



Dounreay Site
Restoration Ltd

DINGWALL

09 JUN 2010

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Dounreay Site
Restoration Ltd

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Our Reference: D/SEPA/4561N
Your Reference: SEPA/DSRL/50105Y

3 June 2010

Dear Sir

**APPLICATION FOR A DISPOSAL AUTHORISATION UNDER RSA 93
SUBMISSION OF ADDITIONAL INFORMATION REQUESTED BY SEPA**

In respect of your letter SEPA/DSRL/50105Y, dated 12 May 2010, please find enclosed the information requested in respect of the quantities and types of wastes that DSRL wishes to dispose off the nuclear licensed site.

In respect of your request for further information on the treatment of the Sodium imported from Germany, DSRL responded to SEPA, our reference D/SEPA/4549N dated 19 May 2010. The table attached deals with all the other waste types anticipated to be disposed from the Dounreay premises.

If you have any queries regarding the contents of this letter, please do not hesitate to contact Mr John Disbury, on telephone extension 01847 806065, who will be pleased to assist.

Yours faithfully

A J Scullion
Director of Assurance

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Waste to be disposed off premises

Name and Address to Who Waste is to be Disposed	Description of Waste	Principal Radionuclides or Group of Radionuclides	Anticipated Annual Activity in Waste to be Disposed, Beta/Gamma GBq	Anticipated Annual Activity in Waste to be Disposed, Alpha GBq	Anticipated Specific Activity in Waste to be Disposed	Anticipated Annual Volume of Waste to be Disposed - m ³
Studsvik Nuclear AB S SE-611 82 Nyköping Sweden or; Metals Recycling Facility Studsvik UK Ltd 1 Joseph Noble Road Lillyhall Workington, Cumbria CA14 4JX	Steel, Cast Iron, Aluminum, Copper, Lead, Brass, Cables	Fingerprints are to be predominately beta/gamma and/or low toxicity alpha.	2070	690	Activity not exceeding; (i) All alpha-emitting radionuclides 4 GBq/Tonne (ii) All other radionuclides not including (i) above 12 GBq/Tonne. Unless lower limits are required per the specific facility WAC.	20
Low Level Waste Repository Holmrook Cumbria CA19 1XH	Steel, Cast Iron, Aluminum, Copper, Lead, Brass, Cables, Mercury	Fingerprints are to be predominately beta/gamma and/or low toxicity alpha.	828	276	Activity not exceeding; (i) All alpha-emitting radionuclides 4 GBq/Tonne (ii) All other radionuclides not including (i) above 12 GBq/Tonne. Unless lower limits are required per the specific facility WAC.	8
CARLA Melting Plant Siempelkamp Nukleartechnik GmbH Siempelkampstr. 45 - 47803 Krefeld-Germany	Steel, Cast iron, Aluminum, Copper, Lead, Brass, Cables	Fingerprints are to be predominately beta/gamma and/or low toxicity alpha.	414	138	Activity not exceeding; (i) All alpha-emitting radionuclides 4 GBq/Tonne (ii) All other radionuclides not including (i) above 12 GBq/Tonne. Unless lower limits are required per the specific facility WAC.	4

Name and Address to Who Waste is to be Disposed	Description of Waste	Principal Radionuclides or Group of Radionuclides	Anticipated Annual Activity in Waste to be Disposed, Beta/Gamma GBq	Anticipated Annual Activity in Waste to be Disposed, Alpha GBq	Anticipated Specific Activity in Waste to be Disposed	Anticipated Annual Volume of Waste to be Disposed - m ³
EnergySolutions, LLC Bear Creek Operations 1560 Bear Creek Road Oak Ridge, TN 37830	Steel, Cast Iron, Aluminum, Copper, Lead, Brass, Cables	Fingerprints are to be predominately beta/gamma and/or low toxicity alpha.	414	138	Activity not exceeding; (i) All alpha-emitting radionuclides 4 GBq/Tonne (ii) All other radionuclides not including (i) above 12 GBq/Tonne. Unless lower limits are required per the specific facility WAC.	4
AEA Technology plc Or Forschungszentrum Karlsruhe GmbH	Ion Exchange Resin	Cs-137	500	-	-	-
Customer Services Tradebe Fawley, Charleston Road, Hardley, Hythe, Southampton Postcode: SO45 3NX Telephone No: 023 8088 3000 E:mail: sales@tradebe-fawley.co.uk	Sodium metal Solvents Oils Zinc Bromide Scintillants	Tritium and other beta emitting nuclides and alpha emitting nuclides	³ H – 600 Beta -12	Alpha – 4	-	51m ³ solids 50m ³ liquids



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Our Reference: D/SEPA/4601N
Your Reference: SEPA/DSRL/50105Y

4 August 2010

Dear Sir

**APPLICATION FOR A DISPOSAL AUTHORISATION UNDER RSA 93
SUBMISSION OF ADDITIONAL INFORMATION REQUESTED BY SEPA**

In your letter SEPA/DSRL/50105Y, dated 12 May 2010, you requested an options appraisal report for managing radioactive liquid waste and a demonstration that the chosen options represent Best Practicable Means. Please find attached a paper that provides this information.

Please note that having undertaken this options assessment DSRL wishes to withdraw the request in its RSA application to dispose of radioactive wastes via inactive outfalls, as referred to in the following application documents:

Radioactive Substances Act 1993 (as amended) Application Form for Authorisation to accumulate and dispose of radioactive waste

- Paragraph 7(g)(2)

Information in Support of an Application for Authorisation for the Disposal of Liquid, Gaseous and Solid Radioactive Wastes from Dounreay (RSA Application (09) INFO)

- 10.3.2 (last paragraph)
- 10.3.2.1

If you have any queries regarding the RSA application please contact Mr John Disbury, on 01847 806065, or on the attached BPM paper please contact Mr Graham Beaven, on 01847 803690, or Dr Niall Watson, 01847 806197, who will be pleased to assist.

Yours faithfully

**A J Scullion
Director of Assurance**

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Restoration Ltd**

ISSUE SECTION Environment Team	MARKING None	DOCUMENT REF: LLETP BPM Decision Analysis 019 DEC(10)P294
Title: Preferred Discharge Options for High Volume Low Activity Aqueous Effluent		Issue: 2 (approved)
		Date: July 2010
		Pages: 1 of 13 (including cover sheet)
Purpose: For Committee Consideration and Approval.		File No:

SUMMARY

DSRL recently submitted an application for a new Radioactive Substances Act (RSA) Authorisation. In reviewing the application, the Scottish Environment Protection Agency (SEPA) has asked DSRL to demonstrate that any discharge option for High Volume Low Activity (HVLA) aqueous effluent that differs from the current authorised route (via the Low Level Liquid Effluent Treatment Plant (LLETP) and Outfall 10) is compliant with the conditions and limitations of a granted Authorisation. This includes ensuring that the discharge option represents Best Practicable Means (BPM).

In addition, DSRL has applied to surrender its Pollution Prevention and Control (PPC) Part A permit. Alongside this SEPA is preparing a variation to the existing RSA Authorisation to make it compliant with the Controlled Activities Regulations (CAR). SEPA has also confirmed that the tidal discharge window will not be carried forward into the RSA variation.

These drivers provide a further opportunity for DSRL to consider options for the disposal of HVLA effluent; for example, to revisit Options for Managing Manhole 5 Discharges during high rainfall events, as outlined in Dounreay Environment Committee paper DEC(10)P266.

This BPM Decision Analysis Form identified ten potential HVLA effluent streams. Of these, three were considered to be HVLA; namely, effluent from the Solid Low Level Waste Pits, Manhole 5 and the Castle Gate Seep. Potential management options for dealing with these three waste streams were evaluated to determine what represented BPM for each waste stream.

DEC is requested to consider and approve this paper, prior to it being submitted to SEPA. By doing so it agrees that the BPM necessitates a change to the management arrangements for these three waste streams, which should be pursued, subject to finalised costs not being prohibitive.

Issue	Date	Author Name Signature	Checked and Agreed by Name Signature	Endorsed by Name Signature	Approved by DEC
1	30/06/2010	Niall Watson	Graham Beaven	Doug Graham	Simon Middlemas
2	15/07/2010	Niall Watson	Graham Beaven	Doug Graham	Simon Middlemas
		<i>Niall Watson</i>	<i>G. Beaven</i>	<i>D. Graham</i>	<i>S. Middlemas</i>

Distribution:

Standard DEC plus Graham Beaven, Phil Cartwright, Harvey Cowe, Mark Crichton, Leslie Mackay, Morris MacLeod and Michael W Tait



Preferred Discharge Options for High Volume Low Activity Aqueous Effluent

1. Background

DSRL recently submitted an application for a new Radioactive Substances Act (RSA) Authorisation ^(Ref. 1). In reviewing the application, the Scottish Environment Protection Agency (SEPA) has asked DSRL to demonstrate that any discharge option for High Volume Low Activity (HVLA) aqueous effluent that differs from the current authorised route (via the Low Level Liquid Effluent Treatment Plant (LLETP) and Outfall 10) is compliant with the conditions and limitations of a granted Authorisation. This includes ensuring that the discharge option represents Best Practicable Means (BPM).

In addition, DSRL has applied to surrender its Pollution Prevention and Control (PPC) Part A permit. Alongside this SEPA is preparing a variation to the existing RSA Authorisation to make it compliant with the Controlled Activities Regulations (CAR)¹. SEPA has also confirmed that the tidal discharge window will not be carried forward into the RSA variation ^(Ref. 2).

2. Issue

These drivers provide a further opportunity to consider options for the disposal of HVLA effluent; for example, to revisit Options for Managing Manhole 5 Discharges during high rainfall events, as outlined in Dounreay Environment Committee paper DEC(10)P266 ^(Ref. 3).

Three meetings of Suitably Qualified and Experienced Personnel (SQEP) were held to identify all effluent waste streams that could potentially be classed as HVLA (see Table 1 below) based on whether they were rainfall dependent (and thus could be high in volume) and un-sentenced discharges (typically low activity streams).

Meeting 1 was attended by Graham Beaven (ATO Holder for the LLETP and the Low Active Drain), Harvey Cowe (Mechanical Engineer), Michael W Tait (Facility Manager for the LLETP and the Low Active Drain), John Heathcote (Land Remediation), Morris MacLeod (Environmental Advisor), John Disbury (Environmental Compliance Manager) and Mark Crichton (Technical Author). It identified potential HVLA effluent streams (see Table 1) and selected those for assessment (see Section 3). Option assessment parameters were chosen (see Section 4) and used to review the options associated with Manhole 5 (see Table 4) and the Castle Gate Seep (see Table 5).

Meeting 2 was attended by Graham Beaven, Harvey Cowe, Michael W Tait, Leslie Mackay (Solid Low Level Waste Pits Facility Manager), John Heathcote, John Disbury and Mark Crichton. It considered options for dealing with effluent from the Solid LLW Pits (see Table 3).

Meeting 3 was attended by Graham Beaven, Phil Cartwright (Project Sponsor Environment Stakeholder Interface), Morris MacLeod and Niall Watson (Environmental Advisor). It considered further options for dealing with effluent from the Solid LLW Pits (see Table 3).

The conclusions, including the identified BPM option for each of the three HVLA effluent waste streams, are summarised in this BPM Decision Analysis Form.

¹ The Water Environment (Controlled Activities) (Scotland) Regulations 2005 (No. 348)

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Table 1: Potential HVLA Waste Streams

	Waste Stream	Volume (m ³ /day) ^a	Activity (Bq/ml) ^a	
1.	D1212 Solid LLW Pits	~50	0.04 α	0.57 β
2.	Manhole 5	~20 – 200 ^b	0.035 α ^c	0.12 β ^c
3.	Castle Gate Seep	~40 – 60 ^b	0.07 Cs-137	0.003 Cs-137 ^d
4.	LAD Secondary Containment			
	• Street 5	134 m ³ per month ^e	0.05 α ^f	0.13 β ^f
	• Street 6	148 m ³ per month ^e	0.05 α ^f	0.23 β ^f
	• Downstream ^g			
5.	DFR Outfall Chamber	~20	0.06 α	0.13 β
6.	Barrier 45	0 – 20	0.001 α	0.01 β
7.	D1209 Ventilation Sump			
	• D1208	≤2.5	0.14 α	0.45 β
	• D1213	2 – 12	0.14 α	0.45 β
8.	D1225 ILW Shaft	<3	0.05 α	40 β
9.	Cast Iron Drain	2 – 3	0.1 α	3 β
10.	Borehole Sampling	≤3	0.04 α	0.13 β

a The primary source of the data on volumes and activities is contained in DEC(08)P124 Protocol For Isolation Of Facilities From The Low Active Drain To Minimise Liquor Arisings At D3000 During Extended Periods Of Very High Rainfall^(Ref 4). These data were supplemented by other information, as detailed in the following table notes.

b Manhole 5 and Castle Gate Seep flows are inter-related: the maximum combined flow is around 250 m³ per day.

c Average of the last ten samples taken from the Manhole 5 arisings. These samples were taken monthly.

d The figure in DEC(08)P124 was 0.02 Bq/ml Cs-137. However, this figure predates the commencement of pumping from Manhole 5, which has significantly reduced the volume and activity of the groundwater intercepted and subsequently pumped from the Castle Gate Seep^(Ref 5). This has resulted in an order of magnitude decrease in activity.

e Maximum monthly volume since 2007. It is not possible to attribute a daily volume from these data.

f Based on average monthly sampling analysis from sample points D30LD6 (for Street 5 sump) and D30LD7 (for Street 6 sump).

g No data, as currently being commissioned.

3. Selection of HVLA Waste Streams

Of the ten potential HVLA waste streams identified, the following seven were discounted as HVLA for the reasons stated below. Hence, these will continue to be discharged via the LLETP process.

Low Active Drain (LAD) Secondary Containment

The primary function of the LAD Secondary containment is to provide a safe route to the LLETP should the LAD fail. In the event of a leak from the LAD, more active – *Low Volume Higher Activity (LVHA)* – liquor could be introduced into the secondary containment.

DFR Outfall Chamber

The overall volume of effluent from the DFR Outfall Chamber is relatively small. In addition, significant engineering would be required to connect the chamber to either outfall 2 or 4.

Barrier 45

The overall volume of effluent from this area is low, with flow only occurring during very wet weather.

D1209 Ventilation Sump

The effluent volumes are very small. The activity levels are high compared to the majority of the other potential HVLA effluent waste streams.

D1225 ILW Shaft

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The volume of effluent is very small and its activity level is not low.

Cast Iron Drain

The volume of effluent is very small and its activity level is not low.

Borehole Sampling

The volume of effluent is very small. As there is no engineered route due to the widespread distribution of boreholes the current transport via bowsers to the LLETP should continue. There is no advantage gained in transport to the non-active outfalls.

4. Option Assessment

The three remaining effluent waste streams were considered to be HVLA; namely, effluent from the Solid LLW Pits, Manhole 5 and the Castle Gate Seep (see Figure 1). Potential management options for dealing with these waste streams were generated and are listed in Table 2 below. For each waste stream, the various management options were evaluated to determine which option represented BPM (see Tables 3 to 5 below). The management of these effluent waste streams were also considered holistically to ensure a management change did not adversely impact on other HVLA effluent waste streams. The criteria used to determine BPM were discussed and agreed to at Meeting 1 and included: cost (installation / set-up and operational); technical difficulty; safety; environmental benefit; and fault condition behaviour.

Table 2: Management Options for HVLA waste streams

Waste Stream 1 - D1212 Solid LLW Pits

- Option 1.1 Status quo
- Option 1.2 Discharge directly via new outfall
- Option 1.3 Discharge directly via an extension to outfall 2
- Option 1.4 Install a new drain to D3002 Adit for discharge via outfall 10
- Option 1.5 Switch off pumps (and do nothing)
- Option 1.6 Prevent all water from entering the pits

Waste Stream 2 - Manhole 5

- Option 2.1 Status quo
- Option 2.2 Switch off pumps (and do nothing)
- Option 2.3 Divert from Gravity Receipt Tank to sea discharge line
- Option 2.4 Discharge directly via an extension to outfall 4
- Option 2.5 Discharge directly via new outfall .

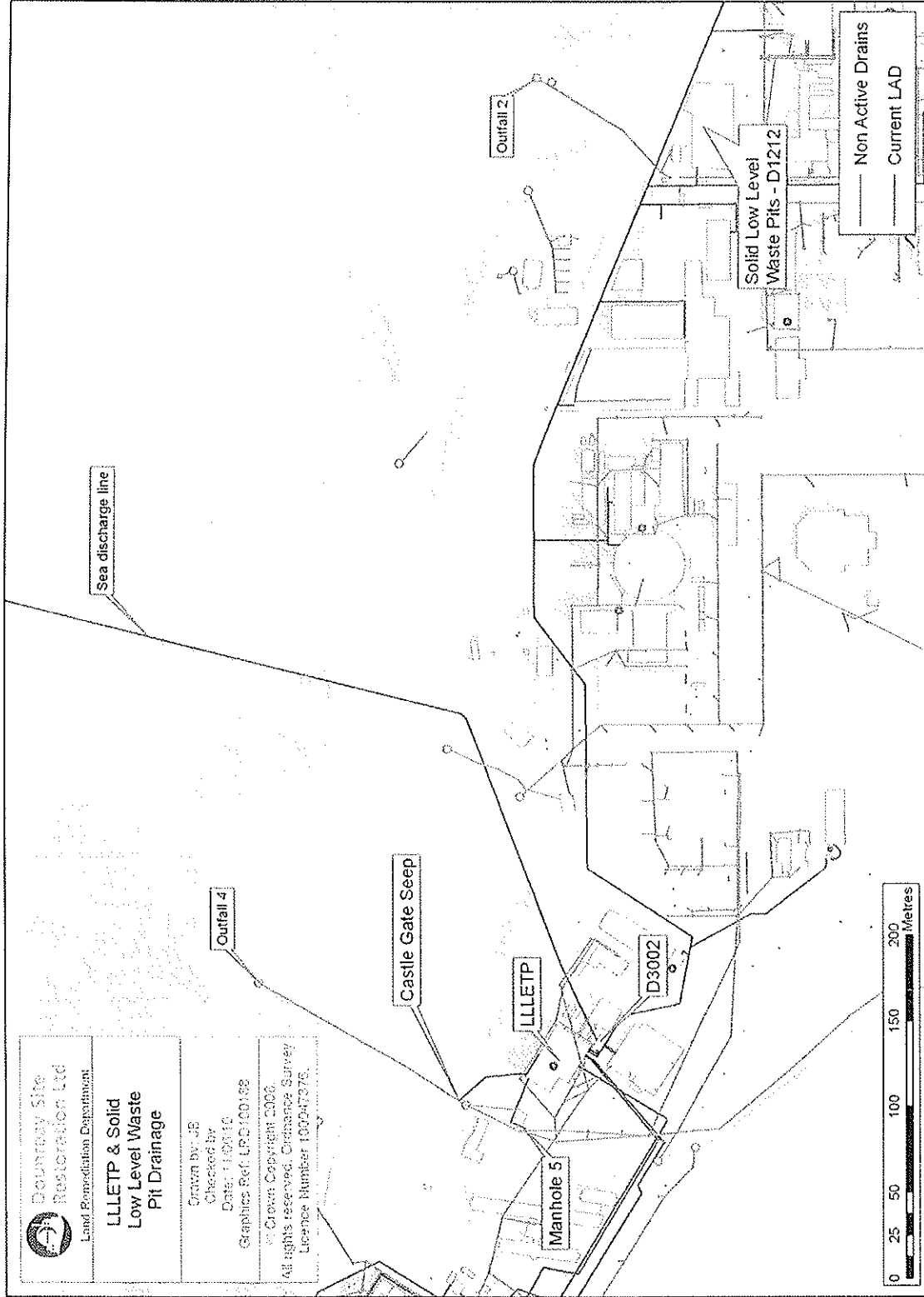
Waste Stream 3 - Castle Gate Seep

- Option 3.1 Status quo
- Option 3.2 Switch off pumps (and do nothing)
- Option 3.3 Divert from Gravity Receipt Tank to sea discharge line
- Option 3.4 Discharge directly via an extension to outfall 4
- Option 3.5 Discharge directly via new outfall

For those management options which involve a change to the status quo consideration needs to be given to the sampling and filtration requirements.

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Figure 1: Location Map



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Table 3: Assessment of options for Waste Stream 1 (D1212 Solid Low Level Waste Pits)

Description of Option	Installation	Cost		Technical Difficulty	Safety Aspects	Environmental Benefit	Fault Condition	Advantages	Disadvantages
		Operation	of						
<p>1.1 Status quo</p> <p>Effluent from the Solid LLW Pits would continue to be pumped to the LLETP, prior to discharge via outfall 10, except during heavy or prolonged rainfall events when the input from the LLW pits to the LLETP would be temporarily switched off.</p> <p>Note that a BPA review of the LLW Pits was in late 2008 concluded that a sampling and analytical trial was required to:</p> <ul style="list-style-type: none"> Establish the actual levels of particulate and activity in the leachate; and Determine the radioactive species associated with the particulate. 	Nil	Current costs of £100,000.	No change.	None.	Prevents unauthorised discharge as every consignment is sampled and characterised at the LLETP prior to discharge. Note also occurs at the Solid LLW Pits: the ATO Agreement states the weekly samples are bulked and a monthly analysis is done	Effluent from the Solid LLW Pits placed added pressure on the LLETP, with the potential to require a temporary system shutdown (cessation of pumping) in response to a high rainfall event, but only in conjunction with weather dependent effluent streams (Castle Gate Seep and Manhole 5).	<ul style="list-style-type: none"> No additional or operating costs. All effluent is characterised prior to sea discharge. Out-of-spec liquor can be isolated and not discharged. 	<ul style="list-style-type: none"> Build up of effluent in the Solid LLW Pits if pumping to the LLETP has to be shut down in response to a high rainfall event. This could lead to a greater interaction with the solid waste disposed in the Solid LLW Pits and thus elevated activity in future effluent discharges. 	
<p>1.2 Discharge directly via new outfall</p> <p>This would involve concept and detailed design (including appropriate dilution and dispersion modelling and determination of the filtration requirements) and substantial engineering works.</p> <p>The length of the new outfall would be determined on the basis of dilution and dispersion modelling. However, the assumption is that the outfall would need to be a minimum of 50 metres in length so that it extended beyond the local bay.</p> <p>Sampling options include sentenced, continuous and spot. Sentenced sampling would require installation of a holding tank, which would not be cost effective. Given the potential for variation in the activity of the discharge it is assumed that weekly spot sampling would be required until it could be demonstrated that the activity level was fairly constant, at which point DSRL could move to a less frequent sampling regime for this discharge. Alternatively, one could undertake flow-proportional sampling with an automatic sampler.</p>	<p>>£100,000</p> <p>This is not a precise estimate, but is an indicative cost to help distinguish between options.</p>	Increase in costs with laboratory and additional analysis and maintenance.	Complex engineering required in an inter-tidal environment involving: excavation, installation of new outfall, infilling etc.	Significant: challenge of working in the inter-tidal environment.	Environmental detriment due to an increase in solid waste arisings (associated with construction of new outfall) alongside the possibility of undetected oils and solvents. The diverse inventory and deteriorating physical condition of the Solid LLW Pits, where historic control of disposals was not as rigorous as current methods has the ability to include regulated constituents, such as solvents and oils.	Effluent could be consigned in an uncontrolled manner, with elevated activity discharged unknowingly and without being recorded. A filtration failure (blockage or breakthrough) could result in a non-compliant consignment of effluent being discharged to sea.	<ul style="list-style-type: none"> Slightly reduces pressure on the LLETP during high rainfall events. 	<ul style="list-style-type: none"> High installation cost involves significant engineering. Safety risks of working in the inter-tidal environment. Dilution and dispersion modelling required to assist the location of the discharge point. The discharge would not be authorised in the short term. Risk of not being authorised by SEPA in the long term. Another discharge point added to the Atlantic Ocean. More chance of actively washing back onto the foreshore than in option 1.4 (assuming the new outfall does not extend as far as outfall 10). 	
<p>1.3 Discharge directly via an extension to outfall 2</p> <p>This would involve concept and detailed design (including appropriate dilution and dispersion modelling and determination of the filtration requirements) and substantial engineering works.</p> <p>The length of the extension to the outfall would be determined on the basis of dilution and dispersion modelling. However, the assumption is that the total outfall length</p>	<p>>£100,000</p> <p>This is not a precise estimate, but is an indicative cost to help distinguish between options.</p>	Increase in costs with laboratory and additional analysis and maintenance.	Complex engineering required in an inter-tidal environment involving: excavation, installation of outfall extension, infilling etc.	Significant: challenge of working in the inter-tidal environment.	Environmental detriment due to an increase in solid waste arisings (associated with construction of outfall extension) alongside the possibility of undetected oils and solvents. The diverse inventory and deteriorating physical condition of the Solid LLW Pits, where historic control of disposals was	Effluent could be consigned in an uncontrolled manner, with elevated activity discharged unknowingly and without being recorded. A filtration failure (blockage or breakthrough) could result in a non-compliant consignment of effluent being discharged to sea.	<ul style="list-style-type: none"> Slightly reduces pressure on the LLETP during high rainfall events. 	<ul style="list-style-type: none"> High installation cost involves significant engineering. Safety risks of working in the inter-tidal environment. Dilution and dispersion modelling required. Risk of not being authorised by SEPA in the long term. More chance of 	

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Description of Option	Installation		Cost		Technical Difficulty	Safety Aspects	Environmental Benefit	Fault Condition	Advantages	Disadvantages
	Cost	Operation	Cost	Operation						
<p>1.4 Install a new drain to D3002 Aft for discharge via outfall 10</p> <p>This would involve lifting the LAD duct covers from the Solid LLW Pits to the D3002 Aft and installing new pipe work to the D3002 Aft which bypasses the LLETP process. It will involve design and engineering works, but in a more limited manner (options 1.2 and 1.3).</p> <p>1.5 Switch off pumps (and do nothing)</p>	~£30,000	Increased sampling resulting in higher costs. No change in pumping requirements from the Solid LLW Pits, but reduced pumping requirements at the LLETP resulting in lower electricity costs.	Reduced costs as pumping not required (no electricity or maintenance costs).	Relatively straightforward.	Minimal.	Discharge will still occur via outfall 10. Slight increase in solid waste arising: new drum will become contaminated requiring disposal at end of its operational life. Reduced energy consumption (electricity).	Effluent could be consigned in an uncontrolled manner, with elevated activity discharged unknowingly and without being recorded.	<ul style="list-style-type: none"> Slightly reduces pressure on the LLETP during high rainfall events; via authorised outfall. 	<ul style="list-style-type: none"> Installation costs are not insignificant. Potential for effluent to be consigned in an uncontrolled manner. 	
<p>1.5 Prevent all water from entering the pits</p> <p>*Air in this context means reducing water entry to the extent that pumping is no longer required. This would require insertion of a great blanket around the pits and would therefore involve a lengthy design phase and substantial engineering works.</p> <p>Notes</p>	>£1,000,000	Similar to option 1.5.	Very challenging due to buried infrastructure, and presence of high hazard facilities (e.g. DT200) in the vicinity.	Significant, as this involves engineering on a heavily occupied part of the site including the presence of high hazard facilities in the vicinity.	Minimal.	<ul style="list-style-type: none"> Similar to option 1.5, but seepage would be less likely. 	<ul style="list-style-type: none"> Minimises water ingress into the Solid LLW Pits. Reduced operating costs. 	<ul style="list-style-type: none"> Very high installation cost. Unlikely to prevent all water ingress. Safety risks associated with working in a high hazard environment. 		

Option 1.1: The Solid LLW Pits have six dedicated sump/pumps catering for individual samples to be taken. It is recognised that if the pumps were switched off or cut-out there would be a substantial 'hold-up' capacity; routinely checks of the remote indication panel highlight any anomalies. It is currently proposed to install an abatement system to Pit 3, similar to that employed in the other pits. Option 1.2: The pipe-work downstream of Kalscreen 2 is routed underground. Hence, any connection would be outwith the fenced site. Additional regulatory sampling regime has associated cost implications. Options 1.2 and 1.3: Unless the extended outfall 2 or the new outfall is the same length as outfall 10 (600 metres), the discharge would be closer to shore, but this would be offset by being able to discharge the same volume over a longer time frame (due to the removal of the tidal window). Considering a new outfall 500 metres in length would appear to be disproportionate to the benefit, particularly given the low activity of the Solid Low Level Waste Pits effluent.

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Table 4: Assessment of options for Waste Stream 2 (Manhole 5)

Description of Option	Cost		Technical Difficulty	Safety Aspects	Environmental Benefit	Fault Condition	Advantages	Disadvantages
	Installation	Operation						
<p>2.1 Status quo</p> <p><i>Effluent from Manhole 5 will continue to be pumped to the LLETP, prior to discharge via outfall 10, except during heavy rainfall events when the Manhole 5 input to the LLETP would be temporarily switched off.</i></p>	Nil.	Current costs of <£6,000.	No change.	None	No additional contamination of the beach (in normal operations).	System shutdown in response to a high rainfall event or loss of electricity supply resulting in an unauthorised discharge onto the beach from the Castle Gate Sump.	<ul style="list-style-type: none"> No additional installation or operating costs. Prevents the GRT flooding with radioactive groundwater during high rainfall events. 	<ul style="list-style-type: none"> Potential for unauthorised overflow onto the beach if pumping to the LLETP has to be shut down in response to a high rainfall event. Shutdown results in additional contamination of the beach. Shutdown results in uncontrolled discharge.
<p>2.2 Switch off pumps (and do nothing)</p>	Nil.	Reduced costs as pumping not required (no electricity or maintenance costs).	None.	None (nothing additional to status quo).	Reduced energy (electricity) consumption as pumping not required. A drawback is it would result in repeat contamination of the beach.	Shutdown of pumps would result in more frequent (unauthorised) discharge onto the beach, i.e. not just during high rainfall events.	<ul style="list-style-type: none"> Reduces the likelihood of the GRT flooding with radioactive groundwater during high rainfall events. No installation costs. Reduced operating costs. 	<ul style="list-style-type: none"> No control of discharges. Discharges are unauthorised. Additional radioactive contamination of the beach.
<p>2.3 Divert from Gravity Receipt Tank to sea discharge line</p> <p><i>This would involve some design (including determining the filtration requirements) and engineering works to re-route the effluent.</i></p> <p><i>The discharge could be routed to outfall 10 via the telemetry line or via the actual discharge line. The telemetry route would need a duckbill to be installed at the outfall chamber. The actual discharge line would need to be designed such that a LLETP sea discharge and a Manhole 5 discharge could occur concurrently.</i></p> <p><i>There will be a need to review the filtration requirements as the current system is abated by settlement and filtration through the LLETP process. Although filtration at source is not included it was considered within the design of the Manhole 5 pumping system and can be easily added.</i></p> <p><i>Given the consistency in activity levels of the discharge, monthly spot sampling is assumed to be sufficient.</i></p>	<£20,000	Reduced pumping requirements at the LLETP resulting in lower electricity costs.	Relatively straightforward.	Minimal.	Discharge will still occur via outfall 10. Reduced levels of contamination at drain. Reduced energy (electricity) consumption as less pumping is required.	Effluent could be consigned in an uncontrolled manner, with elevated activity discharged unknowingly and without being recorded. However, characterisation has shown consistent activity levels with little variability over 2 years.	<ul style="list-style-type: none"> Prevents the GRT flooding with radioactive groundwater during high rainfall events. Discharge via authorised outfall. No additional contamination of the beach. Reduced operating costs. Less chance of activity washing back onto the foreshore than in options 2.4 and 2.5, due to the length of outfall 10. 	<ul style="list-style-type: none"> Some installation costs. Potential for effluent to be consigned in an uncontrolled manner, i.e. no holding tank.
<p>2.4 Discharge directly via an extension to outfall 4</p> <p><i>In this option the discharge bypasses the LLETP process. Realising this would involve concept and detailed design (including appropriate dilution and dispersion modelling and determination of the filtration requirements) and substantial engineering works.</i></p>	>£100,000	Increase in costs associated with analysis of determinands for the monthly spot samples and maintenance. (Determinands as might be required in the authorisation).	Complex engineering required in an inter-tidal environment involving excavation, installation of outfall extension, infilling etc.	Significant: challenge of working in the inter-tidal environment.	Prevents contamination of the beach during high rainfall events.	Effluent could be consigned in an uncontrolled manner, with elevated activity discharged unknowingly and without being recorded. However, characterisation has shown consistent activity levels with little variability over 2 years.	<ul style="list-style-type: none"> Prevents the GRT flooding with radioactive groundwater during high rainfall events. Controlled discharge in that effluent passes via a contained outfall pipe to the receiving water, rather than 	<ul style="list-style-type: none"> High installation cost. Involves significant engineering. Safety risks of working in the inter-tidal environment. Dilution and dispersion modelling required. Risk of not being authorised by SEPA.

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Description of Option	Installation	Cost	Operation	Technical Difficulty	Safety Aspects	Environmental Benefit	Fault Condition	Advantages	Disadvantages
<p>The length of the extension to the outfall would be determined on the basis of dilution and dispersion modelling. However, the assumption is that the total outfall length (including the extension) would need to be a minimum of 50 metres so that it extended beyond the local bay.</p> <p>There will be a need to review the filtration requirements as the current system is abated by settlement and filtration through the LLETTP process. Although filtration at source is not included it was considered within the design of the Manhole 5 pumping system and can be easily added.</p> <p>Given the consistency in activity levels of the discharge, monthly spot sampling is assumed to be sufficient.</p>									
<p>2.5 Discharge directly via new outfall</p> <p>In this option the discharge bypasses the LLETTP. Realising this would involve precise estimate of concept and detailed design (including appropriate dilution and dispersion modelling and determination of the filtration requirements) and substantial engineering works.</p> <p>The length of the new outfall would be determined on the basis of dilution and dispersion modelling. However, the assumption is that the outfall would need to be a minimum of 50 metres in length so that it extended beyond the local bay.</p> <p>There will be a need to review the filtration requirements as the current system is abated by settlement and filtration through the LLETTP process. Although filtration at source is not included it was considered within the design of the Manhole 5 pumping system and can be easily added.</p> <p>Given the consistency in activity levels of the discharge, monthly spot sampling is assumed to be sufficient.</p>	<p>>£100,000</p> <p>This is not a precise estimate but is an indicative cost to help distinguish between options.</p>	<p>Increase in costs associated with analysis of determinands for the monthly spot samples and maintenance. Determinands as might be required in the authorisation.</p>	<p>Complex engineering required in an inter-tidal environment involving excavation, installation etc.</p>	<p>Significant challenge of working in the inter-tidal environment.</p>	<p>Prevents contamination of beach during rainfall events.</p>	<p>Effluent could be consigned in an uncontrolled manner, with elevated activity discharged unknowingly and without being recorded. However, characterisation has showed consistent activity levels with little variability over 2 years. A filtration failure or breakthrough could result in a non-compliant consignment of effluent being discharged to sea.</p>	<p>Prevents the GRT flooding with radioactive groundwater during high rainfall events. Controlled discharge in that effluent passes via a contained outfall pipe to the receiving water, rather than contaminating the groundwater which then goes on to contaminate a large area of land prior to reaching the receiving water. Prevents repeat contamination of the beach.</p> <p>Allows the early decommissioning of the Castle Gate Sleep System. The system is passive and would not require pumping.</p>	<p>High installation cost</p> <p>Involves significant engineering works of working in the inter-tidal environment. Dilution and dispersion modelling required to assess the location of the discharge point. The discharge would not be authorised in the short term.</p> <p>Risk of not being authorised by SEPA in the long term.</p> <p>Another discharge point added to the Atlantic Ocean. More chance of actively washing back onto the foreshore than in option 2.3 (assuming the new outfall does not extend as far as outfall 10).</p>	
<p>Notes</p> <p>Note the Manhole 5 effluent is only about 5 litres the drinking water advisory threshold. A limited programme of analysis is likely to provide enough evidence that metals and priority substances are not an issue.</p> <p>Options 2.4 and 2.5: If filters are introduced to the system then there will be a requirement to pump liquor which would therefore offer no real benefit over option 2.3.</p> <p>Options 2.4 and 2.5: Unless the extended outfall 4 or the new outfall is the same length as outfall 10 (500 metres), the discharge would be closer to shore, but this would be offset by being able to discharge the same volume over a longer time frame (due to the removal of the tidal window). Constructing a new outfall 500 metres in length would appear to be disproportionate to the benefit, particularly given the very low activity of the Manhole 5 effluent.</p> <p>Options 2.4 and 2.5: List of advantages and disadvantages based on DEC10/P266 (Rev 2)</p>									

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Table 5: Assessment of options for Waste Stream 3 (Castle Gate Seep)

Description of Option	Cost		Technical Difficulty	Safety Aspects	Environmental Benefit	Fault Condition	Advantages	Disadvantages
	Installation	Operation						
<p>3.1 Status quo</p> <p><i>Effluent from Castle Gate Seep will continue to be pumped to the LLETP, prior to discharge via outfall 10, except during heavy rainfall events when the Castle Gate Seep input to the LLETP would be temporarily switched off.</i></p>	Nil.	Current costs of <£5,000.	No change.	None.	No contamination of the beach (in normal operations).	System shutdown in response to a high rainfall event or loss of electricity resulting in unauthorised discharge onto the beach from the Castle Gate Seep.	<ul style="list-style-type: none"> No installation or additional operating costs. Prevents the GRT flooding with radioactive groundwater during high rainfall events. 	<ul style="list-style-type: none"> Potential for unauthorised overflow onto the beach if pumping to the LLETP has to be shut down in response to a high rainfall event. Shutdown results in additional contamination of the beach. Shutdown results in uncontrolled discharge.
<p>3.2 Switch off pumps (and do nothing)</p>	Nil.	Reduced costs as pumping not required (no electricity or maintenance costs).	None.	None (nothing additional to status quo).	Reduced energy (electricity) consumption as pumping not required. A benefit is it would result in repeat contamination of the beach.	Shutdown of pumps would result in more frequent (unauthorised) discharge onto the beach, i.e. not just during high rainfall events.	<ul style="list-style-type: none"> Reduces the likelihood of the GRT flooding with radioactive groundwater during high rainfall events. No installation costs. Reduced operating costs. 	<ul style="list-style-type: none"> No control of discharges. Discharges are unauthorised. Additional radioactive contamination of the beach.
<p>3.3 Divert from Gravity Receipt Tank to sea discharge line</p> <p><i>This would involve some design (including determining the filtration requirements) and engineering works to re-route the effluent. The discharge could be routed to outfall 10 via the telemetry line or via the actual discharge line. The telemetry route would need a duckbill to be installed at the outfall chamber. The actual discharge line would need to be designed such that a LLETP sea discharge and a Castle Gate Seep discharge could occur concurrently. Given the consistency in activity levels of the discharge, monthly spot sampling is assumed to be sufficient.</i></p>	<£20,000	Reduced pumping requirements at the LLETP resulting in lower electricity costs.	Relatively straightforward.	Minimal.	Discharge will still occur via outfall 10. Reduced levels of contamination all drain. Reduced energy (electricity) consumption as less pumping is required.	Effluent could be consigned in an uncontrolled manner with elevated activity discharged unknowingly and without being recorded. However, characterisation has showed consistent activity levels with little variability over 4 years.	<ul style="list-style-type: none"> Prevents the GRT flooding with radioactive groundwater during high rainfall events. Discharge via authorised outfall. No additional contamination of the beach. Reduced operating costs. Less chance of activity washing back onto the foreshore than in options 3.4 and 3.5, due to the length of outfall 10. 	<ul style="list-style-type: none"> Some installation costs. Potential for effluent to be consigned in an uncontrolled manner, i.e. no holding tank.
<p>3.4 Discharge directly via an extension to outfall 4</p> <p><i>In this option the discharge bypasses the LLETP process. Realising this would involve concept and detailed design (including appropriate dilution and dispersion modelling and determination of the filtration requirements) and substantial engineering works. The length of the extension to the outfall would be determined on the basis of dilution and dispersion modelling. However, the assumption is that the total outfall length (including the extension) would need to be a minimum of 50 metres so that it extended beyond the local bay.</i></p>	>£100,000	Increase in costs associated with analysis of determinands for the monthly spot samples and maintenance. (Determinands as might be required in the authorisation).	Complex engineering required in an inter-ideal environment involving excavation, installation of outfall extension, infilling etc.	Significant challenge of working in the inter-ideal environment.	Prevents repeat contamination of the beach during high rainfall events.	Effluent could be consigned in an uncontrolled manner with elevated activity discharged unknowingly and without being recorded. However, characterisation has showed consistent activity levels with little variability over 4 years. A filtration or breakthrough could result in a non-compliant consignment of effluent being discharged to sea.	<ul style="list-style-type: none"> Prevents the GRT flooding with radioactive groundwater during high rainfall events. Controlled discharge in that effluent passes via a contained outfall pipe to the receiving water, rather than contaminating the groundwater which then goes on to contaminate a large area of land prior to reaching the outfall. Prevents repeat 	<ul style="list-style-type: none"> High installation cost Involves significant engineering. Safety risks of working in the inter-ideal environment. Dilution and dispersion modelling require Risk of not being authorised by SEPA in the long term. More chance of activity washing back onto the foreshore than in option 3.3 (assuming the outfall extension

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Description of Option	Installation	Cost	Operation	Technical Difficulty	Safety Aspects	Environmental Benefit	Fault Condition	Advantages	Disadvantages
<p>Given the consistency in activity levels of the discharge, monthly spot sampling is assumed to be sufficient.</p>								<ul style="list-style-type: none"> • contamination of the beach. • Allows the early decommissioning of the Castle Gate Seep System. • The system is passive and would not require pumping. 	<ul style="list-style-type: none"> • Does not extend as far as outfall 10.
<p>3.5 Discharge directly via new outfall</p> <p>In this option the discharge bypasses the LLETP process. Revising this would involve concept and detailed design (including appropriate dilution and dispersion modelling and determination of the filtration requirements) and substantial engineering works.</p> <p>The length of the new outfall would be determined on the basis of dilution and dispersion modelling. However, the assumption is that the outfall would need to be a minimum of 50 metres in length so that it extended beyond the local bay.</p> <p>Given the consistency in activity levels of the discharge, monthly spot sampling is assumed to be sufficient.</p>	<p>>€100,000</p> <p>This is not a precise estimate, but is an indicative cost to help distinguish between options.</p>	<p>Increase in costs associated with analysis of determinands for the monthly spot samples and maintenance. (Determinands as might be required in the authorisation)</p>	<p>Complex engineering required in an inter-tidal environment involving excavation, installation of new outfall, infilling etc.</p>	<p>Significant challenge of working in the inter-tidal environment.</p>	<p>Prevents contamination of beach during rainfall events.</p>	<p>repeat of high rainfall events.</p>	<p>Effluent could be consigned in an uncontrolled manner, with elevated activity discharged unknowingly and without being recorded. However, characterisation has shown consistent activity levels with little variability over 4 years.</p> <p>A filtration failure (blockage or breakthrough) could result in a non-compliant consignment of effluent being discharged to sea</p>	<ul style="list-style-type: none"> • Prevents the GRT flooding with radioactive groundwater during high rainfall events. • Controlled discharge in that effluent passes via a contained outfall pipe to the receiving water, rather than contaminating the groundwater which then goes on to contaminate a large area of land prior to reaching the receiving water. • Prevents repeat contamination of the beach. • Allows the early decommissioning of the Castle Gate Seep System. • The system is passive and would not require pumping. 	<ul style="list-style-type: none"> • High installation cost involves significant engineering. • Safety risks of working in the inter-tidal environment. • Dilution and dispersion modelling required to assist the location of the discharge point. • The discharge would not be authorised in the short term. • Risk of not being authorised by SEPA in the long term. • Another discharge point added to the Atlantic Ocean. • More chance of active washing back onto the foreshore than in option 3.3 (assuming the new outfall does not extend as far as outfall 10).
<p>Notes</p>	<p>Note the Castle Gate Seep system currently has filtration at source to protect downstream equipment within the LLETP from coarse particulate matter (ref 2). Note the activity of, and indeed the case to humans from drinking, Castle Gate Seep effluent is now less than that of seawater. A limited programme of analysis is likely to provide enough evidence that metals and priority substances are not an issue.</p> <p>Options 3.4 and 3.5: Unless the extended outfall 4 or the new outfall is the same length as outfall 10 (600 metres), the discharge would be closer to shore, but this would be offset by being able to discharge the same volume over a longer time frame (due to the removal of the tidal window). Constructing a new outfall 500 metres in length would appear to be disproportionate to the benefit, particularly given the very low activity of the Castle Gate Seep effluent.</p> <p>Options 3.4 and 3.5: List of advantages and disadvantages based on DEC10/P266 (ref 2).</p>								

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5. Discussion

Currently, effluent from the Castle Gate Seep and Manhole 5 is combined into a single 2 inch pipe prior to discharge into the Gravity Receipt Tank (at the start of the LLETP process). Hence, it is expected that the 3 inch telemetry pipe will have the capacity to deal with the volume of flow from both Manhole 5 and the Castle Gate Seep (options 2.3 and 3.3). Having both discharges routed to the same place is the most cost effective option, and the current pumps at the Castle Gate Seep and Manhole 5 should be able to cope with the small extra distance involved in connecting directly to the sea discharge line (outfall 10).

It is uncertain whether the effluent from the Solid LLW Pits, the Castle Gate Seep and Manhole 5 could all be routed to outfall 10 via the telemetry pipe. Hence, it makes more sense to tackle the Castle Gate Seep and Manhole 5 together and in preference to the Solid LLW Pits.

It is acknowledged that the BPM option selected for each waste stream (see below) reflects the current situation and may be different in the future. For example, larger sample sizes of the effluent at the Solid LLW Pits are required to drive down the "less than" figures so that DSRL can more accurately determine activity levels and variability. This revised sampling regime is currently being programmed into the Life Time Plan and it will be 3 to 4 years before sufficient data have been gathered to make the case for switching off the pumps at the Solid LLW Pits (option 1.5), which has to be the BPM goal consistent with the site's interim end point.

Holistically, if no change was proposed to the management of effluent from the Castle Gate Seep or Manhole 5, making management modifications to other effluent streams is unlikely to reduce the pressure on operations at the LLETP during heavy or prolonged rainfall. For example, on its own, stopping discharges from the Solid LLW Pits to the LLETP is unlikely to make much difference if the Castle Gate Seep and Manhole 5 still discharge to the LLETP. However, stopping discharges from either the Castle Gate Seep or Manhole 5 will reduce the pressure on the LLETP and, as mentioned above, it is easier to stop both these waste streams.

Having considered the various options, including assessing their advantages and disadvantages (Tables 3 to 5), a BPM option was identified for each of the three waste streams. As noted earlier the individual BPM options were also considered holistically. The same BPM option has been selected for both Manhole 5 and the Castle Gate Seep, which makes it a more attractive option and provides a degree of confidence in the robustness of the assessment process.

The BPM option for each waste stream is:

- D1212 Solid Low Level Waste Pits: continue with the status quo (option 1.1) until a case can be made to switch off the pumps and do nothing (option 1.5). Note there may be an interim step once data are collected and the BPM reviewed – see comment in discussion above.
- Manhole 5: divert from the Gravity Receipt Tank to sea discharge line (option 2.3).
- Castle Gate Seep: divert from the Gravity Receipt Tank to sea discharge line (option 3.3).

The justification for this is:

The effluent streams from the Solid LLW Pits, Manhole 5 and the Castle Gate Seep are classed as HVLA on the basis that they are high volume with considerably lower activities than the other waste streams (see Table 1 above). If these three waste streams continue to be routed to LLETP, they will dilute discharges from LLETP and place a strain on its operations. Diverting Manhole 5 and the Castle Gate Seep effluent from the Gravity Receipt Tank will prevent the LLETP from being overwhelmed during high rainfall events and stop unauthorised overflows onto the beach during such events. It is a refinement of the rationale presented in a previous BPM DEC(10)P266 ^(Ref. 3), taking into account SEPA's intention to remove the tidal window constraint. In terms of the Solid LLW Pits, continuing pumping effluent to the LLETP prior to discharge via

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outfall 10 in the short to medium term will ensure that suitable control is retained over these discharges, whilst allowing sufficient time for a case to be made for cessation of pumping in the longer term.

6. References

1. Disbury, J. (2009). Information in Support of an Application for Authorisation for the Disposal of Liquid, Gaseous and Solid Radioactive Wastes from Dounreay, 2009. Dounreay Environment Committee Paper DEC(09)P226.
2. Email correspondence between SEPA and DSRL, dated the 16th June 2010.
3. Beaven, G. (2010). Options for Managing Manhole 5 Discharges during high rainfall events. Dounreay Environment Committee Paper DEC(10)P266.
4. Beaven, G. (2008). Protocol For Isolation Of Facilities From The Low Active Drain To Minimise Liquor Arisings At D3000 During Extended Periods Of Very High Rainfall. Dounreay Environment Committee Paper DEC(08)P124.
5. Heathcote, J. (2009). Demonstration of the application of BPM for the management and control of Castlegate Seep and Manhole 5. Dounreay Environment Committee Paper DEC(09)P195.
6. Irwin, E. (2008). Best Practicable Means review of the care and maintenance of the LLW pits complex. Dounreay Environment Committee Paper DEC(08)P165.

Approval

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Our Reference: D/SEPA/4611Y

17 August 2010

Dear Sir

**APPLICATION FOR THE DISPOSAL OF RADIOACTIVE WASTES FROM THE PREMISES
AT DOUNREAY, CAITHNESS**

An application for the disposal of radioactive wastes was submitted to SEPA on 6th April 2010 (D/SEPA/4528 refers). Two additions have been identified, that DSRL would wish to be included in the application and they are:

1. At Section 5, the Undertakings for which the premises are used are detailed. It has recently been discovered by DSRL that the practice of accepting particles of irradiated fuel/cladding recovered from the local beaches and immediate seabed is not included in the Undertakings. This omission therefore leads to the fact that the disposal of the accumulated particles is/will not be authorised.
2. At Section 6, the description of the DFR stack will change when the 6th flue, that runs through the vertical centre of the stack, is brought into use.

Consequently, DSRL requests the addition of the following statements to the application.

Section 5 – 5a Please provide details of the undertaking carried on by the applicant at the premises specified at question 4a or 4f above

- 10 Acceptance to the premises from the local beaches and immediate seabed particles of irradiated fuel/cladding for activity determination and safe disposal in an appropriate manner.

Section 5 – 5b Please say how the radioactive wastes are produced

SOLIDS

The particles of irradiated fuel/cladding are a legacy of historic disposals from the Dounreay site in the aqueous radioactive waste discharges dating back to the 1960's and 1970's. The particles are being recovered from local beaches when discovered and from the immediate seabed during planned remediation campaigns.

Section 5 – 5e Do you intend to receive and dispose of radioactive waste from other premises? (give details)

Although the beaches and seabed are not identified as premises authorised for the disposal of radioactive wastes it is deemed appropriate to declare the recovered particles as originating from other premises.

The above additions along with item 6 in Section 5 - 5a registers the undertaking of accepting and preparing for disposal the particles recovered and accepted by DSRL.

Section 6 – 6b For each discharge point please give a full description of the waste and identify or describe the discharge point.

The table describes the discharge points and includes the estimated discharge (Bq/yr). The stack serving the DFR complex has 6 flues however, the centre flue is not currently in use. The 6th flue will be brought into service to discharge the extract from the Breeder Fuel Retrieval Building and the tool maintenance and storage glovebox in D1100. Therefore to fully describe the DFR Stack the following is added to the Table:

Discharge Point	Height (m) (from ground level)	Efflux Velocity (m/s)	Radionuclides	Estimated maximum discharge (Bq/yr)	
DFR Pond	51	16.28	Alpha and beta particulate, tritium gas, krypton gas	Alpha Beta ³ H ⁸⁵ Kr	1.52E+05 3.41E+08 1.36E+12 3.00E+12
DFR Sphere	51	19.65			
DFR ESB	51	21.75			
DFR NDP	51	19.34			
DFR C4	51	29.86			
DFR BFR Extract	51	10.6			

The BFR Extract Efflux Velocity is currently a design estimate and is subject to change

If you have any queries on the content of this letter please contact Mr John Disbury on telephone 01847 806065 who will be pleased to assist.

Yours faithfully

A J Scullion
Peter Thompson
A J Scullion
Director of Assurance

