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Ref: TOR15/010N  
Our Ref: RS/NUC/TORNESS

Specialist, Radioactive Substances  
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SEPA AYR  
- 1 APR 2015  
RECEIVED

FAO Ms Isabelle Watson, RSA Specialist

30<sup>th</sup> March 2015

Dear Ms Watson

Please find enclosed a response to your letter reference RS/NUC/TORNESS dated 29<sup>th</sup> January 2015 which asked for further information on our application to vary the Torness Power Station Certificate of Authorisation - RSA/A/0070116.

Yours sincerely

**PAUL WINKLE**  
Station Director, Torness

Attachment 1: TOR/RSA/VARIATION/2013/1



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# Nuclear Generation Limited

## Torness

### Supplementary information to support variation request to Torness Power Station's RSA Certificate.

Originated by:	Craig O'Donnell Radioactive Waste Advisor	Date: March 2015
Reviewed by:	Andrew Moodie Environmental Safety Group Head	Date: March 2015
Reviewed by:	Michael McHugh Technical & Safety Support Manager	Date: March 2015

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## 1 Purpose

The purpose of this additional information submission is to provide further details on:-

- Which higher activity wastes are intended for disposal at which facility;
- Details regarding arrangements that are, or would be, in place to demonstrate the selected waste management option is BPM;
- How the selected waste management options meet the aims and principles of Scotland's Higher Activity Waste Policy
- Physical quantities, radionuclide content, activity per radionuclide and anticipated frequencies of transfer of waste to each identified disposal site.
- Detailed description of radioactive waste types that may be transferred to Torness from other EDF sites
- Details regarding storage arrangements for the radioactive wastes transferred from each Station
- Onward disposal arrangements for each identified waste type and time on site for each waste type transferred to Torness
- Decision making process and BPM arrangements for waste transfers to Torness.

## 2 HAW Types, disposal routes, frequency and specific activity

The precise volume of higher activity solid radioactive waste produced during the forthcoming years at Torness will depend on the future management of the two Advance Gas Cooled Reactors (AGRs).

The volume & activity estimates provided within this submission are based on a review of the performance of the station during the last 3 years, information from the national waste inventory, waste characterisation reports and consideration of current stored volumes on site.

Based on the previously named reviews, the waste arisings for Torness would not be expected to increase significantly as the plant ages.

Six Higher Activity Waste streams (HAW) have been considered in this submission. It is envisaged these HAW types will be transferred off-site to the destinations listed within table 3.2 of TOR/RSA/VARIATION/2013, where it can be treated to produce a final waste form that is categorised as Lower Activity Waste (LAW).

For completeness, desiccant has been included despite being authorised under the existing permit.

Disposal routes selected for the aforementioned waste streams are based on current use – if in the future a named disposal site developed a new process/technique that became the BAT for a particular named waste stream then Torness would endeavour to pursue such a route.

Additionally, Torness would not want to be constrained should an equivalent disposal site become operational that was geographically closer and/or financially more cost effective for disposal of a particular named HAW stream.

**Table 1: HAW Types**

<p>Generic HAW Oils &amp; Sludges</p>	<p>Active waste oil arisings are assayed and may contain the full spectrum of activity found in liquid waste treated in the liquid waste processing facilities. The activity in the oil is caused by activity uptake from the reactor coolant. There are also tritiated oil arisings that occur within the tritiated water storage tanks that serve the desiccant driers.</p> <p>The processing of active effluent at AGR stations produces waste in the form of sludge. Predominantly sludges arise from the backwashing of sand filters in the AETP and PWTP but other processes cause sludge arisings such as the oil bound sludges generated from gas circulator maintenance and the AETP oil separators. Oil-bound sludges can arise as well as non-oily sludges accumulated in process plant sump bottoms and tanks. A significant fraction of the contamination present in sludges is short lived radio nuclides e.g. Fe-55, Cr-51, Co-60, S-35, Mn-54 and Ca-45 and as such storage in settling tanks allows for a significant reduction in sludge activity. Also present in sludges may be Zn-65, Cs-137 and Cs-134 particulate. It is likely the majority of the sludges generated at Torness during operational life will be LAW however there is the potential for generating HAW sludges if a particular process vessel requires to be cleaned/emptied earlier than anticipated.</p> <p>Currently within this category, Torness have only generated tritiated oils associated with oil recovered from the TET system and reactor instrumentation and as such all subsequent BPEO references, specific activity and frequency of arisings within this submission are with reference to tritiated oil.</p> <p>However if other HAW oils do arise, the specific activity may be different depending on the origin of the oil. This may require a different disposal strategy depending on the dose/radiochemical properties of the oil.</p>
<p>Generic Metallic Solid HAW Waste e.g. Bypass gas plant (BPGP) inlet/blowdown filters &amp; Other filters (Not shredded/compacted)</p>	<p>As the plant ages, specific plant components may require replacement that may in itself be HAW or through size reduction create HAW components. Torness currently do not have any Metallic Solid HAW however a reasonably foreseeable waste item in this category would be BPGP inlet/blowdown filters.</p> <p>The BPGP is responsible for conditioning and drying the reactor coolant. Within the system there are several filters that will require to be replaced during Station operation. Recently, 2 inlet filter filters have been exchanged but HAW to LAW decay period was &lt; 24 months and were disposed as LAW to LLWR. In future years, the activity of the filters may increase and may require disposal individually as HAW.</p>

<p>Generic Solid HAW Waste: Drummed Waste</p>	<p>Drummed solid HAW waste consists of general waste materials, secondary wastes and redundant items.</p> <p>Occasionally the overall radioactive content of a shredded &amp; compacted drum may exceed 4 GBq/te of alpha or 12 GBq/te of beta/gamma activity.</p> <p>These waste drums have historically been produced from vacuum cleaner bags and shredded filters e.g. vessel air extract HEPA filters. i.e. low mass/volume, high concentration of activity generally created as a result of concentrating the LAW waste stream.</p> <p>The inclusion of this waste stream assumes that:-</p> <ol style="list-style-type: none"> <li>1) No application of LLWR discrete item limits if being disposed to LLWR.</li> <li>2) No averaging activity over a consignment container e.g. averaging over a full IP2 FHISO package.</li> <li>3) No onsite decay used to allow HAW drum to decay to LAW.</li> </ol>
<p>Ion Exchange Resin</p>	<p>Ion exchange resins are a solid organic material usually in the form of beads that are used to treat a variety of effluents. These resin beads are usually contained in steel tanks through which the water passes, the resins work by adsorbing soluble ions from the liquids that are passed over them and as a result reduce the soluble activity in the water.</p> <p>At Torness, radioactive ion-exchange resins arise mainly from pond water treatment in the PWTPs but ion-exchange resins also arise from liquid effluent treatment in the AETPs. The resins are used for the removal of soluble radioactive species from the liquids processed. Spent resin is discharged from IX plant when exhausted and transferred to storage vessels.</p> <p>It is expected that PWTP resins will be HAW and AETP resins will be LAW. For purpose of consideration in this submission, pond water ion exchange resin will be considered. The principal contaminants present are Ba-133, Co-60, Cs-134, Cs-137 and Mn-54 (reference 6). These are typical fission and activation products that may be found in liquid treatment systems from which the resin has been extracted. Other isotopes may be present.</p>

Catalyst	<p>The AGR reactor gas bypass plant contains recombination units for recombining oxygen with any carbon monoxide (CO) which has formed within the CO<sub>2</sub> reactor coolant gas. The unit also converts gaseous species of hydrogen to water, thereby removing tritiated water vapour moisture from the coolant. The catalyst is in the form of granular alumina / platinum catalyst, the platinum having been deposited onto an alumina base granule (0.3% by weight). Once the material ceases to fulfil its function and there is a risk of oxygen breaking through to the reactor, the catalyst is replaced and the spent catalyst becomes a waste product.</p> <p>Radionuclide concentrations associated with these wastes are expected to be low except for tritium and S-35. The level of tritium in the waste will determine whether it is treated as HAW or LAW. <b>For the purpose of this submission, the same specific activity values have been used for both desiccant and catalyst.</b></p> <p>It is currently the baseline strategy for catalyst to be processed and packaged using the same washing process as desiccant waste, however recent trials conducted on catalyst samples have shown the washing process to be less effective at removing activity.</p>
Desiccant	<p>Radionuclide concentrations are low except tritium and S-35. However, radioactive decay of S-35 (half life 87 days) means that the specific activity is low in wastes which have been stored for more than 3 years.</p> <p>The level of tritium chemically bonded in the waste determines whether it is to be treated as LAW or HAW. In order to remove water vapour from the AGR gas coolant the gas by-pass stream is passed through towers containing beads of silica gel based desiccant. A component of the water vapour that is absorbed into the desiccant is tritiated. The tritium originates mainly as a tertiary fission product, with a possible additional contribution from the activation of lithium impurities. Desiccant may contain both ceramic and steel balls which are used to retain the desiccant within the towers.</p> <p>The effectiveness of the desiccant decreases over time as a result of the temperature cycling resulting from regeneration cycles; it is therefore replaced periodically during statutory outages. The determination of desiccant life, and decision as to which planned outage the in-service batch will last until, is made by assessing the frequency of desiccant regeneration cycles. Batches can be changed after anything between a few years to over 10 years. Before being finally discharged from the reactor driers, desiccant is heated as for regeneration to ensure the activity loading is minimised</p>

The data presented in the following Tables represents the volume and activity of waste to be transferred from Torness site utilising the different preferred disposal options. The specific activity values quoted in Table 2 are for guidance purposes only – they should not be interpreted as an upper bound on specific activities that may be generated during future operation.

**Table 2: HAW Volumes, Specific Activity & Rate of Arising**

Waste Stream	Current Volume (m <sup>3</sup> )	Specific Activity (MBq/g)							Alpha emitters	Future Arisings (m <sup>3</sup> /year)
		H-3	Carbon - 14	Phosphorous-32 and Sulphur-35	Beta and Weak Gamma Emitters (P33, Cl36, Ca45, Cr51, Fe55, Ni63, Sr90, Cd109, I129, Pm147)	Medium Gamma Emitters (Co57, Zn65, Se75, Sr85, Rb86, Zr95, Ru103, Ru106, Ba133, Cs137, Hg203)	Strong Gamma Emitters (Na22, Sc46, Mn54, Fe59, Co56, Co58, Co60, Ag110m, Sb124, Cs134, Eu152, Eu154)	Other isotopes not listed (excl. alpha)		
HAW Oils & Sludges	1.3	3.00	0.001	0.002	~ NIL	0.0000003	0.0000004	~ NIL	~ NIL	0.3
Bypass Gas Plant Inlet Filter/Blowdown Filters	0	0.00	0.0002	0.00001	0.008	0.001	0.002	~ NIL	0.000004	1 Filter every 3 years
Ion Exchange Resin	23.7	~ NIL	~ NIL	~ NIL	~ NIL	0.06	0.4	~ NIL	0.0003	N/A
Catalyst	30	0.20	0.00003	~ NIL	~ NIL	~ NIL	~ NIL	0.00004	~ NIL	N/A
Solid Drummed Waste (no onsite decay period applied)	0	0.002	0.0002	0.00001	0.02	0.00007	0.004	~ NIL	0.00006	1
Desiccant	0	0.20	0.00003	~ NIL	~NIL	~ NIL	~ NIL	0.00004	~ NIL	30m <sup>3</sup> in 2018, 30m <sup>3</sup> in 2020/2023

**Table 3: Requested disposal sites in variation request**

Incinerator, Hythe, UK	1
Metal Treatment Facility, Lilyhall, UK	2
Waste Treatment & processing site, Winfrith, UK	3
Incinerator, Eise mere Port, UK	4
Incinerator, Slough, UK	5
Incinerator, Dessel, Belgium	6
Metal treatment facility, Krefeld, Germany	7
Incinerator & Metal Treatment Facility, Nyköping, Sweden	8
Incinerator & Metal treatment facility, Tennessee, USA	9
Other UK incinerators	10
Other overseas incinerators and metal treatment plants	11
Any UK and overseas radioactive treatment facilities which become available at a future date.	12

**Table 4: Preferred & Secondary disposal routes for identified waste types**

Waste Stream	Preferred Route	Secondary Routes	Potential routes subject to BAT
Generic HAW Oils & Sludges: Tritiated Oil	1	4*, 5*, 6*, 8*, 9*, 10*, 11*, 12*	4, 5, 6, 8, 9, 10, 11, 12
Generic HAW Oils & Sludges: Sludges	3*	None currently identified	12
Generic Metallic Solid HAW Waste e.g. Bypass gas plant (BPGP) inlet/blowdown filters & Other filters (Not shredded/compacted & no onsite HAW to LAW decay)	2	3	7, 8, 9, 11, 12
Ion Exchange Resin	3*	None currently identified	1, 4, 5, 6, 8, 9, 10, 11, 12
Catalyst	3*	None currently identified	1, 4, 5, 6, 8, 9, 10, 11, 12
Solid Drummed Waste (no onsite decay period applied or application of discrete item limits)	3	None currently identified	1, 4, 5, 6, 8, 9, 10, 11, 12
Desiccant	3	None currently identified	1, 4, 8, 9, 10, 11, 12

\*Preferred/secondary route – not currently assessed.



### 3 Demonstration of BPM

With respect to demonstrating that our arrangements are BPM, or would be, Torness will comply with the company specification "Providing a framework for Sustainable Approach to Waste Management (SAWM)" (reference 1) for all waste streams not currently covered by an existing BPM strategy.

The disposal of Tritiated Oils is covered by an existing BPM strategy (reference 2) which determines incineration as the preferred option. The treatment & disposal of this waste stream will utilise the existing framework contract with the operator of the Hythe incinerator.

Likewise with desiccant disposal – an existing BPM strategy (reference 3) and framework contract is utilised for desiccant treatment and disposal.

### 4 Requirements of Scotland's Higher Activity Waste Policy

The aim of the SAWM framework (reference 1) – "to ensure that wastes are managed safely and in a sustainable way taking into account long – term environmental considerations at an early stage rather than at the time of transfer from a site or disposal. In simple terms, this means doing the right thing at the right time in the right way". This is broadly comparative to the aim of the Higher Activity Waste Policy.

With respect to the Waste Hierarchy and the Proximity Principle:-

**Waste hierarchy:** The current Station radwaste management practices for preventing/minimising generation of LAW apply equally to HAW. For example, improved control of reactor gas conditions ensures the life of desiccant can be maximised up to the region of 15 years. This is approximately twice as long as originally anticipated. Unfortunately there is limited scope to reuse potential HAW items – particularly those included in this submission. Therefore it is imperative that Torness select the correct treatment facility which results in the lowest aggregated environmental impact whilst meeting the principles of the HAW Policy. This is controlled via the BPM process detailed within reference 1 and for some HAW waste streams, such as tritiated oil, they already have an underpinning BPEO strategy.

**Proximity Principle:** Currently there are no available treatment facilities (or disposal facilities for LAW) at a regional level for HAW. The waste management options named in table 3 above apply to both UK and international facilities. Currently Torness do not make use of any international facility. The geographical aspect of the proximity principle will be applied if and when competing treatment facilities with similar waste acceptance criteria come on line in different geographical locations.

## 5 Transfer of LAW waste from other EDF sites to Torness

Due to the geographical location of Torness and the locations of the currently available disposal sites it is not envisaged Torness will be receiving radioactive waste during the current operational lifespan from other EDF sites for the purpose of interim storage, loading of containers or onward transfer.

If however this option was exercised the physical characteristics of waste transferred could encompass the full suite of wastes that Torness are currently (and potentially in future) permitted to transfer for treatment and/or disposal.

Currently Torness consign on average 50m<sup>3</sup> of LAW for treatment/disposal per year with a significant proportion going for incineration at the Hythe site. It is therefore reasonable to assume that only a small proportion of any sites waste would be suitable for transfer to other EDF sites for the purposes mentioned above. Torness estimate such a volume to be less than 10m<sup>3</sup> per year at a maximum frequency of 2 road transfers per year (in accordance with The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009) from other EDF sites.

The activity breakdown for other EDF sites waste are available from reference 4 which detail EDF Station LAW radioactive waste fingerprints.

Storage arrangements for any radioactive waste transferred to Torness will be controlled as per current practices as detailed in the Station Radioactive Waste Management Safety Case (reference 5). Approximate dwell time of such waste on the Torness site will depend on the waste stream in question but an average dwell time of up to 30 days before onward transfer should be assumed with a maximum dwell time of 6 months. This would be considered as part of any BPM assessment generated if required as a result of the SAWM frame work (reference 1).

**6 References**

1	BEG/SPEC/SHE/ENVI/038	Definition, Review and Optimisation of Radioactive Waste Management Strategies: Providing a Framework for Sustainable Approach to Waste Management (SAWM)
2	ERO/REP/0031/GEN	Strategic Review of Options for the Management of Tritiated Oil and Particulate at AGR Sites,
3	ENL/REP/0055/AGR/08	Best Practicable Environmental Option Study for the Management of Spent AGR Desiccant
4	BEG/FORM/SHE/ENVI/013	EDF Waste Fingerprints
5	NFL/REP/0048/TOR/11	Torness Radioactive Waste Facilities Safety Case
6	15878-TR-0002	Radioactive Waste Measurement, Sampling and Characterisation of Solid Waste Within Active Effluent Treatment Plant Storage Tanks at Torness Power Station (2010)