WASTE STREAM 9C321 Contaminated Soil LLW

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

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	0 m^3
Future arisings -	1.4.2092 - 31.3.2095.....	930.0 m^3
Total future arisings:		930.0 m^3
Total waste volume:		930.0 m^3

Comment on volumes: Waste arisings are assumed to occur at a uniform rate over three years. Final Dismantling & Site Clearance is assumed to commence in 2088 with reactor dismantling commencing in 2092 and lasting for 3 years. The volumes and radioactivity have been calculated for 85 years after reactor shutdown, i.e. 2091.

Uncertainty factors on volumes:

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

WASTE SOURCE Contaminated soil that has resulted from plant operation and maintenance.

PHYSICAL CHARACTERISTICS

General description: Based on upper natural material descriptions. No made ground descriptions in reference: Generally a sandy fine to coarse rounded flint gravel. Likely to be a thin clayey sand topsoil above formation. None larger than cobble sized gravel fragments likely.

Physical components (%vol): Flint gravel (70%), sand (25%), clay (5%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m^3): ~1.4

Comment on density: The bulk density is an estimate and may be subject to revision. Estimate assumes bulkage factor (physical expansion) of around 1.3. Available information about the soil types indicates that the bulkage factor could be 1.2 and the density would then be $1.5 t/m^3$.

CHEMICAL COMPOSITION

General description and components (%wt): Soil, rubble, organic material and water. Percentages are not estimated.

Chemical state: Neutral

Chemical form of radionuclides:
H-3: The tritium content is insignificant.
C-14: The carbon 14 content is insignificant.
Cl-36: The chlorine 36 content is insignificant.
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 plutonium isotope content is insignificant.

Metals and alloys (%wt): There are no bulk or sheet metal items present in the waste.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	0		
Other ferrous metals.....	0		
Iron.....			
Aluminium.....	0		
Beryllium.....	NE		

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Cobalt		
Copper	0	
Lead	0	
Magnox/Magnesium	0	
Nickel		
Titanium		
Uranium		
Zinc	0	
Zircaloy/Zirconium	0	
Other metals	0	Other metals are not expected except in their oxide form.

Organics (%wt): Organic matter will be associated with the soil. Halogenated plastics or rubbers are not expected.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	NE		
Paper, cotton	NE		
Wood	NE		
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	100.0		
Brick/Stone/Rubble	0		
Cementitious material	0		
Sand			
Glass/Ceramics	0		

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Graphite	0
Desiccants/Catalysts	
Asbestos	0
Non/low friable	
Moderately friable	
Highly friable	
Free aqueous liquids	NE
Free non-aqueous liquids	0
Powder/Ash	0

Inorganic anions (%wt): Anion content not fully determined. The anion content of the waste is naturally occurring oxides expected in soil.

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

Materials of interest for waste acceptance criteria: There will be water associated with the waste. There may be traces of biological material.

	(%wt)	Type(s) and comment
Combustible metals	0	
Low flash point liquids	0	
Explosive materials	0	
Phosphorus	0	
Hydrides	0	
Biological etc. materials	TR	
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):

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

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Potential for the waste to contain discrete items: No.

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction		
Supercompaction (HFC)		
Incineration		
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recyling / reuse		
Other / various		
None		100.0

Comment on planned treatments: -

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository		
Expected to be consigned to a Landfill Facility	100.0	1.4
Expected to be consigned to an On-Site Disposal Facility		
Expected to be consigned to an Incineration Facility		
Expected to be consigned to a Metal Treatment Facility		
Expected to be consigned as Out of Scope		
Expected to be recycled / reused		
Disposal route not known		

Classification codes for waste expected to be consigned to a landfill facility: 17 05 03* or 17 05 04

Upcoming (2022/23-2024/25) Waste Routing (if expected to change from above):

Disposal Route	Stream volume %		
	2022/23	2023/24	2024/25
Expected to be consigned to the LLW Repository			
Expected to be consigned to a Landfill Facility			
Expected to be consigned to an On-Site Disposal Facility			
Expected to be consigned to an Incineration Facility			
Expected to be consigned to a Metal Treatment Facility			
Expected to be consigned as Out of Scope			
Expected to be recycled / reused			
Disposal route not known			

Opportunities for alternative disposal routing: -

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

Waste Packaging for Disposal: (Not applicable to this waste stream)

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Container	Stream volume %	Waste loading m³	Number of packages
1/3 Height IP-1 ISO			
2/3 Height IP-2 ISO			
1/2 Height WAMAC IP-2 ISO			
1/2 Height IP-2 Disposal/Re-usable ISO			
2m box (no shielding)			
4m box (no shielding)			
Other			

Other information: -

Waste Planned for Disposal at the LLW Repository: (Not applicable to this waste stream)

Container voidage: -

Waste Characterisation Form (WCH): -

Waste consigned for disposal to LLWR in year of generation: -

Non-Containerised Waste for In-Vault Grouting: (Not applicable to this waste stream)

Stream volume (%): -

Waste stream variation: -

Bounding cuboidal volume:

Inaccessible voidage: -

Other information: -

RADIOACTIVITY

Source: Contamination that has resulted from plant maintenance and operation. Cs-137 is expected to dominate.

Uncertainty: Only approximate estimates have been made of the total specific activities. The estimates are typical of measurements at other sites, the activity may vary either way by a factor of 10. The activities quoted are those at the time of final site decommissioning.

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: Provision of detailed data will have to await detailed site characterisation.

Other information: The activities quoted are those at 85 years after reactor shutdown, i.e. in 2091. 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				8	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36				8	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				8	Pb 205				8
Fe 55				8	Pb 210				8
Co 60				8	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				6	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				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			1.78E-05	C C 2	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**		**1.78E-05**	**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