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|---------------------|--------------|--|
| WASTE STREAM | 3L319 | Stage 3 Decommissioning: Miscellaneous Metals and Materials (Reactor and Non-Reactor) LLW |
|---------------------|--------------|--|

SITE Heysham 1

SITE OWNER EDFE NGL

WASTE CUSTODIAN EDFE NGL

WASTE TYPE LLW

WASTE VOLUMES

| | | Reported |
|------------------------|---------------------------|----------------------|
| Stocks: | At 1.4.2019..... | 0 m ³ |
| Future arisings - | 1.4.2019 - 31.3.2112..... | 0 m ³ |
| | 1.4.2112 - 31.3.2113..... | 19.2 m ³ |
| | 1.4.2113 - 31.3.2114..... | 21.1 m ³ |
| | 1.4.2114 - 31.3.2115..... | 29.3 m ³ |
| | 1.4.2115 - 31.3.2116..... | 80.2 m ³ |
| | 1.4.2116 - 31.3.2117..... | 2.0 m ³ |
| Total future arisings: | | 151.9 m ³ |
| Total waste volume: | | 151.9 m ³ |

Comment on volumes: Waste volumes will be variable depending on station operating conditions.

Uncertainty factors on volumes: Stock (upper): x Arisings (upper) x 1.5
 Stock (lower): x Arisings (lower) x 0.5

WASTE SOURCE A variety of materials from plant dismantling.

PHYSICAL CHARACTERISTICS

General description: This waste stream contains metals and miscellaneous material such as inorganic sludges and flocs. Waste can be packaged in standard NDA packages.

Physical components (%vol): A variety of constituents including metallic items and inorganic sludge.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~1

Comment on density: The density is of the waste as prepared for packaging.

CHEMICAL COMPOSITION

General description and components (%wt): This waste stream contains metals and miscellaneous material such as inorganic sludges and flocs.

Chemical state: Neutral

Chemical form of radionuclides: H-3: Diffused into matrix
 C-14: There may be some surface contamination as graphite.
 Cl-36: The chlorine will be incorporated in steel components
 Se-79: Selenium content not expected to be significant
 Tc-99: Not determined
 I-129: Not determined
 Ra: Radium content is insignificant
 Th: Thorium content is Insignificant
 U: Not determined
 Np: The neptunium content is insignificant
 Pu: Not determined

Metals and alloys (%wt):

| | |
|---------------------------|-------|
| | - |
| Stainless steel..... | ~25.0 |
| Other ferrous metals..... | ~25.0 |
| Iron..... | NE |
| Aluminium..... | NE |
| Beryllium..... | NE |
| Cobalt..... | NE |
| Copper..... | NE |

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| | | |
|------------------------|-------------------------------------|-------|
| | Lead..... | NE |
| | Magnox/Magnesium..... | NE |
| | Nickel..... | NE |
| | Titanium..... | NE |
| | Uranium..... | NE |
| | Zinc..... | NE |
| | Zircaloy/Zirconium..... | NE |
| | Other metals..... | NE |
| Organics (%wt): | None expected. | |
| | Total cellulose..... | 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..... | NE |
| | Oil or grease | |
| | Fuel..... | |
| | Asphalt/Tarmac (cont.coal tar)... | |
| | Asphalt/Tarmac (no coal tar).... | |
| | Bitumen..... | |
| | Others..... | |
| | Other organics..... | 0 |
| Other materials (%wt): | - | |
| | Inorganic ion exchange materials. | 0 |
| | Inorganic sludges and flocs..... | ~50.0 |
| | Soil..... | 0 |
| | Brick/Stone/Rubble..... | 0 |
| | Cementitious material..... | 0 |
| | Sand..... | 0 |
| | Glass/Ceramics..... | 0 |
| | Graphite..... | 0 |
| | Desiccants/Catalysts..... | 0 |
| | Asbestos..... | NE |
| | Non/low friable..... | |
| | Moderately friable..... | |
| | Highly friable..... | |
| | Free aqueous liquids..... | 0 |

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| | | | |
|--|--|----|---------------|
| | Free non-aqueous liquids..... | 0 | |
| | Powder/Ash..... | 0 | |
| Inorganic anions (%wt): | Not fully assessed. | | |
| | 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: | The presence or absence of asbestos has yet to be confirmed. | | |
| | 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..... | 0 | |
| | Corrosive materials..... | 0 | |
| | Pyrophoric materials..... | 0 | |
| | Generating toxic gases..... | 0 | |
| | Reacting with water..... | 0 | |
| | Active particles..... | 0 | Not expected. |
| | Soluble solids as bulk chemical compounds..... | 0 | |
| Hazardous substances / non hazardous pollutants: | - | | |
| | Acrylamide..... | NE | |
| | Benzene..... | NE | |
| | Chlorinated solvents..... | NE | |
| | Formaldehyde..... | NE | |
| | Organometallics..... | NE | |
| | Phenol..... | NE | |
| | Styrene..... | NE | |
| | Tri-butyl phosphate..... | NE | |
| | Other organophosphates..... | NE | |
| | Vinyl chloride..... | NE | |

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| | |
|---------------------------------------|--------------------|
| Arsenic..... | NE |
| Barium..... | NE |
| Boron..... | NE |
| Cadmium..... | NE |
| Caesium..... | NE |
| Selenium..... | NE |
| Chromium..... | NE |
| Molybdenum..... | NE |
| Thallium..... | NE |
| Tin..... | NE |
| Vanadium..... | NE |
| Mercury compounds..... | NE |
| Others..... | NE |
| Electronic Electrical Equipment (EEE) | |
| EEE Type 1..... | NE |
| EEE Type 2..... | NE |
| EEE Type 3..... | NE |
| EEE Type 4..... | NE |
| EEE Type 5..... | NE |
| Complexing agents (%wt): | Not yet determined |
| EDTA..... | NE |
| DPTA..... | NE |
| NTA..... | NE |
| Polycarboxylic acids..... | NE |
| Other organic complexants..... | NE |
| Total complexing agents..... | NE |

Only trace quantities, if any.

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 | | |
| Recycling / reuse | | |
| Other / various | | |
| None | | 100.0 |

Comment on planned treatments:

It is likely that in line with the waste hierarchy, wastes will be treated preferentially by incineration, metal decontamination/melting, supercompaction, optimal packaging in disposal containers or immobilisation by encapsulation where necessary, prior to ultimate disposal. At present, insufficient information is available to determine the percentages.

WASTE STREAM**3L319****Stage 3 Decommissioning: Miscellaneous Metals and Materials (Reactor and Non-Reactor) LLW****Disposal Routes:**

| Disposal Route | Stream volume % |
|---|-----------------|
| 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 | 100.0 |

Upcoming (2019/20-2021/22) Waste Routing (if expected to change from above):

| Disposal Route | Stream volume % | | |
|---|-----------------|---------|---------|
| | 2019/20 | 2020/21 | 2021/22 |
| 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 | | | |

Waste Packaging for Disposal:

| Container | Stream volume % | Waste loading m ³ | 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 | 100.0 | ~11.71 | 13 |

Other information: -

Waste Planned for Disposal at the LLW Repository:

Container voidage: -

Waste Characterisation Form (WCH): It is not yet determined if the waste meets LLWR's Waste Acceptance Criteria (WAC).

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

Potential for the waste to contain discrete items: 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: -

WASTE STREAM**3L319****Stage 3 Decommissioning: Miscellaneous Metals and Materials (Reactor and Non-Reactor) LLW****RADIOACTIVITY**

| | |
|---|---|
| Source: | Activation of the materials and impurities. There may be some contamination. |
| Uncertainty: | Only very approximate estimates have been made of the total specific activities. |
| 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: | Activation/decay calculations based on neutron flux and projected operating history. |
| Other information: | No radionuclides other than those listed are expected to be significant. |

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| Nuclide | Mean radioactivity, TBq/m ³ | | | | Nuclide | Mean radioactivity, TBq/m ³ | | | |
|---------|--|----------------|-----------------|----------------|------------------|--|-----------------|-----------------|----------------|
| | Waste at 1.4.2019 | Bands and Code | Future arisings | Bands and Code | | Waste at 1.4.2019 | Bands and Code | Future arisings | Bands and Code |
| H 3 | | | 8.51E-08 | CC 2 | Gd 153 | | | | |
| Be 10 | | | 5.78E-11 | CC 2 | Ho 163 | | | | |
| C 14 | | | 3.16E-06 | CC 2 | Ho 166m | | | | |
| Na 22 | | | | 4 | Tm 170 | | | | |
| Al 26 | | | | 4 | Tm 171 | | | | |
| Cl 36 | | | 3.58E-05 | CC 2 | Lu 174 | | | | |
| Ar 39 | | | | | Lu 176 | | | | |
| Ar 42 | | | | | Hf 178n | | | | |
| K 40 | | | | | Hf 182 | | | | |
| Ca 41 | | | 3.21E-11 | CC 2 | Pt 193 | | | | |
| Mn 53 | | | | | Tl 204 | | | | |
| Mn 54 | | | | 5 | Pb 205 | | | | |
| Fe 55 | | | 6.43E-13 | CC 2 | Pb 210 | | | | 8 |
| Co 60 | | | 1.79E-08 | CC 2 | Bi 208 | | | | |
| Ni 59 | | | 6.42E-07 | CC 2 | Bi 210m | | | | |
| Ni 63 | | | 7.77E-05 | CC 2 | Po 210 | | | | 8 |
| Zn 65 | | | | 5 | Ra 223 | | | | |
| Se 79 | | | | 8 | Ra 225 | | | | |
| Kr 81 | | | | | Ra 226 | | | | 8 |
| Kr 85 | | | | | Ra 228 | | | | |
| Rb 87 | | | | | Ac 227 | | | | |
| Sr 90 | | | 1.91E-08 | CC 2 | Th 227 | | | | |
| Zr 93 | | | | 8 | Th 228 | | | | |
| Nb 91 | | | | | Th 229 | | | | 8 |
| Nb 92 | | | | | Th 230 | | | | 8 |
| Nb 93m | | | 1.17E-09 | CC 2 | Th 232 | | | | 8 |
| Nb 94 | | | 5.47E-07 | CC 2 | Th 234 | | | | |
| Mo 93 | | | 1.27E-08 | CC 2 | Pa 231 | | | | 8 |
| Tc 97 | | | | | Pa 233 | | | | |
| Tc 99 | | | | 6 | U 232 | | | | |
| Ru 106 | | | | 5 | U 233 | | | | 8 |
| Pd 107 | | | | 8 | U 234 | | 5.82E-11 | CC 2 | |
| Ag 108m | | | 7.55E-08 | CC 2 | U 235 | | 9.26E-13 | CC 2 | |
| Ag 110m | | | | 5 | U 236 | | 1.49E-11 | CC 2 | |
| Cd 109 | | | | 5 | U 238 | | 1.72E-11 | CC 2 | |
| Cd 113m | | | 3.94E-11 | CC 2 | Np 237 | | | | 8 |
| Sn 119m | | | | | Pu 236 | | | | |
| Sn 121m | | | | 6 | Pu 238 | | 4.72E-08 | CC 2 | |
| Sn 123 | | | | 5 | Pu 239 | | 2.74E-08 | CC 2 | |
| Sn 126 | | | | 8 | Pu 240 | | 6.45E-08 | CC 2 | |
| Sb 125 | | | | 5 | Pu 241 | | 3.32E-08 | CC 2 | |
| Sb 126 | | | | | Pu 242 | | | | 8 |
| Te 125m | | | | | Am 241 | | 2.37E-07 | CC 2 | |
| Te 127m | | | | | Am 242m | | | | 8 |
| I 129 | | | 1.34E-12 | CC 2 | Am 243 | | | | 8 |
| Cs 134 | | | | 5 | Cm 242 | | | | 5 |
| Cs 135 | | | | 8 | Cm 243 | | 6.18E-12 | CC 2 | |
| Cs 137 | | | 2.84E-07 | CC 2 | Cm 244 | | 6.40E-11 | CC 2 | |
| Ba 133 | | | 7.18E-12 | CC 2 | Cm 245 | | | | 8 |
| La 137 | | | | | Cm 246 | | | | 8 |
| La 138 | | | | | Cm 248 | | | | |
| Ce 144 | | | | 5 | Cf 249 | | | | |
| Pm 145 | | | | | Cf 250 | | | | |
| Pm 147 | | | | 5 | Cf 251 | | | | |
| Sm 147 | | | | | Cf 252 | | | | |
| Sm 151 | | | 2.67E-10 | CC 2 | Other a | | | | 8 |
| Eu 152 | | | 1.56E-08 | CC 2 | Other b/g | | | | 5 |
| Eu 154 | | | 3.48E-10 | CC 2 | Total a | 0 | 3.76E-07 | CC 2 | |
| Eu 155 | | | 2.75E-13 | CC 2 | Total b/g | 0 | 1.18E-04 | CC 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