MOTT MACDONALD

Gravesend Sludge Treatment Centre Residue Management Plan

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Mott MacDonald
4th Floor
Mountbatten House
Grosvenor Square
Southampton SO15 2JU
United Kingdom

T +44 (0)23 8062 8800
mottmac.com

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Issue and Revision Record

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1 Introduction

Southern Water 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 (DAAs).

This document is submitted as part of the Environmental Permit application for Gravesend STC 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, Southern Water will ensure this is undertaken in a manner which minimises the impact to the environment.

1.1 Scope

This document forms part of Southern Water's Environmental Management System (EMS) and is applicable to all the permitted activities relevant to the AD of sludge and the DAAs at the Gravesend 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. The boilers run on diesel or light oil (Therma 35). Combustion of excess biogas is via an on-site flare stack. 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 Site Manager for the Gravesend STC is responsible for ensuring compliance with the Environmental Permit conditions. 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 from across the full chain of specialist teams at Southern Water 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.

A CHP engine and two duel fuelled 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, oil and diesel for the boilers and generators. Their consumption will be monitored, based on purchase records.

Chemicals used across the Site are stored on impermeable surfaces in a contained area within the main process building. Polymer is stored in sealed intermediate bulk containers (IBCs)/bags located on bunded areas.

The Southern Water 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 usage on-site include:

- Eye baths and safety showers - potable water essential
- Limited wash-down points where it would be uneconomic to extend the final effluent wash-water system
- Office mess facilities - kitchen, washing and welfare facilities etc.

The Site has an abstraction licence (9/40/1/508G) to abstract water from an on-site borehole. This is permitted to extract a maximum of 55,000m^3 per year, 340m^3 per day or 20m^3 per hour. The water is used for polymer make up only. There are also a further four groundwater abstraction licences within 1km of the Site. These licences are operated by J Clubb Ltd and permit the use of water for mineral washing and are located 98m and 125m northeast of the Site.

To ensure appropriate use of raw materials to prevent releases of substances to the environment and limit environmental impact Southern Water will follow quality assurance procedures for the purchasing of materials. The raw materials will be selected from specialist suppliers determined by their pre-established material specifications, and will 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 Southern Water 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.

Table 2.1: Raw materials required

Description of raw material and composition	Maximum amount stored (tonnes or m^3)	Annual throughput (tonnes or m^3 each year)	Description of the use of the raw material
Diesel / Oil	50m^3 (50,000 litres - 40,000 litres for generator tank, and 10,000 litres for boiler tank)	~15m^3	Used to fuel generators, boilers and also mechanical plant on site i.e. telehandlers, mobile pumps. The main hazards are detailed in the safety data sheet shown in document reference 790101_MSD_MSDS_GRA February 2024.
Ferric chloride (40%)	<30,000 litres	1,040 tonnes (10 tonnes delivered every 5-6 weeks)	Used for odour control. The main hazards are detailed in the safety data sheet shown in document reference 790101_MSD_MSDS_GRA February 2024.
Highmark C-498 and C498HMW	3 tonnes (3 to 4 x 750kg bags)	19 tonnes (approximately 26 x 750kg bags.	Used as flocculant to enhance thickening and dewatering processes. The main hazards are detailed in the safety data sheet shown in document reference 790101_MSD_MSDS_GRA February 2024.

Description of raw material and composition	Maximum amount stored (tonnes or m^3)	Annual throughput (tonnes or m^3 each year)	Description of the use of the raw material
Kemira Superfloc C-496HMW	1.5 tonnes (2 x 750kg bags)	7.4 tonnes (approximately 10 x 750kg bags)	Used as flocculant to enhance thickening and dewatering processes. The main hazards are detailed in the safety data sheet shown in document reference 790101_MSD_MSDS_GRA February 2024.
SAS SNF Flopam640	1.5 tonnes (2 x 750kg bags)	9.6 tonnes (approximately 13 x 750kg bags)	Used as flocculant to enhance thickening and dewatering processes. The main hazards are detailed in the safety data sheet shown in document reference 790101_MSD_MSDS_GRA February 2024.
Burst 5400 or Flowfoam 681F	$1m^3$ (1,000 litre IBC)	$1m^3$ (1,000 litre IBC)	Used to suppress foaming of sludge within the digester or dewatering process. The main hazards are detailed in the safety data sheet shown in document reference 790101_MSD_MSDS_GRA February 2024.
Carbon filter tanks - Pulsorb GW - AddSorb VA4	2 x 1 tonne filters 1 x 1 tonne filter	3,000 kg minimum	Used for H_2S and Siloxane removal. The main hazards are detailed in the safety data sheet shown in document reference 790101_MSD_MSDS_GRA February 2024.
Hydrated lime, Calcium dihydroxide	Variable	$10m^3$	Bulk granular lime is used to amend sloppy cake on an ad hoc basis (such as during adverse weather conditions). 10 x 1 tonne bags kept on site, all may be used. The main hazards are detailed in the safety data sheet shown in 790101_MSD_MSDS_GRA February 2024.
Coolant – Fuchs Fricofin	~ 300 litres - engine. No further coolant stored on Site.		For cooling CHP engines. The main hazards are detailed in the safety data sheet shown in 790101_MSD_MSDS_GRA February 2024.
Lubrication Oils – Titan Ganymet Ultra	~ 200 litres – engine 1000 litres – clean tank 1000 litres – waste tank		For lubrication of CHP engines. The main hazards are detailed in the safety data sheet shown in 790101_MSD_MSDS_GRA February 2024.

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 wastes are handled and stored in such a way as to ensure containment and prevent escape. Fugitive emissions to the environment are, therefore, negligible.

Southern Water manages its waste in accordance with the Council Directive 2008/98/EC on waste (the Waste Framework Directive), 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

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.			Organic and grit screenings sent to composting facilities. *Sent to CFS "Composting Facilities Services" for processing[1]	
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 (WTW) 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		
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, Southern Water seeks to obtain chemicals via	IBCs are returned to the manufacturer for re-use			

[1] MTS Cleaning Services LTD (2023) Recycling Sewage Waste. Available online at: https://mtscleansing.co.uk/commercial/recycling-sewage-waste/

Description of waste	Produced by	Prevent	Re-use	Recycling	Recovery	Disposal
		tanker to prevent this waste occurring.				
Solid sewage cake/ Biosolids	Dewatered digested sludge / Liming maturation stage			Recycled/recovered - 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).	Compliant biosolids are recycled in agriculture (as soil conditioner)	
Condensate	CHP engines, digesters			Returned to STC for treatment.		
Biofilter media	Biofilter media associated with odour control units (OCU)	Periodic replacement	Could be washed and re-used if possible			Waste will be WAC (Waste Acceptance Criteria) tested and sent for disposal at the appropriate landfill.
Carbon filters	Odour Control Unit	Periodic replacement	Re-generation			In rare occasions, where carbon can't 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.		

*MTS in-house treatment facility recycles sewage waste into a beneficial soil conditioner. The industrial scale in-vessel composting system is operated by MTS sister company Composting Facilities Services Ltd (CFS).

CFS confirm, the waste that goes in is firstly separated from water to solids. Any non-organic waste is then picked out and sent to a materials recovery facility which reuses/recycles this material. Any stone like waste is washed and recycled elsewhere. As for the rag, as most of it is now biodegradable this helps the decomposition process.

The alternative outlet that MTS take grit/ screenings to is Geneco/Wessex Water, Avonmouth Composting and Aggregate Facility.

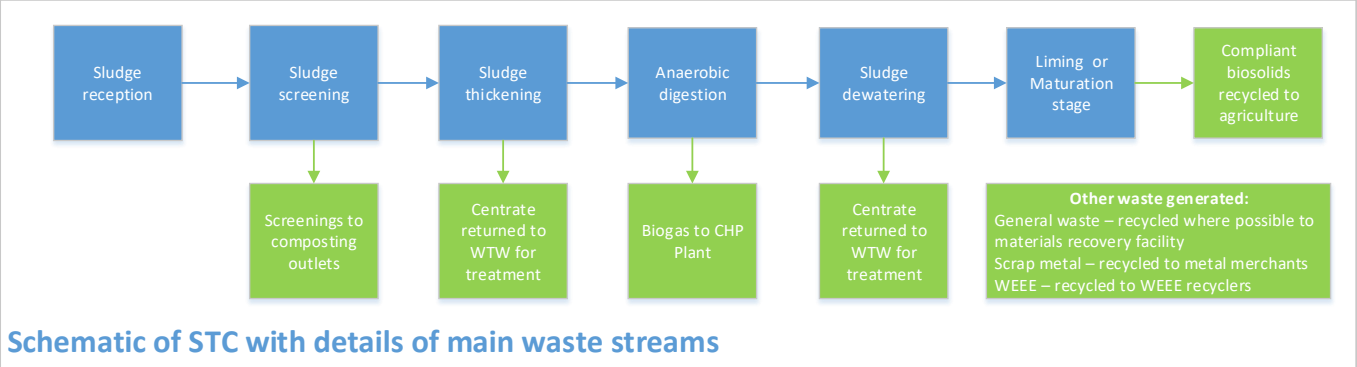
Presented in Table 2.3 are details on containment type and location for the waste generated on site.

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	2,580m^3	1 x Digester	Tanks
Sludge	Liquid	N/A	100m^3	Thickened Sludge Storage Tank	Tank
Sludge	Liquid	N/A	290m^3	Sludge holding Tank	Tank
Sludge	Liquid	N/A	720m^3	Sludge Reception Tank	Tank
Sludge Biogas	Biogas	N/A	320m^3 Headspace	Post Digestion Storage Tank	Tank
Sludge cake	Liquid	N/A	<6,000m^3	Cake Bays	Bays
Biogas	Biogas	UN1971	925m^3	Biogas Holder Digester Headspace	Gas bag Digesters Pipelines Flare Stack CHP Engine

The sampling and characterisation of wastes and the final off-site transport of waste is carried out by licensed waste contractors in accordance with Duty of Care requirements. The implementation of EMS procedures and the current Environmental Policy ensures optimum disposal of the wastes produced.

A typical schematic of the main waste streams, where produced, from the STC is shown below.



Schematic of STC with details of main waste streams

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

Biosolids generated at Southern Water STC are typically recycled to farmland.

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:

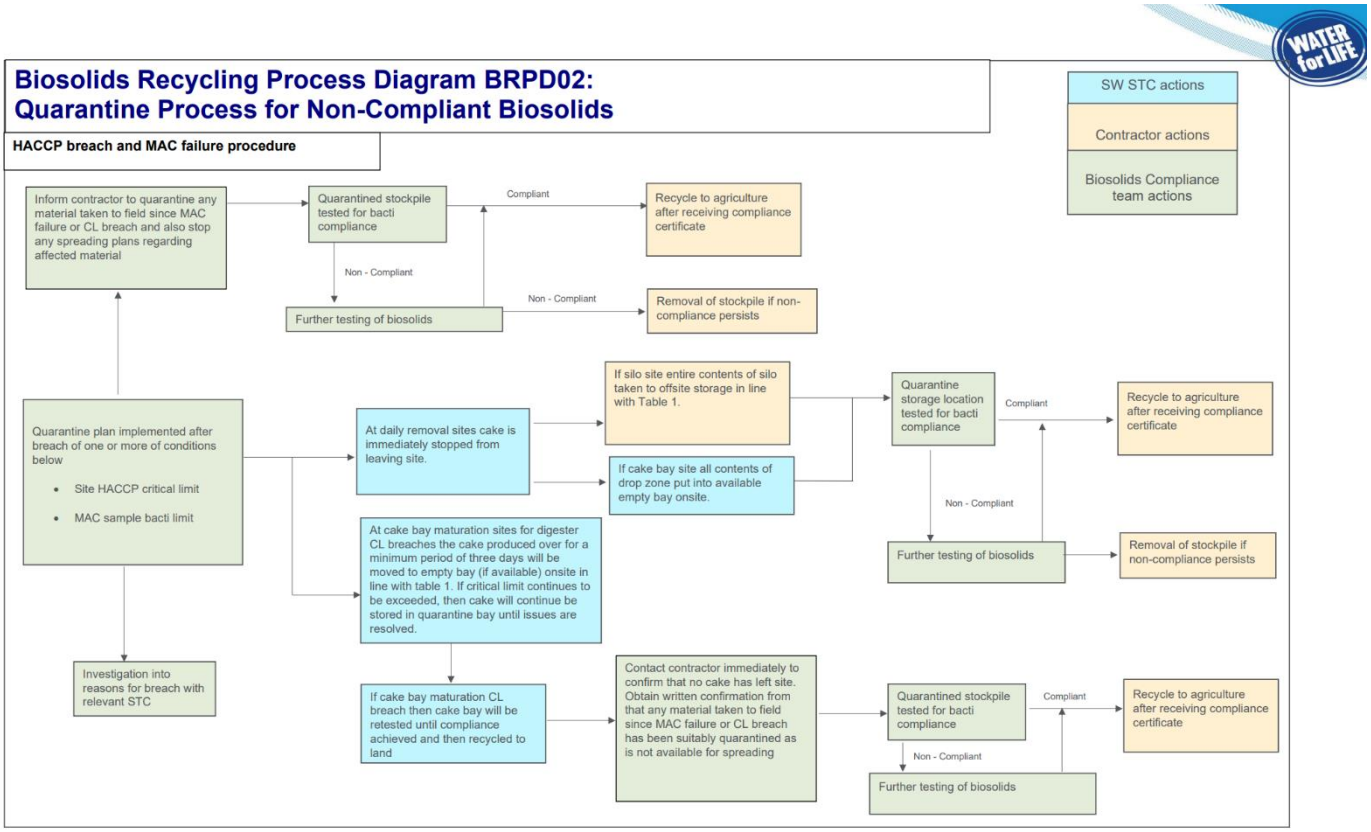
- **Hazard Analysis Critical Control Point (HACCP) limit breach:** Each STC has a HACCP plan which contains the treatment critical control points with which the operations should comply. If

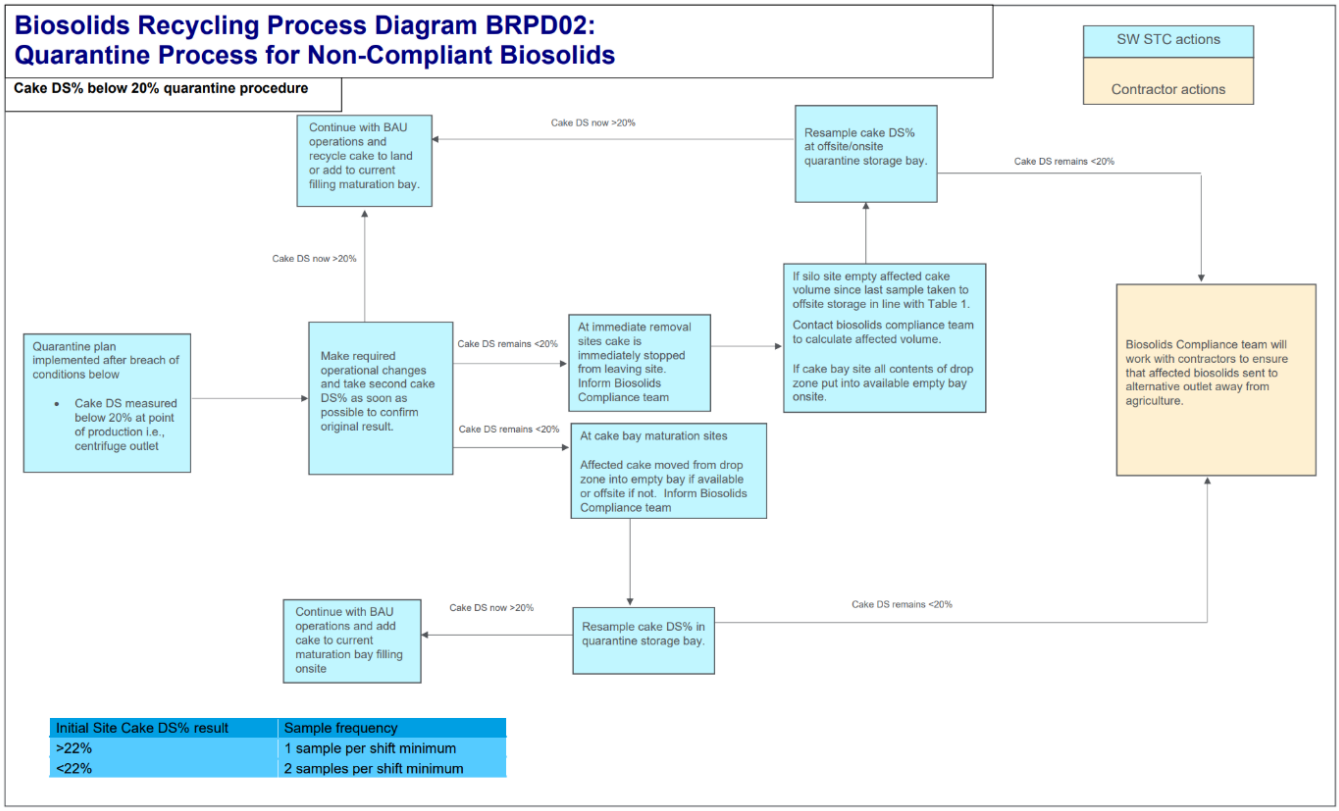
any site-specific HACCP critical limits are breached, then the affected material must be quarantined.

- **Maximum Acceptable Concentration (MAC) sample failure**
- **Biosolid dry solid percentage (DS%) falls below 20%:** Biosolids applied to land in England 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 below.

Once quarantined, biosolids must be resampled and confirmed to be compliant after a further period of treatment before they can be recycled to land.





If quarantining is required, and the breach is HACCP or MAC failure related, then the material should be held on site in an empty bay until compliant QA results are received from the laboratory provider. After compliance is confirmed, the relevant stakeholders will be notified by a certificate of compliance that biosolids from the site in question can now be recycled to land.

If the compliance breach is related to biosolid dry solid (DS%) content of the cake being below 20%, then the affected material will be held in quarantine until alternative treatment or disposal can be arranged by Southern Water.

If non-compliant material cannot be held on site, then the Site Manager should liaise with the Southern Water Biosolids Compliance Team to arrange alternative storage.

3 Residue Management

This section outlines the measures Southern Water 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 Southern Water'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.

A Waste Management Framework Contract ensures that approved contractors have been pre-vetted and helps ensure they have the relevant expertise, competency and access to permitted facilities appropriate to each transferred waste stream. Our waste contractors will supply us with a Waste Transfer Note (WTN) and/or Hazardous Waste Consignment Note (HWCN) - 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 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
IBC and other packaging	Bulk, non-tanker deliveries to STC activities involving chemicals (i.e. polymer for sludge thickening), anti-foam agents (for digester use). Where feasible, Southern Water 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
Odour Control Unit (OCU) chemicals	Chemicals recirculate through OCU with small amounts released to site drainage in blowdown and condensates.	**Recovered –** removed from site by licensed waste contractor **Disposed** - Disposal via adjacent WTW following treatment	No improvement opportunities foreseen or proposed. Current route considered to be BAT.

Description of residues	Management method	WFD Fate	Proposal/potential improvement
	Bulk chemical waste transferred for off-site recovery at appropriately permitted facility.		
Waste oil 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 installation boundary. Filters and other oily items are stored within appropriate segregated containers in the waste storage area. Off-site recovery at an appropriately permitted facility.	**Recovered/recycled** - as hazardous waste.	No improvement opportunities foreseen or proposed. Current route considered to be BAT.
Screenings / Grit	As much screenings / grit as possible is screened out during earlier processes (outside the scope of this permit) to minimise that entering AD process.	**Treatment/ Composted/ Disposed** **Southern Water Waste Framework Contractor MTS Cleansing Services has an enterprise company called Composting Facilities Services. All Southern Water waste of this category is sent to CFS for processing. Anything that cannot be composted is either sent to incineration or some form of reclamation, such as creating building materials. Recycling Sewage Waste - MTS Cleansing Services Ltd.	No improvement opportunities foreseen or proposed at present. Current route considered to be BAT.
Biogas condensate	Condensate is removed from the biogas lines using moisture traps. Released to site drainage and returned to works inlet for processing at the adjacent WTW.	**Disposed** - Disposal via adjacent WTW following treatment.	No improvement opportunities foreseen. Current route considered to be BAT.
Centrate	Sludge thickening and sludge dewatering process waters, removed. Released to site drainage, via a liquor return	**Disposed** - Disposal via adjacent WTW following treatment.	No improvement opportunities foreseen. Current route considered to be BAT.

Description of residues	Management method	WFD Fate	Proposal/potential improvement
	monitoring point and pumping station and returned to works inlet for processing at the adjacent WTW.		
Solid sewage cake/ Biosolids	Sludge cake is stored in a bay to ensure appropriate maturation is met. It is covered when transported.	**Recycled/recovered** - 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). Compliant biosolids are recycled to agriculture (as soil conditioner).	No improvement opportunities foreseen*. Current route considered to be BAT.

* Our Biosolids are fully compliant with all relevant regulations, and we hold Biosolids Assurance Scheme (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.).

**MTS in-house treatment facility recycles sewage waste into a beneficial soil conditioner. The industrial scale in-vessel composting system is operated by MTS sister company Composting Facilities Services Ltd (CFS).
CFS confirm, the waste that goes in is firstly separated from water to solids. Any non-organic waste is then picked out and sent to a materials recovery facility which reuses/recycles this material. Any stone like waste is washed and recycled elsewhere. As for the rag, as most of it is now biodegradable this helps the decomposition process.
The alternative outlet that MTS take grit/ screenings to is Geneco/Wessex Water, Avonmouth Composting and Aggregate Facility

In collaboration with the rest of the industry and the Environment Agency we are actively working on understanding these potential issues through participation in the Chemical Investigation Programme 4 (CIP4). Our PR24 submission to OFWAT included a Bioresources Long-Term Strategy document, exploring alternative solutions to mitigate against the risk of the disappearing landbank. A publicly accessible version of which is available here: https://www.southernwater.co.uk/media/9051/srn36-bioresources-strategy_redacted.pdf

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.

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.
- The sludge from the post digestion sludge storage tank is dewatered by one centrifuge to reduce its volume. Dewatered digested cake is stored in the cake storage bays, before being transported off-site for storage prior to being recycled to agricultural land as a soil conditioner.
- Sewage sludge is de-watered from the works to be treated at the Site. Treated sludge is then recycled to agricultural land as a soil fertiliser. The treated sludge meets the Biosolids Assurance Scheme Quality Standards. The volume of sludge recycled to agricultural land is monitored by the waste services team.
- The biogas from the AD process is burned in a CHP engine and is used to provide power for the Site processes. Surplus power is exported to the grid.
- Polymer intermediate bulk containers (IBCs) are sent back to the supplier for re-use.
- Grit is collected for composting and used as a soil conditioner. This process is licenced and controlled via the Environment Agency.
- WEEE, batteries, waste oils and oil contaminated items such as oily rags are treated as waste hazardous waste in accordance with legislation, these are removed from Site by an approved suppler, using approved waste carriers.

Main storage of waste on the Site is located at NGR TQ 66617 73994. All skips and containers are located on a hardstanding to prevent leaching into the ground. Skips and containers are clearly labelled. All waste from the Site is sorted into this waste area.

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 waste electronic and electrical equipment (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, as shown in Table 2.2 for different Site activities. 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. Southern Water applies a Duty of Care by ensuring waste is removed by a suitable licensed waster carrier.

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.

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.

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.