

<b>WASTE STREAM</b>	<b>3N12</b>	<b>Gas Circulator LLW</b>
---------------------	-------------	---------------------------

**SITE** Hinkley Point B

**SITE OWNER** EDFE NGL

**WASTE CUSTODIAN** EDFE NGL

**WASTE TYPE** LLW

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2019.....	28.4 m <sup>3</sup>
Future arisings -	1.4.2019 - 31.3.2023.....	70.0 m <sup>3</sup>
	1.4.2023 - 31.3.2025.....	35.0 m <sup>3</sup>
Total future arisings:		105.0 m <sup>3</sup>
Total waste volume:		133.4 m <sup>3</sup>

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

Uncertainty factors on volumes: Stock (upper): x 1.25 Arisings (upper) x 1.75  
 Stock (lower): x 0.75 Arisings (lower) x 0.25

**WASTE SOURCE** LLW from the gas circulator maintenance.

**PHYSICAL CHARACTERISTICS**

General description: Hard and soft trash which will include metal and plastic. Large items of waste include copper windings loaded into half-height ISO containers.

Physical components (%wt): Metal (inc. Drum) (~56%), Soil/Rubble (~4%), Soft Organics (~25%), Plastic/Rubber (~13%), Other (Shellac) (~2%)

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): ~0.56

Comment on density: Density as stated in current WSCD.

**CHEMICAL COMPOSITION**

General description and components (%wt): Metal (inc. Drum) (~56%), Soil/Rubble (~4%), Soft Organics (~25%), Plastic/Rubber (~13%), Other (Shellac) (~2%).

Chemical state: Neutral

Chemical form of radionuclides: H-3: diffused into materials  
 C-14: as graphite particulate and incorporated into metal particles.  
 Cl-36: Incorporated into steels  
 Se-79: Not expected to be significant  
 Tc-99: Not expected to be significant  
 I-129: Not expected to be significant  
 Ra: Not expected to be significant  
 Th: Not expected to be significant  
 U: Not Assessed  
 Np: Not expected to be significant  
 Pu: Not Assessed

Metals and alloys (%wt): Metal thicknesses have not been estimated apart from the drum thickness which will be > 1mm.

Stainless steel.....	<11.0
Other ferrous metals.....	<45.0
Iron.....	NE
Aluminium.....	NE
Beryllium.....	NE
Cobalt.....	NE
Copper.....	P
Lead.....	NE
Magnox/Magnesium.....	NE

**WASTE STREAM**

**3N12**

**Gas Circulator LLW**

	Nickel.....	NE	
	Titanium.....	NE	
	Uranium.....	NE	
	Zinc.....	NE	
	Zircaloy/Zirconium.....	NE	
	Other metals.....	NE	
Organics (%wt):	The waste contains cellulose as paper. Halogenated and non halogenated plastics and small quantities of rubber are also present. Traces of oil may be present. Polyester is present in the form of 'Shellac'. The waste contains halogenated plastic as PVC.		
	Total cellulosics.....	~25.0	
	Paper, cotton.....	~25.0	
	Wood.....	TR	
	Halogenated plastics .....	~1.0	PVC
	Total non-halogenated plastics.....	~12.0	
	Condensation polymers.....	~2.0	Polyester
	Others.....	~10.0	
	Organic ion exchange materials....	0	
	Total rubber.....	~2.0	
	Halogenated rubber .....	NE	
	Non-halogenated rubber.....	~2.0	
	Hydrocarbons.....	NE	
	Oil or grease .....	NE	
	Fuel.....	NE	
	Asphalt/Tarmac (cont.coal tar)...	NE	
	Asphalt/Tarmac (no coal tar)....	NE	
	Bitumen.....	NE	
	Others.....	NE	
	Other organics.....	NE	
Other materials (%wt):	-		
	Inorganic ion exchange materials.	0	
	Inorganic sludges and flocs.....	0	
	Soil.....	~2.0	
	Brick/Stone/Rubble.....	~2.0	
	Cementitious material.....	0	
	Sand.....	0	
	Glass/Ceramics.....		
	Graphite.....	0	
	Desiccants/Catalysts.....	0	
	Asbestos.....	0	
	Non/low friable.....		
	Moderately friable.....		
	Highly friable.....		
	Free aqueous liquids.....	0	

**WASTE STREAM****3N12****Gas Circulator LLW**

	Free non-aqueous liquids.....	0	
	Powder/Ash.....	0	
Inorganic anions (%wt):	Not estimated but if present there would only be trace amounts.		
	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:	-		
	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	

**WASTE STREAM****3N12****Gas Circulator LLW**

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.....	TR

Not expected to be present but a trace quantity may be present on detailed analysis.

**TREATMENT, PACKAGING AND DISPOSAL**

**WASTE STREAM****3N12****Gas Circulator LLW**

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

Treatment	On-site / Off site	Stream volume %
Low force compaction		
Supercompaction (HFC)	Off-site	~10.0
Incineration	Off-site	~70.0
Solidification	Off-Site	<5.0
Decontamination		
Metal treatment	Off-Site	~10.0
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None		~5.0

Comment on planned treatments:

In line with the waste hierarchy, wastes will be treated preferentially by incineration, metal decontamination/melting, supercompaction, optimal packaging in HHISOs or immobilisation by encapsulation where necessary, prior to ultimate disposal at the LLW Repository. These treatments will be carried out off-site under contract with companies such as LLWR Ltd, Studsvik, Tradebe and Inutec. The percentages are based on the history of consignments across the fleet of EDF Energy Nuclear Generation stations.

**Disposal Routes:**

Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	15.0
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	70.0
Expected to be consigned to a Metal Treatment Facility	10.0
Expected to be consigned as Out of Scope	
Expected to be recycled / reused	5.0
Disposal route not known	

**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 <sup>3</sup>	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	15.0	~13.55	2
2m box (no shielding)			
4m box (no shielding)			
Other			

Other information:

Waste loading is representative of the raw waste following further planned treatments. The waste will be reduced to 50% of its original waste volume after further planned treatments.

**WASTE STREAM****3N12****Gas Circulator LLW****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 does not have a current WCH.  Wastestream Characterisation Document is still currently valid.
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:	-

**RADIOACTIVITY**

Source:	Activity source is variable, but mainly activation products.
Uncertainty:	The activity values are estimates based upon operating experience. The values quoted are indicative of the activities that are 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:	Activity estimates are based on fingerprint of waste stream and on dose rate measurements of drummed waste.
Other information:	-

**WASTE STREAM                      3N12                      Gas Circulator LLW**

Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	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	2.8E-09	CC 2	2.8E-09	CC 2	Gd 153				
Be 10		8		8	Ho 163				
C 14	3E-10	CC 2	3E-10	CC 2	Ho 166m				
Na 22		4		4	Tm 170				
Al 26		4		4	Tm 171				
Cl 36	5.35E-09	CC 2	5.35E-09	CC 2	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41		8		8	Pt 193				
Mn 53					Tl 204				
Mn 54	5.5E-10	CC 2	5.5E-10	CC 2	Pb 205				
Fe 55	2.06E-08	CC 2	2.06E-08	CC 2	Pb 210	8			8
Co 60	5E-09	CC 2	5E-09	CC 2	Bi 208				
Ni 59		8		8	Bi 210m				
Ni 63	1.65E-09	CC 2	1.65E-09	CC 2	Po 210	8			8
Zn 65	3E-10	CC 2	3E-10	CC 2	Ra 223				
Se 79		8		8	Ra 225				
Kr 81					Ra 226	8			8
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	2E-10	CC 2	2E-10	CC 2	Th 227				
Zr 93		8		8	Th 228				
Nb 91					Th 229	8			8
Nb 92					Th 230	8			8
Nb 93m		8		8	Th 232	8			8
Nb 94	1.1E-11	CC 2	1.1E-11	CC 2	Th 234				
Mo 93		8		8	Pa 231	8			8
Tc 97					Pa 233				
Tc 99		8		8	U 232				
Ru 106	1E-10	CC 2	1E-10	CC 2	U 233	8			8
Pd 107		8		8	U 234	1.41E-11	CC 2	1.41E-11	CC 2
Ag 108m	9.5E-12	CC 2	9.5E-12	CC 2	U 235		8		8
Ag 110m	5E-11	CC 2	5E-11	CC 2	U 236		8		8
Cd 109					U 238	1.36E-11	CC 2	1.36E-11	CC 2
Cd 113m					Np 237		8		8
Sn 119m					Pu 236				
Sn 121m		8		8	Pu 238		8		8
Sn 123					Pu 239		8		8
Sn 126		8		8	Pu 240		8		8
Sb 125	5E-11	CC 2	5E-11	CC 2	Pu 241	1.05E-09	CC 2	1.05E-09	CC 2
Sb 126					Pu 242		8		8
Te 125m					Am 241	2.05E-11	CC 2	2.05E-11	CC 2
Te 127m					Am 242m		8		8
I 129		8		8	Am 243		8		8
Cs 134	5E-11	CC 2	5E-11	CC 2	Cm 242		8		8
Cs 135		8		8	Cm 243		8		8
Cs 137	6.5E-10	CC 2	6.5E-10	CC 2	Cm 244		8		8
Ba 133	1.1E-11	CC 2	1.1E-11	CC 2	Cm 245		8		8
La 137					Cm 246		8		8
La 138					Cm 248				
Ce 144	5E-11	CC 2	5E-11	CC 2	Cf 249				
Pm 145					Cf 250				
Pm 147	1.5E-10	CC 2	1.5E-10	CC 2	Cf 251				
Sm 147					Cf 252				
Sm 151					Other a		6		6
Eu 152	1.59E-11	CC 2	1.59E-11	CC 2	Other b/g		8		8
Eu 154	2.38E-11	CC 2	2.38E-11	CC 2	<b>Total a</b>	<b>4.82E-11</b>	<b>CC 2</b>	<b>4.82E-11</b>	<b>CC 2</b>
Eu 155	1.75E-11	CC 2	1.75E-11	CC 2	<b>Total b/g</b>	<b>3.89E-08</b>	<b>CC 2</b>	<b>3.89E-08</b>	<b>CC 2</b>

**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