WASTE STREAM 9C912 Effluent Treatment Plant, Ponds and Decontamination 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 -	1.4.2022 - 31.3.2027.....	224.5 m^3
Total future arisings:		224.5 m^3
Total waste volume:		224.5 m^3

Comment on volumes: Waste volumes take no account of volume reduction by supercompaction.

Uncertainty factors on volumes:

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

WASTE SOURCE

9C912 is a large area legacy operational fingerprint under which waste generated through decommissioning of the plants and systems associated with the wet fuel storage ponds, active effluent treatment plant (AETP), flask handling, washdown and storage areas are consigned. This waste stream covers wastes generated from decommissioning activities from the following areas:• Ponds (PA) – above water only (waste from underwater are not included and require segregation)• Flask washdown and handling area (FW)• Active effluent treatment plant (EP)• Ponds water filtration caesium removal (PWFCR)• Lug vaults (LG)• DAMAL labs

PHYSICAL CHARACTERISTICS

General description: The types of waste associated with this waste stream include decommissioned plant and equipment, structural materials, scaffolding tubes, plasterboard, asbestos, concrete/rubble, soils, lead shot/shielding and secondary wastes such as damaged PPE, wood, coveralls, enclosure sheeting, other plastics and rubber. Other items are likely to be generated as the decommissioning continues including asbestos gaskets, asbestos lagging and ponds waste (with potential traces of sodium carbonate and sodium hydroxide liquid). In addition, there are a number of full height ISO containers containing legacy mixed waste items, drums and bags which have originated from this waste stream, however the specific area within the fingerprint from where these items arose is unknown. Other wastes have also been identified and include HEPA filters and vacuum cleaner bags which are generated across the waste stream areas.Plant systems and items in this area have been identified to be subject to similar radiological activation and contamination processes and conditions. Activation products, fission products and actinide contamination are anticipated in this low level waste (LLW) decommissioning waste stream. All sources of radiological contamination are considered to be in a decaying state.

Physical components (%wt): Decommissioned plant and equipment, structural materials, scaffolding tubes, plasterboard, asbestos, concrete/rubble, soils, lead shot/shielding and secondary wastes such as damaged PPE, wood, coveralls, enclosure sheeting, other plastics and rubber. Percentage breakdown by weight is metal waste (~54%wt), plastics (~18%wt), rubble/concrete (~6%wt), rubber (~7%wt), wood (~6%wt), soil (~1%wt), powder / ash (~1%wt), plaster board (~1%wt), biodegradable putrescilbes (~1%wt), other organic (~1%wt), and other (~4%wt).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m^3): ~0.47

Comment on density: Taken from WCH mass divided by volume.

CHEMICAL COMPOSITION

General description and components (%wt): Decommissioned plant and equipment, structural materials, scaffolding tubes, plasterboard, asbestos, concrete/rubble, soils, lead shot/shielding and secondary wastes such as damaged PPE, wood, coveralls, enclosure sheeting, other plastics and rubber. Percentage breakdown by weight is metal waste (~54%wt), plastics (~18%wt), rubble/concrete (~6%wt), rubber (~7%wt), wood (~6%wt), soil (~1%wt), powder / ash (~1%wt), plaster board (~1%wt), biodegradable putrescilbes (~1%wt), other organic (~1%wt), and other (~4%wt).

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Chemical state:	Neutral
Chemical form of radionuclides:	H-3: Tritium present in surface contamination of waste by tritiated liquor. C-14: Carbon 14 may be present in the form of graphite dust. Cl-36: Chlorine 36 may be present as a contaminant of graphite dust. U: The chemical form of uranium isotopes has not been determined but may be uranium oxides. Pu: The chemical form of plutonium isotopes has not been determined but may be plutonium oxides.
Metals and alloys (%wt):	Metal thickness may vary from ~1mm to ~30mm.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel	6.3	7428 kg stainless steel assuming stainless based type 304, 8% nickel, 18% chromium. Plant and equipment items and structural materials.	
Other ferrous metals	43.6	Assumption of 90% iron in all other ferrous metals. Plant and equipment items and structural materials.	
Iron			
Aluminium	<1.1	Scaffold tubes, 42 HEPA filters and legacy plant items.	
Beryllium			
Cobalt			
Copper			
Lead	<2.9	Lead shot / lead shielding.	
Magnox/Magnesium	<0.02	Trace quantities i.e. metal alloys.	
Nickel			
Titanium			
Uranium			
Zinc	<0.08	Trace quantities. 42 HEPA filters, galvanised metal coatings.	
Zircaloy/Zirconium			
Other metals			

Organics (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	6.0		
Paper, cotton			
Wood	6.0		
Halogenated plastics	4.0	Plastic bags, PPE and sheeting.	
Total non-halogenated plastics	14.0	Plastic bags, PPE and sheeting.	
Condensation polymers	7.0		
Others	7.0	Plastic bags, PPE and sheeting.	
Organic ion exchange materials			
Total rubber	7.0	From rubber boots and gloves and overshoes (soles). The waste may also contain halogenated rubber as neoprene.	
Halogenated rubber	3.5		
Non-halogenated rubber	3.5		

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Hydrocarbons.....	
Oil or grease	
Fuel.....	
Asphalt/Tarmac (cont.coal tar)...	
Asphalt/Tarmac (no coal tar).....	
Bitumen.....	
Others.....	
Other organics.....	1.0

Other materials (%wt): Others includes wastes outside of the above categories including, 1.25kg ponds wastes (sodium hydroxide), trace of liquid potentially on waste; 1.25kg ponds wastes (sodium carbonate), trace of liquid potentially on waste; 625 kg of asbestos, man-made mineral fibres, chrysotile (white). The 'approximate overall composition by weight and volume' table (above) can only report whole numbers and thus certain percentages have been rounded up/down to suit this need.

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..			
Inorganic sludges and flocs.....			
Soil.....	1.0		
Brick/Stone/Rubble.....	6.0	Concrete/rubble.	
Cementitious material.....			
Sand.....			
Glass/Ceramics.....	0.36	Man made mineral fibre lagging.	
Graphite.....			
Desiccants/Catalysts.....			
Asbestos.....	0.17	Lagging and CAF joints - chrysotile (white).	
Non/low friable.....	0.17	Lagging and CAF joints - chrysotile (white).	
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....			
Free non-aqueous liquids.....			
Powder/Ash.....	1.0		

Inorganic anions (%wt): Carbonates, aluminates and silicates will be associated with concrete.

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

Materials of interest for waste acceptance criteria: Sodium carbonate <<0.01%, Sodium Hydroxide <<0.01%.

	(%wt)	Type(s) and comment
Combustible metals.....		
Low flash point liquids.....		
Explosive materials.....		
Phosphorus.....		
Hydrides.....		
Biological etc. materials.....		
Biodegradable materials.....	1.0	
Putrescible wastes.....	1.0	
Non-putrescible wastes.....		
Corrosive materials.....	P	0.125m3
Pyrophoric materials.....		
Generating toxic gases.....		
Reacting with water.....	P	250m2
Higher activity particles.....		
Soluble solids as bulk chemical compounds.....		

Hazardous substances / non hazardous pollutants: Ponds waste (sodium hydroxide) and Ponds waste (sodium carbonate).

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....		
Chlorinated solvents.....		
Formaldehyde.....		
Organometallics.....		
Phenol.....		
Styrene.....		
Tri-butyl phosphate.....		
Other organophosphates.....		

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Vinyl chloride.....		
Arsenic.....		
Barium.....		
Boron.....	0	
Boron (in Boral).....		
Boron (non-Boral).....		
Cadmium.....		
Caesium.....		
Selenium.....		
Chromium.....		
Molybdenum.....		
Thallium.....		
Tin.....		
Vanadium.....		
Mercury compounds.....		
Others.....	<4.0	Others includes wastes outside of the above categories.
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.....		

Potential for the waste to contain discrete items: Yes. Large Metal Items (LMIs)/"substantial" thickness items considered "durable" assumed DIs; Stainless items assumed DIsLarge Concrete Items (LCIs) may be DIs; drummed (ungrouted)/"rubbleised" wastes assumed not DI

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction	On-site	0.50
Supercompaction (HFC)	Off-site	0.50
Incineration	Off-site	91.0
Solidification		
Decontamination		
Metal treatment	Off-site	3.5
Size reduction		
Decay storage		
Recyling / reuse		
Other / various		
None		5.0

Comment on planned treatments: 4% disposal as VLLW to landfill and 1% direct disposal to LLWR.

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	1.5	0.47
Expected to be consigned to a Landfill Facility	4.0	0.47
Expected to be consigned to an On-Site Disposal Facility		
Expected to be consigned to an Incineration Facility	91.0	0.40
Expected to be consigned to a Metal Treatment Facility	3.5	1.4
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 04 05, 17 05 03*/04, 17 06 01*, 17 02 01, 17 02 03

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:

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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	0.50	~43.2	< 1
1/2 Height IP-2 Disposal/Re-usable ISO	1.0	~10	< 1
2m box (no shielding)			
4m box (no shielding)			
Other			

Other information: 43.2m3 loading volume is calculated based on the fact that you can low force compact two times the normal volume of waste into a 200 litre/0.2m3 drum (400 litres/0.4m3), you can then fit 36 drums (14.4m3) into a ½ height ISO, each drum can be super-compacted to a 1/3 of its original volume so therefore can get 3 x the amount of un-compacted drums into the final disposal container (43.2m3).

Waste Planned for Disposal at the LLW Repository:

Container voidage: -

Waste Characterisation Form (WCH): The waste meets the LLWR's Waste Acceptance Criteria (WAC).
The waste has a current WCH.
Inventory information is consistent with the current WCH.

Waste consigned for disposal to LLWR in year of generation: Yes.

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: Activation and contamination of materials.

Uncertainty: Activity values are current best estimates. Specific activity is a funciton of Station operating history. The values quoted are indicative of the activities that would be expected.

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: Data taken from WCH 1MXN-3DUA-0-WCH-0-4595 V4 decayed three years to 2022 for start date of arisings.

Other information: -

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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			8.53E-08	C C 1	Gd 153				8
Be 10				8	Ho 163				8
C 14			3.32E-08	C C 1	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36			1.56E-08	C C 1	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			6.31E-09	C C 1	Pb 210				8
Co 60			3.83E-09	C C 2	Bi 208				8
Ni 59				8	Bi 210m				8
Ni 63			2.62E-08	C C 1	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			3.57E-06	C C 1	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			1.16E-09	C C 2	Th 234			4.84E-09	C C 2
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			5.2E-09	C C 1
Ag 108m			2.67E-09	C C 2	U 235			3.04E-09	C C 1
Ag 110m				8	U 236				8
Cd 109				8	U 238			4.84E-09	C C 1
Cd 113m				8	Np 237				8
Sn 119m				8	Pu 236				8
Sn 121m				8	Pu 238			1.71E-07	C C 1
Sn 123				8	Pu 239			1.28E-07	C C 1
Sn 126				8	Pu 240			2.41E-07	C C 1
Sb 125			2.03E-09	C C 2	Pu 241			5.11E-06	C C 1
Sb 126				8	Pu 242				8
Te 125m				8	Am 241			4.41E-07	C C 1
Te 127m				8	Am 242m				8
I 129				8	Am 243				8
Cs 134			7.75E-09	C C 2	Cm 242				8
Cs 135				8	Cm 243				8
Cs 137			1.92E-05	C C 2	Cm 244			2.02E-08	C C 1
Ba 133			2.4E-09	C C 2	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			4.24E-08	C C 1	Cf 251				8
Sm 147				8	Cf 252				8
Sm 151			4.93E-07	C C 1	Other a				
Eu 152			4.8E-09	C C 2	Other b/g				
Eu 154			2.51E-08	C C 2	**Total a**	**0**		**1.01E-06**	**C C 1**
Eu 155			4.19E-09	C C 2	**Total b/g**	**0**		**2.86E-05**	**C C 1**

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