may be in the same waste package.
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:	-
Uncertainty:	-
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:	-

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Other information:	The activities quoted are those at 85 years after reactor shutdown, i.e. in 2085. There may be some contamination by Cs137.

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Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	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				8	Gd 153				8
Be 10				8	Ho 163				8
C 14			2.9E-02	C C 2	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36			4.7E-06	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			5.6E-08	C C 2
Mn 54				8	Pb 205				8
Fe 55			1.7E-07	C C 2	Pb 210				8
Co 60			3.6E-04	C C 2	Bi 208				8
Ni 59			4.7E-03	C C 2	Bi 210m				8
Ni 63			3.4E-01	C C 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				8	Th 227				8
Zr 93				8	Th 228				8
Nb 91				8	Th 229				8
Nb 92			2.4E-09	C C 2	Th 230				8
Nb 93m				6	Th 232				8
Nb 94			6.5E-05	C C 2	Th 234				8
Mo 93			1.8E-04	C C 2	Pa 231				8
Tc 97				8	Pa 233				8
Tc 99			3.3E-05	C C 2	U 232				8
Ru 106				8	U 233				8
Pd 107				8	U 234				8
Ag 108m			4.9E-06	C C 2	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				8
Sn 123				8	Pu 239				8
Sn 126				8	Pu 240				8
Sb 125				8	Pu 241				8
Sb 126				8	Pu 242				8
Te 125m				8	Am 241				8
Te 127m				8	Am 242m				8
I 129				8	Am 243				8
Cs 134				8	Cm 242				8
Cs 135				8	Cm 243				8
Cs 137				6	Cm 244				8
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**	**0**		**0**	
Eu 155				8	**Total b/g**	**0**		**3.74E-01**	**C C 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