Severn Trent Water Limited
Alfreton Sludge Treatment Facility

Permit number EPR/GP3690CH

Severn Trent Water Limited

Alfreton Sewage Treatment Works,
Alfreton Road
Alfreton
Derbyshire
DE55 6AW

Raw Materials, Water and Waste Residue Management Plan

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Contents

Executive Summary

In accordance with the consolidated IED Environmental Permit for Alfreton and associated written management systems, this is the site management plan covering use of raw materials, water and residues. Severn Trent Water Limited is required to review and record at least every 4 years whether there are suitable alternative materials that could reduce environmental impact or opportunities to improve the efficiency of raw material and water use and to carry out a waste production review.

The prime function of the sludge treatment facility at Alfreton Sewage Treatment Plant is to capture the energy potential from the treatment of sewage sludges. The plant is run 24/7 due to the continuous supply of sewage received at the treatment works either from the surrounding catchment, or via tanker discharge.

Environmental Management System and Technical Competence

The Severn Trent Water Environmental Management System (EMS) is certified to ISO14001:2015 standard. All permitted IED installations are within the certification scope.

Severn Trent Water is committed to continual environmental improvements, including materials management, water resources and waste management. This commitment is delivered through better control of processes, capital investments, and environmental training.

Under the EMS, a risk assessment has been carried out to evaluate environmental aspects and impacts of the Company's operations. Energy production activities, including use of materials and water as well as waste production have been evaluated. These activities have been considered as having both positive and negative impact. All negative impacts were considered to have a medium impact with appropriate mitigating measures in place without further recommendations (refer to EMS Aspects & Impact Register see Guidance tab).

The permitted activities are undertaken by technically competent persons, within the scope of Severn Trent Water's Competence Management System. This is certified to the EU Skills CMS Standard and UKAS accreditation.

Process Responsibility

The Operational Manager for the site has overall responsibility for reviewing the processes on the site that use raw materials, raw water and create residue wastes. This document is reviewed 4-yearly, but in reality, 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, so it is in our best interests to undertake these reviews regularly, and to include representatives across the full chain of specialist teams involved in the 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 overdosing of chemicals), and that wastes are minimised (such as worn parts or broken machinery).

Raw Materials and Water Management

There are a limited number of raw materials used in the process. All materials used at the installation are subject to storage and handling procedures. There are no dusty or potentially wind conveyed materials used on the installation.

The use of raw materials is carefully monitored and benchmarked for cost reasons, and in many cases the correct quantity has to be precisely used for proper processing to take place, so there are controls in place through monitoring and optimisation of the process.

Regular maintenance of the installation ensures that there are minimal energy losses from worn parts, thereby maintaining its inherent efficiency.

Biogas

The principal fuel used in the installation is biogas resulting from the anaerobic digestion of sludge from the sewage treatment works. There is no alternative fuel used in the gas engines as the biogas utilisation is the primary reason for the installations existence. Biogas is stored in a gas holder within the installation boundary.

The heat produced by the CHP engine allows the 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.

The new engine can generate approximately 1.05MWh.

Fuel Oil

Ultra Low Sulphur light fuel oil is also used in the installation as a standby fuel for the boiler plant only. The boilers operate if there is a temperature deficit to provide supplementary heat to the digestion plant; this only happens occasionally in practice.

Lubrication oil

Lubrication oil used on site in the CHP engine, with the volume dictated by the operational requirements. Severn Trent Water monitors the use of oil to increase its efficiency and reduce quantities required. The monitoring is carried out through a monthly oil analysis programme, which assesses the condition of the oil. The oil is changed if the quality is below pre-defined standards. This minimises consumption of oil as it will only be replaced when necessary. Once determined to be below standard, the oil is changed and the replaced oil is sent for recycling off-site.

CHP engine oil is monitored for contaminants, which indicate oil performance and general engine condition.

In addition, oil is used in the transformers; this is sampled every two years and only changed if the sample shows any deterioration. Transformer oil does not contain PCBs.

Water

Water used on the installation is mains water, for three purposes:

- General use;
- Make up of polymer; and the
- Heating loop and boiler system.

Water within the heating loop and boiler systems are treated with dosing chemicals under the management of a specialist subcontractor. It is in closed loop system which only requires minimal top up and inhibitor chemicals addition. This is to decrease water hardness that can cause scale build up within the heat exchangers. The system is inspected for leaks, particularly where excess water has to be added to top up the system.

Mains water is provided by Severn Trent Water, and metered on site.

A review has been undertaken of water use within the site, to see if lower grade water, specifically final effluent from the works can be used to replace any potable water. Savings have been identified and implemented, for example, where water is used for washing down purposes within the site, for example if a spillage of sludge occurs, this water is final effluent from the works.

Waste Water Streams

Waste water transfers from the operational areas of the site back to the works inlet for treatment prior to final discharge take place via the sites drainage system. Where such transfers leave the permitted area for the digestion process, these are marked on the site plan.

Waste water arises from a number of sources within the works. These include:

- Surface water drainage (predominately rainfall related);
- Dewatering of digested sewage sludge by centrifuges;
- Biogas condensate from moisture traps on biogas lines;
- Boiler blowdown; and
- Washing / cleaning of surfaces.

The drainage system at the works collects both process waters and surface water drainage within the same system. In order to reduce the risk of spillages being diverted directly to the adjacent water body, all water in the drainage system is captured and returned to the works inlet for processing within the UWWTD stream at the site. Where drainage leaves the permit boundary, it may include waste waters from within areas of the site which sit outside of the permit boundary, due to the design and configuration of the drainage system within the works. These are all collected in the same system and prevented from directly discharging to any watercourse.

To reduce the risk from smaller, accidental spills we have separate controls in place. Tankers offload within impermeable areas and standard spill procedures are in place. Chemicals are stored within impermeable areas and within bunds.

Containment assessments are being undertaken to show where further improvements are required on site.

Drainage plans are available on site to show any drain leading to the treatment works, and any drain which may lead to controlled waters. The drainage plan is dated 2021, and shows drains returning to the inlet of the treatment works.

Drainage leaves the permit boundary at 2 points, labelled as T1 – T2 on the installation boundary and emission point plan. Points T3 – T5 on the installation boundary and emission point plan, are offloading points for waste imports. Please see Figure 1

Emission point reference and location	Source	Parameter	Quantity	Unit
T1 SK 41286 56789	Return Liquors from site drainage system	-	-	-
T2 SK 41239 56622	Return liquors from pumping station	-	-	-
T3 SK 41436 56598	Offloading point for waste to the works inlet for treatment in the UWWTD stream	-	-	-
T4 SK 41314 56755	Offloading point to the LTP	-	-	-
T5 SK 41269 56621	Offloading point for sludge to the digestion process	-	-	-

Sampling points and their purpose are:

Emission point reference and location	Source	Parameter	Quantity	Unit
S1 SK 41257 56597	Drum thickener sampling point	-	-	-
S2 SK 41287 56748	Liquor treatment plant centrate sampling point	-	-	-

S3 SK 41433 56597	Sampling point for waste to the works inlet for treatment in the UWWTD stream	-	-	-
S4 SK 41287 56748	Sampling point for LTP imports	-	-	-
S5 SK 41268 56621	Sampling point for sludge imports	-	-	-

The following substances may be present at elevated concentrations in the drainage leaving the permitted area:

- BOD;
- COD
- Suspended Solids
- Ammonia
- pH

We have always undertaken periodical sampling of ammonia on the centrate returns with regard to loading impacting the operation of the treatment works. More recently, we are shadow sampling twice monthly for Ammonia, Soluble BOD, Total BOD, Orthophosphates and Suspended Solids in return liquors to the inlet, using the sample points noted in the table above. Direct regular sampling of these returns is a fairly recent addition to our processes so our understanding of the variance in these returns is developing. COD, BOD, Total Nitrogen, TOC, Ammoniacal Nitrogen, total Phosphorous, suspended solids and pH are directly available at our UKAS accredited contract laboratory and we will begin sampling for these determinands. Not all processes have flow meters on the return lines, assumptions will be made from the throughput of the asset. Temperature would be a field-based measurement, currently this is not measured. STW will aim to sample for PFOS and PFOA on a six-monthly basis to build up a data set, but due to the two weeks analysis turn around, these are not of use to the live operational process.

The data obtained from the return sampling will be used to optimise the process and STW will carry out root cause investigations with the process support teams to understand what changed on site and ensure that we can reduce the risk to the inlet. If any abnormalities are identified in the sample data following root cause investigations, the Process Team will collaborate with wider site based teams and the Catchment team to ascertain the root cause.

As part of the new IED permit and in line with BAT 3, we commit to carrying out further chemical analysis of the waste water, testing for all pollutants expected to be present in the discharge. We are currently in discussion with UKAS accredited laboratories to see what analysis is possible on our leachate returns, and what ‘minimum reporting value’ is appropriate. This review will be undertaken in line with EA guidance, for example Surface Water Pollution Risk Assessment for your environmental permit, and Monitoring Discharges to Water. The sampling will be undertaken by our suitably trained internal

teams that already undertake compliance sampling for EA discharge permits to MCERTS standards. Analysis will be contracted to UKAS accredited laboratories.

The site drainage system was designed to take all potentially contaminated waste waters back to the works inlet, and as such, features a large number of points where elements of the drainage system leave the proposed environmental permit boundary.

There is no separation between 'clean' sources of returned water, such as surface water run off, from process related waste waters. Therefore the most appropriate sample points have been identified as per the emission point plan. The drainage system is equipped with a number of oil interceptors to capture any spilled petrochemicals to prevent them entering the works inlet.

The site returns, including those from the Sludge Treatment Facility, will be returned to the effluent flow via pipes to the WwTWs inlet. These return downstream of the storm overflow and the Flow to Full Treatment MCERTS monitor, used for compliance with EA discharge permits. This means that there are no pathways for the returns to be present in storm discharge.

Water Usage

The usage of potable water is metered by Severn Trent at the site.

Biogas

Biogas production is not subject to direct measurement, due to the difficulty of measuring volumes with or without moisture content. Instead biogas production is monitored by CHP engine output over time. Flare use is monitored and recorded and an allowance made for gas based on flare capacity.

Waste Gases

Waste gases are generated in a limited number of locations within the site, primarily the air emission points associated with the biogas handling, storage and utilisation system.

Biogas comprises a mixture of approximately 40% carbon dioxide and 60% methane; with low levels of other volatile organic compounds and Hydrogen Sulphide and entrained moisture. Moisture is removed using moisture traps within the biogas handling system, so both the exact composition and volume of biogas handled at the site vary dependent upon the precise location where sampling occurs.

There are four main potential sources:

- Pressure relief valves;
- Boiler emissions;
- CHP stacks; and
- Flare stack.

There are potentially low volumes of waste gases not captured from open topped secondary digesters and pathogen kill tanks at the site, as well as from cake stored on the cake pad.

Pressure relief valves, if operated, will release raw biogas.

CHP stacks, boilers and flare stacks combust biogas, so will release primarily CO_2, and NOx with low volumes of SO_2 volatile organic compounds (VOCs)and CO.

The CHP is subject to routine maintenance and annual air emission monitoring. The flare stack is not monitored unless its operational hours exceed 10% of the year.

There are also low volume emissions from the odour control units on site, although the full composition of these is not analysed. As part of the new IED permit, we commit to carrying out a review of our abatement plants, to determine whether measures have been effective, and to further characterising emissions from the odour control units in line with BAT 3 and 8 to demonstrate that H2S, NH3, TVOC and HCI are not present in the waste gas stream. If H2S, NH3, TVOC or HCI are found to be present, or any improvements to equipment required, a monitoring and improvement plan will be put in place in agreement with the EA.

These release points are shown on the site plan.

Emission point reference and NGR location	Source	Parameter	Concentration	Units
A1 SK 41294 56654	CHP engine	NOx	500	mg/m^3
		SO_2	350	mg/m^3
		CO	1400	mg/m^3
A2 SK 41270 56643	Auxiliary Boiler 1	No limit set	-	-
A3 SK 41271 56641	Auxiliary Boiler 2	No limit set	-	-
A4 SK 41272 56640	Auxiliary Boiler 3	No limit set	-	-
A5 SK 41216 56650	Emergency Flare	NOx	150	mg/m^3
A6 SK 41249 56645	Gas storage pressure relief valves	No limit set	-	-
A7 SK 41276 56679	Digester storage tanks pressure relief valves	No limit set	-	-
A8 SK 41258 56672	Digester storage tanks pressure relief valves	No limit set	-	-
A9 SK 41255 56618	Odour control unit – imported sludge	No limit set	-	-

A10 SK 41272 56599	Odour control unit – sludge transfer	No limit set	-	-
A11 SK 41298 56604	Odour control unit – sludge tanks	No limit set	-	-

Inventory

Biogas production is monitored at the site, based upon the electrical output of the CHP engine in kWh, based around a standard consumption of biogas per kWh, from the manufacturer's specification for the CHP engine. An allowance can then be added for flare use, which is minimal at sites. This will give a volume of produced biogas following the removal of gross moisture within the handling system.

As the production is dependent upon sewage inputs and flows, the volume produced in any month varies.

Other Raw Materials

The site has three areas covered by odour control units (OCUs) located within the installation boundary. Two P1000 Peacemakers located in parallel at the sludge import area, and two P1000 Peacemakers located in parallel in the sludge transfer area, and a biofilter at the pre-digestion sludge tanks. Each of the Peacemaker OCUs comprises a layered dry chemical scrubbing system using dry impregnated media granules.

These units are monitored for performance and are subject to an annual maintenance check by a specialist contractor. Media in the OCUs is not subject to annual replacement, as per manufacturer's recommendation. Media does require ad hoc replacement after approximately five years, whereby the spent pellets can be recycled. They have been sized appropriately for the odour source.

Table 3 below lists all the raw materials used on site.

Table 3: Raw Material List

Description of raw material and composition	Maximum storage amount	Annual throughput (tonnes per annum or as stated)	Description of the use of the raw material	Alternatives
Anti foam	2 IBCs (1000 liters each)	5 IBCs/year.	Added to primary digesters to reduce foaming, as required	Standard product used for this purpose within the industry
Fuel oil/Diesel/LFO	15,000 litres	<10,000 litres	Back-up fuel for use within boilers and or back-up generators	No viable alternative. Used as a backup only.
Lubricating oils	2,500 litres	<4,000 litres	Equipment lubricant	None available
Glycol coolant	100 litres	<500 litres	CHP engine coolant	None available
Dry chemical scrubber material	None	Replaced as required on return basis to manufacturer	Dry chemical pellets impregnated with stabilized chlorine dioxide in first stage. Second stage utilizes countervalient pelleters.	None as unit designed to use this media for chemical scrubbing
AWT Biograded Rock	Not stored on site	Replaced as required	Biofilter used in the odour control unit	None available
Water treatment chemicals	Not stored on site	Replaced as required	Water treatment for the boilers	None available
Biogas	1,500m^3	See 1.1 Biogas	Primary fuel for the CHP	Best available practice.
Polymer	6 tonnes	<100 tonnes	Digested sludge thickening	None available
Lime	Not stored on site	<10 tonnes/year	Pathogen control for sludge where kill level has not been achieved	None available
AdBlue	2,500 litres	Replaced as required		None available
Caustic Soda	15 tonnes	Replaced as required		None available

Ferric Sulphate	30 tonnes	Replaced as required	Phosphate/Struvite control	None available

Raw Material	Composition	Fate
Biogas Biogas COSHH	Methane (57.2%) Carbon dioxide (41.6%) Other (1.2%)	Electrical and heat energy Air emissions of carbon monoxide, carbon dioxide, sulphur dioxide and nitrogen oxides
LFO	Ultra Low Sulphur Light Fuel Oil (100%)	Air emissions of carbon monoxide, carbon dioxide, sulphur dioxide and nitrogen oxides. Local watercourses if uncontained.
Lubrication oil Lub Oil COSHH	Oil (100%)	Waste – Recycled
Polymer Polymer COSHH	Polyacrylamide copolymer Distillates (petroleum) (20-50%) Isotridecanol, ethoxylated (<3%)	Absorption into sewage sludge or centrifuged cake. Leftover polymer returned to head of works via centrate liquors.
Chemical pellets (for dry chemical stage of OCU)	Ceramic pellets impregnated with stabilised chlorine dioxide and second stage with countervaliant technology.	Absorption of odorous compounds from air by chemical reaction (chloride dioxide) and electrostatic means (countervaliant)
Boiler and heat transfer water treatment chemicals	Proprietary oxygen scavengers, and water softeners	Boiler and heat exchanger system drained occasionally to on site effluent drains
Anti-Foam Anti-Foam COSHH	Polyakloxylate	Absorption into sewage sludge. Waste product to be recycled.
Lime Lime COSHH	Calcium di-hydroxide (100%)	Integration into sludge cake
AdBlue AdBlue COSHH		
Caustic Soda Caustic Soda COSHH		

Ferric Sulphate Ferric Sulphate COSHH		

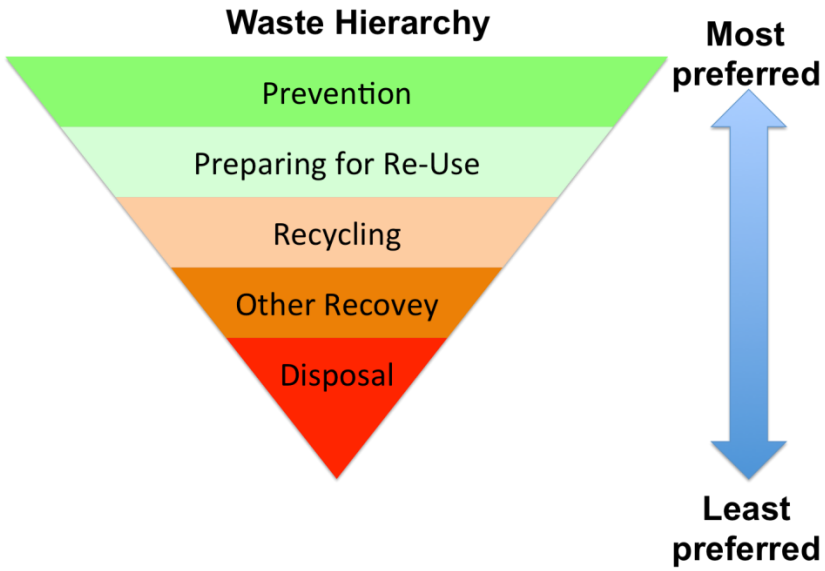
Residue Management

This document records the measures we take to:

- Minimize the generation of residues arising from the treatment of waste
- Optimise the waste hierarchy
- Ensure the proper 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 collocated on the same site, or on gaseous emissions from the processes. Nor does it include the solid sewage cake produced by dewatering digested sewage sludge, which is 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 Biosolids Assurance Scheme (BAS).

The Waste Hierarchy demonstrates the most preferred options for waste management, and Severn Trent Water commits to achieving waste targets by utilizing its approach.



There are only a limited number of residue streams that require off-site disposal, treatment or recycling because this sludge treatment facility is collocated with Severn Trent Water's sewage treatment works (see Table 4).

The residues are stored within designated areas as described within the Waste Management Standard Operating Procedures.

Oil filters and some contaminated maintenance wastes are considered hazardous and are therefore segregated from non-hazardous wastes for disposal in line with 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.

All waste contractors used will be registered with the Environment Agency / Natural Resources Wales and have a current Waste Carriers Licence. Our waste contractors will supply us with a Waste Transfer Note (WTN) and/or Waste Consignment Note (WCN) - dependant on what type of waste is being removed from site. 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 WCN)

The residues produced by the permitted processes including management in line with the waste hierarchy and areas for potential improvement and future review are detailed in Table 2 below:

Table 4: Residue List

Residue Type	Current Measures	In line with Waste Hierarchy	Potential Improvements
Waste lube oil	The quality of the oil is monitored so as to minimise its replacement. Any waste oil is recycled. Waste oil is stored in a tank within a bunded area inside the installation boundary. Off site recovery at appropriately licensed facility	Recycled	No improvement opportunities foreseen. Current route considered to be BAT
Waste transformer oil	The quality of the oil is monitored so as to minimise its replacement. Any waste oil is recovered. Off site recovery at appropriately licensed facility (by specialist contractor)	Recovery	No improvement opportunities foreseen. Current route considered to be BAT
Waste coolant	Glycol coolant is monitored and replaced as required to protect the CHP engine. Any waste coolant is recovered. Off site recovery at appropriately licensed facility (by specialist contractor)	Recovery	No improvement opportunities foreseen. Current route considered to be BAT
Biogas condensate	Condensate is removed from the biogas lines using moisture traps	Disposal following treatment	No improvement opportunities foreseen. Current route considered to be BAT

	Released to site drainage and returned to works inlet for processing within the UWWTD stream		
General engineering waste (e.g. oily rags, oil filters, air filters)	Stored within appropriate segregated containers in the waste storage area. Disposed of (as hazardous waste) by specialist contractor	Disposal	No improvement opportunities foreseen. Current route considered to be BAT
Contaminated PPE	Stored within appropriate segregated containers in the waste storage area. Disposed of (as hazardous waste) by specialist contractor	Disposal	No improvement opportunities foreseen. Current route considered to be BAT
Spill kit materials	Minimisation of spillages through regular maintenance, pollution prevention infrastructure, and staff training on Standard Operational Procedures. Spill kits used for hazardous materials (oil or fuel) will be managed as hazardous waste. Spillages of liquids will be contained and treated on site where possible.	Disposal	No improvement opportunities foreseen. Current route considered to be BAT
Fluorescent tubes	Stored within appropriate segregated containers in the waste storage area. Removed from site (as hazardous waste) by specialist contractor for offsite recycling	Recycling	No improvement opportunities foreseen. Current route considered to be BAT
Dry chemical pellets from OCU	Removed from OCU during servicing for regeneration. Off site recovery at appropriately permitted facility	50% recycled 50% disposal	No improvement opportunities foreseen, as returned to manufacturer for refreshing, Current route considered to be BAT
Scrap Metal	Stored within appropriate segregated skip. Off site recovery at appropriately licensed facility	Recycled	No improvement opportunities foreseen. Current route considered to be BAT

Empty chemical containers	Use of chemical is minimised in the processes by performance monitoring, which results in decreasing the amount of waste containers produced. Returned to producer for reuse where possible, or removed from site by specialist sub-contractor.	Reuse	Bulk chemicals currently delivered by tanker to reduce use of individual containers No improvement opportunities foreseen. Current route considered to be BAT
Grit and screenings from digester cleansing	As much grit and screenings as possible are screened out during earlier processes (outside the scope of this permit) to minimise that entering anaerobic digestion process. Grit and screenings removed from digesters are screened to segregate the waste streams. Grit can be recycled. As screenings originate from non-segregated sources, there are currently no alternatives to landfill.	Grit: Recycled Screenings: Landfill	No improvement opportunities foreseen. Current route considered to be BAT Screenings fate reviewed on a periodic basis to identify alternative routes for this waste stream

Energy Review

Site Energy Management Plan reviews are carried out at all of our permitted sites at frequent intervals.

Sites with CHP engines have a KPI target for generation of electricity from biogas, and excess electricity is exported from the site where possible.

Flare use is monitored to ensure that the use of flaring to control biogas volume is minimised and where appropriate, additional CHP resource is deployed to a site where excess flaring occurs. Where possible, other green energy sources are deployed at works. The onsite generation and use of power and heat from a renewable biogas source represents a positive impact with respect to global warming potential and reduces imports of energy from the grid.

All capital projects consider whole life costs, including energy usage for schemes, and design concepts such as gravity transfers are implemented where possible instead of over pumping. Where possible, low energy lighting is specified and all pumps and motors are appropriately sized for their location. Pumps which may be impacted by rags and solid material are checked and cleaned in accordance with the sites preventative maintenance program, which is developed from a combination of manufacturers recommendations and operational experience of issues with specific pumps within the site network.

Insulating materials are applied to transfer pipelines for hot water and digesters to reduce heat losses, which reduces energy consumption.

Summary and recommendations

Raw Materials and Water Usage Review

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.

A number of monitoring programmes are being put in place for understanding our waste composition better (wastewater returns and waste emission in OCUs). With the outcomes of those activities there may be further improvements available to us.

Residue Production Review

Due to the small number and type of residue streams, there was very little scope for further reduction of those generated on site. All current waste disposal/recovery routes are considered to be BAT and utilise application of the Waste Hierarchy.