MOTT MACDONALD

Afan Sludge Treatment Centre

Residue Management Plan

September 2024

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September 2024

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1 Introduction

Dŵr Cymru Welsh Water (DCWW), also referred as 'the Operator', manages Sludge Treatment Centres (STC) that operate in line with the Environmental Permit Regulations (EPR) (England and Wales) 2016, as amended. The permits for these facilities apply to anaerobic digestion (AD) of sludge and any directly associated activities (DAA).

This document is submitted as part of the Environmental Permit application for Afan STC (the 'Site') to ensure any waste produced as a result of these permitted activities is dealt with in line with the waste hierarchy. Where disposal is necessary, DCWW will ensure this is undertaken in a manner which minimises the impact to the environment.

1.1 Scope

This document forms part of DCWW's Environmental Management System (EMS) and is applicable to all the permitted activities relevant to the AD of sewage sludge and the DAAs at the Afan STC (the 'Site'). The AD facility produces biogas to power the site's electrical equipment and processes and heat to maintain temperature within the digestion process. Biogas is combusted in the Combined Heat and Power (CHP) engines whilst the boilers run on biogas and natural gas. Combustion of excess biogas via an on-site waste biogas burner or emergency flare stack.

With that definition, this document does not focus on the general wastes created from activities outside the scope of the IED permit, for example office buildings, even if they are co-located on the same site, or on gaseous emissions from the processes. There are only a limited number of residue streams that require off-site disposal, treatment or recycling as the STC as it is co-located within a DCWW wastewater treatment works

A list of raw materials on the Site is set out in Section 2.

1.2 Objective

The objectives of this plan are to:

- Assess waste produced on the Site.
- Review actions employed to minimise waste.

1.3 Responsibility

The Catchment Manager for the site is responsible for reviewing the Residue Management Plan, so as to identify any changes to the residues generated and their fate including minimisation and moving up the waste hierarchy. The requirement is to review the processes on site that use raw materials and/or raw water and that create residual wastes, on an annual basis. The review process is ongoing as part of the regular performance monitoring for the Site.

There are many drivers for reducing use of raw materials, and creation of wastes within our processes, including environmental, financial, and resourcing. It is, therefore, in our best interests to undertake these reviews regularly, and to include lead representatives across the full chain of specialist teams at DCWW to be involved in decisions. For example, from initial procurement processes, and contractor management, through to operations, alarms, and the regular maintenance of the installation. These all work together to ensure that the processes utilise the minimum amount of raw materials/water (such as minimising the risk of overdosing of chemicals), and that wastes are minimised (such as worn parts or broken machinery).

2 Residues generated on site

2.1 Biogas

Biogas, resulting from the anaerobic digestion of sludge from the wastewater treatment works, is the primary raw material. Its consumption will be monitored. The use of biogas as the fuel source offers the best environmental option and there is, therefore, no environmental incentive to reduce biogas consumption and consider an alternative source of fuel.

Biogas produced from the digestion process is stored in a double membrane inflatable bag type holder, constructed of PVC coated polyester fabric, which is resistant to UV and microbial degradation. The base of the holder is constructed from reinforced concrete treated to withstand the potentially acidic conditions within the holder. The gas bag is completely enclosed so the gas is not in contact with the concrete.

Two CHP engines and two dual fuel boilers utilise the biogas produced from the AD process. The heat produced by the CHP engines allows the pasteurisation and digestion process to be optimised in order to maximise biogas production. Overall, this allows a greater efficiency in converting sludge to biogas and power. Key to maximising the energy production of the site is the consistent and predictable production of biogas from the digestion process and the minimisation of the use of electrical power in doing so.

The generation and use of power and heat from a renewable biogas source represents a positive impact with respect to global warming potential. All biogas produced is used to supply the Site to reduce the need to import electricity from the grid.

2.2 Secondary raw materials

There are a limited number of secondary raw materials used in the process. Secondary raw materials include chemicals used in processes such as water treatment, polymer and diesel for the boilers. Natural gas is not stored on site, but taken direct from mains supply. Their consumption will be monitored, based on purchase records.

Water treatment chemicals are stored within on impermeable surfaces in a contained area. Polymer is stored in sealed IBC/bags located on bunded areas. The DCWW purchasing procedures are included in EMS. The procedures ensure purchased items conform to specified requirements, including quality parameters, and review suitability for use, including efficiency and minimisation of use of raw materials.

All substances are assessed for COSHH (Control of Substances Hazardous to Health) compliance, where relevant. Material safety data sheets for all materials used and kept on-site will be maintained on the Site.

All raw materials are handled and stored within the confines of the buildings on-site, or in IBCs in bunded areas, with the exception of biogas which is contained within the gas handling system.

Releases of raw materials to land are considered to be negligible due to adequate containment of the materials within suitable storage vessels and presence of a contained drainage system.

Potable water is used on-site as described below, together with reasoning as to why potable water has to be used in each instance:

- Polymer make up – concerns over the impact of using final effluent for this purpose.

- Heat exchanger system water – concerns over the impact of using final effluent for this purpose.
- Eye baths and safety showers – potable water essential.
- Office mess facilities – kitchen, washing and welfare facilities etc.

To ensure appropriate use of raw materials to prevent releases of substances to the environment and limit environmental impact, DCWW will follow quality assurance procedures for the purchasing of materials. The raw materials will be selected from specialist suppliers determined by their to pre-established material specifications; these are to include environmental considerations. Priority choice of purchased raw material will be given to those with the least environmentally harmful chemicals compared to their alternatives, wherever practicable.

Resource efficiency will be achieved through the minimum use of raw materials and water (where possible), and DCWW will undertake the following:

- Maintain records of raw materials and water used.
- Routine resource efficiency audits.
- Review the feasibility of alternative materials that could reduce environmental impact or provide further opportunities to improve resources efficiency at least once every four years.
- Implement further appropriate measures identified from a review.
- Employ good housekeeping measures.
- Undertake regular preventative maintenance to ensure the operations, and energy efficiency, is optimised. This ensures that there are minimal energy losses from worn parts, thereby maintaining the efficiency of the asset.

The raw materials required to operate the permitted installation are presented in Table 2.1. All raw materials are either stored in bunded tanks, on bunded trays or enclosed within a building.

Table 2.1: Raw materials required at the Site

Description of raw material and composition	Maximum amount stored	Annual throughput	Description of the use of raw materials
Diesel	4,500 litres	2,000 litres	Used for mobile plant on site and boilers.
Lubricant oils	2,000 litres	1,500 litres	For lubrication of CHP engines and machinery.
Poly (Cationic Polyacrylamides) (FloPam FO4440 and FloPam FO4808SSH)	35 tonnes	140 tonnes	Used as flocculant to enhance thickening and dewatering processes. Amount ordered depends on centrifuge use.
Edina engine coolant	650 litres	650 litres	Used in CHP engine
Antifreeze	200 litres	200 litres	Used in CHP engine to prevent coolent from freezing
Glycol	350 litres	350 litres	Used in CHP engine to prevent corrosion and scaling
Grease/lubrication oils	200 litres	100 litres	Used for lubrication plant and equipment
Tannin (Polyphos QB20)	1,000 litres	3,000 litres	Boiler water treatment

Description of raw material and composition	Maximum amount stored	Annual throughput	Description of the use of raw materials
Activated carbon	0.36 tonnes	0.072 tonnes	360kg of carbon media across both siloxane filters. Media is changed every five years
Sodium Hydroxide (caustic soda liquor 25%)	1,000 litres	10,000 litres	Used for the boiler water treatment and pipework cleansing
Sulphuroc Acid	1,000 litres	0 litres*	Used for the OCU acid scrubber process (not in used so not stored on site

2.3 Waste

The waste streams, listed in Table 2.2, are likely to be generated at the STC. All waste streams shall be managed in accordance with existing EMS, with any final off-site disposal to be carried out by licensed waste contractors in accordance with Duty of Care requirements, and the application of the waste hierarchy is central to any decision-making process.

All residue is removed from site using suitably competent waste contractors to permitted waste facilities. Regular audits, are undertaken by the Contractor Manager/Procurement Manager, of the contractors and destination sites are undertaken to ensure compliance, as part of DCWW's duty of care requirements.

All wastes are handled and stored in such a way as to ensure containment and prevent escape. Fugitive emissions to the environment are, therefore, negligible. Waste oil is stored in a tank within a bunded area, and all other wastes are stored in appropriately labelled skips located in a waste collection area.

DCWW manages its waste in accordance with the Council Directive 2008/98/EC on waste (the Waste Framework Directive (WFD)), legal requirements and its EMS, by maximising materials re-use, prevent waste, minimise waste generation and maximise recycling and recovery of waste generated from the operation of the Site.

Table 2.2: Waste streams produced at the Site

Description of waste	Produced by	Prevent	Re-use	Recycling	Recovery	Disposal
Screenings/Grit	Grit removed during digester shutdowns and incoming sludge screening	Waste is in the incoming sludge and cannot be prevented.				Disposed of to a designated landfill site
Oils and filters	CHP engines and generators	Periodic replacement. Quality is monitored to minimise use.	Oil filters are re-used		Waste oils are removed through licensed contractor and sent for reprocessing.	
Centrate	Sludge thickening and sludge dewatering				Returned to the Wastewater Treatment Works (WwTW) for treatment	
Biogas	Anaerobic digestion				Transferred to CHP unit for electricity and heat production	Combustion of excess biogas via an on-site flare stack.
General waste	Waste generated from other Site activities (i.e. offices)			Recycled where possible at a materials recycling Site.		Non-recyclable waste is disposed of to a designated landfill site.
Scrap metal				Recycled at scrap metal recycling facilities		
Waste electronic and electrical equipment (WEEE)				Recycled at WEEE recycling facilities		
IBC	Chemical storage (i.e. polymer for sludge thickening), anti-foam agents (for digester use)	STC activities involving chemicals are optimised to ensure overuse is minimised. Where feasible, DCWW seeks to obtain chemicals via tanker to prevent this waste occurring.	IBCs are returned to the manufacturer for re-use			

Description of waste	Produced by	Prevent	Re-use	Recycling	Recovery	Disposal
Solid sewage cake/ Biosolids	Dewatered digested sludge / Liming maturation stage				Compliant biosolids are recycled in agriculture (as soil conditioner)	
Condensate	CHP engines, digesters			Returned to WwTW for treatment.		
Carbon filters	Odour Control Unit	Periodic replacement	Re-generation			In rare occasions, where carbon cannot be regenerated, it will be sent to landfill
Wooden Pallets	Bulk, non-tanker deliveries	STC activities involving chemicals are optimised to ensure overuse is minimised.		Wooden pallets (non-tanker deliveries) and plastic containers removed by licensed waste contractors and recycled.		

Presented in Table 2.3 are details on containment type and location for the waste generated on the Site.

Table 2.3: Waste containment information

Trade name / substance	Solid / liquid / gas / powder	UN number	Max stored on Site (m^3)	Location marked on Site Plan	Type of containment
Sludge	Liquid	N/A	8,500	Digester x 2	Digesters
Sludge	Liquid	N/A	100	Indigenous sludge silo	Silo
Sludge	Liquid	N/A	400	Indigenous secondary sludge tank	Tank
Sludge cake	Solid	N/A	80	Imported cake hopper	Hopper
Sludge	Liquid	N/A	500	Post digestion storage tank	Tank
Sludge	Liquid	N/A	600	Thermal Hydrolysis Plant feed silo	Silo
Sludge cake	Solid	N/A	450	Cake bays	Bays
Biogas	Biogas	UN1971	2,000	Biogas Holder	Gas bag
				Digester	Digesters
				Headspace	Pipelines
					Flare Stack
					CHP Engine

2.3.1 Quarantine procedures for non-compliant or low cake DS% biosolids

Biosolids generated at DCWW STC are typically recycled to agriculture.

Biosolids are subjected to regular quality assurance (QA) sampling and analysis for *E. coli* in line with the Biosolids Assurance Scheme (BAS). If any QA samples fail the relevant maximum allowable limit for *E. coli*, then the material should be quarantined.

Three situations when biosolids need to be quarantined are detailed below:

- **Hazard Analysis Critical Control Point (HACCP) limit breach:** the STC has a HACCP plan which contains the treatment critical control points with which the operations should comply. If any site-specific HACCP critical limits are breached, then the affected material must be quarantined.
- **Maximum Acceptable Concentration (MAC) sample failure**
- **Biosolid dry solid percentage (DS%) falls below 20%:** Biosolids applied to land in Wales must achieve a minimum of 20% dry solids at the point of production.

If any of these situations take place, then material will need to be quarantined in line with the procedure for contingency for non-compliant biosolids[1].

1. The biosolid will be reclassified from holding phase to quarantine status. The quarantined biosolid will not leave site. The Agricultural Scientist must be informed immediately in order to re-classify the ‘holding’ stockpile to ‘quarantined’ stockpile. If there is insufficient storage to

[1] DDCW (2021) Afan advanced anaerobic digester sludge treatment facility – HACCP Plan

hold the biosolids on site, with permission from the Bioresources Operations Manager, the biosolid will be held off site. The Bioresources Operations Manager is responsible for ensuring that adequate controls are in place to prevent application of potential non-compliant biosolids.

2. A second sample may be taken to ascertain if there is a laboratory error. If the result is compliant, the biosolid can be removed from quarantine status.
3. A sample of any stockpiles deemed potentially non-compliant may be taken to confirm biosolid status. If the results are of an enhanced standard, the biosolids in the stockpile may be recycled to land as normal.
4. If biosolid does not meet enhanced standard, the biosolid may be re-treated at another AD sludge treatment facility, limed, or taken to landfill for disposal. This will be decided by the Biosolids Operations Manager at the time of the 'incident'.
5. If a sample result identifies that the biosolids meets conventional standard and all other contingency options are unavailable, consideration will be made to spread to agricultural land as a conventional biosolid. This must be approved by the Head of Bioresources due to implications on DCWWs Measures of Success.
6. Imports may be diverted during this period of non- conformance and indigenous sludge may be transferred to another AD treatment facility until compliance is restored.

In the event of exceptional circumstances occurring at the Site, for example, a potential contamination of the sludge through breaching of critical limits, the following contingency action must be taken:

1. If this event occurs within normal working hours, the catchment performance manager decides on whether to place the biosolids into holding phase. In the event of the catchment performance manager being unavailable the operations supervisor must be contacted.
2. If this event occurs outside normal working hours, the Bronze Manager decides on whether to place the biosolids into holding phase. This decision is then either approved or rejected by the Performance Manager.
3. If the decision is rejected, the biosolid will be removed from holding phase status and recycled to agricultural land as normal.
4. If the decision is approved, any product in the dedicated storage area that is deemed to be non-conforming due to exceptional circumstance, will be placed into holding phase and a sample will be taken. A sampling strategy based on the circumstance will be defined by the Process Technician, Sludge Scientist, Operations Supervisor, AD Performance Manager and the Bioresources Operations Manager, e.g. to ensure retention time in digesters is considered.
5. Depending on the nature and length of the exceptional circumstance and sampling strategy, a decision may be taken to re-route all imports to another AD sludge treatment facility.
6. If the sampling strategy results are compliant (to enhanced treatment standard), the biosolid will be removed from holding phase status and recycled to agricultural land as normal. If the sampling strategy results identify that the biosolids does not meet enhanced treatment standard, the biosolid may be re-treated at another AD sludge treatment facility, limed off site, or sent to landfill. This will be agreed with the Biosolids Operational Manager at the time of failure.
7. If the sampling strategy results identify that the biosolids meets conventional standard and all other contingency options are unavailable, consideration will be made to spread to agricultural land as a conventional biosolid. This must be approved by the Head of Bioresources due to implications on DCWW Measures of Success.
8. If non-compliant material cannot be held at the Site, then the Site Manager should liaise with the Bioresources Operations Manager to arrange alternative storage.

3 Residue Management

This section outlines the measures DCWW takes to:

- Minimise the generation of residues arising from the treatment of waste.
- Optimise handling of wastes in accordance with the waste hierarchy.
- Ensure the proper treatment, recycling, or disposal of residues.

A residue is defined as the solid waste generated by the permitted waste treatment activity. With that definition, this document does not focus on the general wastes created from activities outside the scope of the permit, for example office buildings, even if they are co-located on the same site, or on gaseous emissions from the processes.

There are only a limited number of residue streams that require off-site disposal, treatment or recycling because this sludge treatment facility is co-located with DCWW's sewage treatment works.

The residues are stored within designated areas.

Oil filters and some contaminated maintenance wastes are hazardous and are, therefore, segregated from non-hazardous wastes for disposal in line with appropriate legislation. Where waste is required to be sent offsite, it is sent to a suitably permitted facility for disposal / treatment by approved third party waste management contractors. Framework suppliers are all vetted as part of DCWW tendering process. All successful Suppliers need to meet the qualification criteria, which include but not limited to evidence of required levels on insurance, financial stability, Health and Safety Accreditation and Quality Management Systems. Suppliers are also vetted for their policy on other criteria such as their Anti-Slavery Policy.

A Framework Contract system ensures that approved contractors have been pre-vetted, helping to ensure they have the relevant expertise, competency and access to appropriately permitted facilities to manage each transferred waste stream.

The waste contractors will supply a Waste Transfer Note (WTN), or Hazardous Waste Consignment Note (HWCN) if the waste is hazardous. All waste documentation for the installation is retained for the appropriate length of time at the site (two years for WTN and three years for HWCN)

Table 3.1 presents the residues produced by the permitted processes, the current management in line with the waste hierarchy and areas for potential or proposed improvement.

Table 3.1: Residues list, fate and potential improvement

Description of residues	Management method	WFD fate	Proposal / potential improvement
Solid sewage cake/biosolids	Sludge cake is stored in a cake barn to ensure appropriate maturation is met. It is covered when transported.	Recycling/recovery – Removed from site, following checks to determine its quality and adherence to appropriate requirements, and spread to land in accordance with the Sludge Use in Agriculture Regulations 1989 and the BAS.	Further optimisation of the dry solids output to reduce the quantity and improve the quality produced.

Description of residues	Management method	WFD fate	Proposal / potential improvement
		Compliant biosolids are recycled to agriculture (as soil conditioner)	
Waste oils and filters	Periodically replaced. The quality is monitored to minimise its replacement. Waste oil and filters are recycled. Waste oil is stored in a tank within a bunded area inside the Site boundary. Filters and other oily items are stored within appropriate segregated containers in the waste storage area. Off site recovery at appropriately permitted facility.	Recycled – as hazardous waste	No improvement opportunities foreseen. Current route considered to be BAT
Oily rags, oil filters, air filters	Stored within appropriate segregated containers in the waste storage area. Removed and disposed of (as hazardous waste) by specialist waste contractor or works contractor	Disposal/recycle	No improvement opportunities foreseen. Current route considered to be BAT
Biogas condensate	Condensate is removed from the biogas lines using moisture traps. Released to Site drainage and passes through the return liquor well before being returned to works inlet for processing within the UWWTD stream	Disposed – disposal via adjacent WwTW following treatment.	No improvement opportunities foreseen. Current route considered to be BAT
Centrate	Sludge thickening and sludge dewatering process waters, removed. Released to Site's drainage and returned to works inlet for processing at the adjacent WwTW	Disposed – disposal via adjacent WwTW following treatment.	No improvement opportunities foreseen. Current route considered to be BAT.
Odour control unit (OCU) chemicals	Chemicals recirculate through OCU with small amounts released to site drainage in blowdown and condensates**.** Bulk chemical waste transferred for off-site recovery at appropriately permitted facility.	Recovery – removed from Site by a licensed waste contractor.	No improvement opportunities foreseen. Current route considered to be BAT.
Odour control unit (biofilter)	Replaced as required after inspection from OCU maintenance contractor	Recovery – removed from Site by a licensed waste contractor	No improvement opportunities foreseen. Current route considered to be BAT.
Poly-electrolytes, sodium hydroxide and lab reagents	Chemical waste transferred for off site recovery at appropriately permitted facility	Recovery/recycling – removed by a licensed contractor and recycled.	No improvement opportunities foreseen. Current route considered to be BAT
Carbon filters	Removed from carbon filter unit during servicing (lifespan -5yrs). Off site recovery at appropriately permitted facility.	Recycling/recovery – returned to supplier for recharge.	No improvement opportunities foreseen. Current route considered to be BAT

Description of residues	Management method	WFD fate	Proposal / potential improvement
Grit and screenings	As much grit/screenings as possible are screened out during earlier processes (outside the scope of this permit) to minimise that entering AD process.	Disposal – all waste of this category is sent off site for disposal via landfill.	No improvement opportunities foreseen. Current route considered to be BAT. Grit / screenings fate reviewed on a periodic basis to identify alternative routes for this waste stream.
Packaging waste – wooden pallets, and cardboard/plastic packaging	Bulk, non-tanker deliveries to STC activities involving chemicals etc	Recycling – removed by a licensed contractor and recycled.	Discussion with the product supplier to avoid by using alternatives.
Packaging wastes – IBCs/drums	Bulk, non-tanker deliveries to STC activities involving chemicals (i.e. polymer for sludge thickening), anti-foam agents (for digester use). Where feasible, DCWW seeks to obtain chemicals via tanker to prevent this waste occurring	Re-used – IBCs are returned to the manufacturer for re-use.	No improvement opportunities foreseen or proposed. Current route considered to be BAT
Metal	Redundant or replacement of equipment	Recycling – removed by a licensed contractor and recycled.	No improvement opportunities foreseen. Current route considered to be BAT.
WEEE	Redundant or replacement of equipment. Segregated and sent for recycling	Recycling – removed by a licensed and specialist WEEE contractor for recycling.	No improvement opportunities foreseen. Current route considered to be BAT.

* Our biosolids are fully compliant with all relevant regulations, and we hold BAS certification for safe recycling of our product to agriculture. However, we are mindful the biosolids to agricultural land recycling route is likely to partly (or totally) disappear in future, due to a number of factors (e.g. emerging contaminants, tightening of regulations, public perception etc.).

An annual summary of volumes is reviewed for reporting purposes and options for reduction are assessed by the Catchment Manager.

4 Reducing the production of waste

Only minimal volumes of waste shall be generated at the STC, with waste streams segregated and recovered for recycling where possible. All waste streams shall be managed in accordance with existing EMS, with any final off-site disposal to be carried out by licensed waste contractors in accordance with Duty of Care requirements, and the application of the waste hierarchy is central to any decision making process.

Implementation of EMS procedures and the current Environmental Policy ensures optimum disposal of the wastes produced. Submission of a detailed assessment is not considered necessary due to the minimal quantity of waste produced.

Further consultation with waste contractors will ensure that all waste streams have been considered. The sampling and characterisation of wastes will be covered under the requirements of Duty of Care. The wastes are handled to a minimum and are stored in suitably designed containers prior to being removed from Site, to minimise releases of pollutants to the environment.

The main wastes produced by the installation are waste oils and filters associated with the operation and maintenance of the engines. Other wastes include from Site office (paper, packaging etc), waste collected from general housekeeping across the Site (debris, litter), scrap metals and WEEE (such as computer equipment, printers etc).

Waste generation from the operation of the plant is minimal and limited only to essential maintenance fluids and materials. Waste streams are segregated and recovered for recycling where possible. General waste is sent for recycling, where possible, scrap metal is sent to metal merchants for recycling and WEEE sent to specialist WEEE recycling facilities. DCWW applies a Duty of Care by ensuring waste is removed by a suitable licensed waster carrier.

To reduce volumes of waste:

- All materials and consumables delivered to Site are inspected to ensure that they are fit-for purpose.
- Damaged items are refused and returned to the supplier.
- Sewage sludge is thickened at the works to be treated at the site. Treated sludge is de-watered and then stored in a cake silo.
- The biogas from the AD process is burned either in a CHP engine or boilers, to provide power or heat for the Site processes.
- The biogas is also connected to a flare stack and excess biogas is burnt under normal operating conditions.
- The condensate overflow is contained and returned to treatment via condensate lines and does not spill to land.
- Polymer intermediate bulk containers (IBCs) are sent back to the supplier for re-use
- All skips and containers are located on a hardstanding to prevent leaching into the ground.

Skips and containers are clearly labelled. If a complaint is made with respect to litter the complaints procedure will be followed. The Site Manager will arrange for litter pickers to clear up as appropriate and will assess whether further control measures will be required to ensure that the risk of recurrence is minimised. The details of the complaint and actions taken to resolve the issue will be recorded in the Site Diary and the complaints register. As part of the quarterly health and safety checklist the site is screened for general litter, mud, and debris both within and outside site boundaries.

5 Summary

Currently, there are no additional techniques or raw material alternatives known, which could be implemented on site to reduce environmental impact or improve the efficiency of raw materials or water usage.

Where raw, potable, water can be replaced with lower grade water on site, for example for washing down small spillages, this has already been implemented.

Due to the number and types of residue streams, there was very little scope for further reduction of those generated on site.