MOTT MACDONALD

Queenborough Sludge Treatment Centre Residue Management Plan

September 2024

This page left intentionally blank for pagination.

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

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

Queenborough Sludge Treatment Centre Residue Management Plan

September 2024

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
1	January 2024	Isobel Moss	Anita Manns	Shannon Stone	Draft for client comment
2	January 2024	Isobel Moss	Shannon Stone	Anita Manns	Resubmission
3	Sept 2024	Isobel Moss	Shannon Stone	Anita Manns	Update based on August NDM Rfl

Document reference: 790101_MSD_ResidueMP_QUE September 2024

Information class: Standard

Contents

Tables

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 the anaerobic digestion (AD) of sludge and any directly associated activities (DAA).

This document is submitted as part of the Environmental Permit application for Queenborough STC to ensure any waste produced as a result of the 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.

Queenborough is a Sludge Treatment Centre (STC) (also known as the "Site") and associated Wastewater Treatment Works (WTW). The address for the site is Argent Road, Queenborough, Kent, ME11 5DZ (National Grid Reference: TQ 90914 70575).

Southern Water wishes to vary permit EPR/CP3798HU into an installation permit for the Site to consolidate the:

- Anaerobic digestion of sludge
- Temporary storage of imported cake (raw or digested)
- Acceptance of liquid sludge waste (digestate) at post digestion, for dewatering

for a single consolidated Installation permit.

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 sewage sludge and the DAAs at the Queenborough 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. Any surplus power will be exported to the grid. Biogas is combusted in the Combined Heat and Power (CHP) engines whilst the boilers primarily run on biogas, when available, and gas oil, if the gases are not available. Combustion of excess biogas via an on-site waste biogas burner or emergency 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 Queenborough 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 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 Overview of the STC process

Imported sludge makes up around 2/3 of the total dry solids treated and is received in 1 No. sludge reception tank (270m3). Indigenous primary sludge and imported sludge are screened by 3 No. strain presses and stored in 3 No. post screened sludge storage tank (225m3 each) before being thickened by 2 No. duty / standby gravity belt thickeners and stored in 1 No. thickened sludge storage tank (518m3). Thickened sludge is fed to 2 No. conventional mesophilic anaerobic digesters (3,696m3 total volume) operating at around 35°C. Digested sludge is stored in 2 No. post-digestion sludge storage tank (271m3 each) before being dewatered by 2 No. duty, standby centrifuges. Dewatered digested cake is stored on-site before being transported off-site for storage prior to being recycled to farmland.

Biogas produced from the two digesters will be transported to the one gas holder. The biogas produced gas will then be burnt in the existing CHP engines to produce electricity. The current waste biogas burner (or flare) will be retained and available to burn excess gas.

Centrate and decant liquor from the sludge thickeners gravitates to the site liquor pumping station and are returned to the end of the inlet channel.

The IED permit will include:

- Sludge reception tank 1 No. (270m^3)
- Strain presses 2 No.
- Post screened sludge storage tank 3 No. (225m^3 each)
- Gravity belt thickeners (duty/standby) 2 No.
- Thickened sludge storage tank 1 No. (518m^3)
- Digesters 2 No. (3,696m^3 total volume)
- Post digestion storage tank 2 No. (271m^3 each)
- Centrifuges (duty/standby) 2 No.
- Gas bag holder 1 No. (570m^3)
- Auxiliary boilers 2 No. powered by biogas/gas oil
  - Boiler 1 (dual fuel): 0.88 MWth thermal rated input
  - Boiler 2 (dual fuel): 0.82 MWth thermal rated input
- CHP engine 1 No. (1.1MWth thermal rated input)
- Biogas burner (flare stack) 1 No.
- Cake storage bays 7 No. (total volume 3920m^3), wall height is approximately 6ft (including one back-up bay).
- Odour control units (OCU) 2 No.
- Odorous air is extracted by 2 No. duty, standby fans

The following are outputs from the process:

- Cake (dewatered post digestion sludge) - stored in cake bays before being transported off-site for agricultural use;
- Bio-gas - stored in an existing gas holder, then either:
  - Burnt in the CHP or back-up boilers to generate electricity;
  - Flared in the waste biogas burner.
- Grit and screenings (small amount) – deposited in skips before being taken off-site.

2.1 Anaerobic digestion of sludge

Queenborough catchment covers the towns of Sheerness, Queenborough, Halfway and Minster. The sewerage system comprises combined gravity sewers and rising mains with some 20 No. wastewater pumping stations (WPS).

All flows are received at an elevated inlet works and pass through 3 No. 6mm 2D screens, operating as duty, assist units. Screened sewage then passes through a detritor for grit removal. Following grit removal, flows in excess of the permitted flow to full treatment (FFT), 252 l/s, overflow to 2 No. storm tanks. Storm tank contents are returned to treatment or discharged to the outfall as settled storm sewage.

Flows up to the permitted FFT pass through 4 No. circular primary settlement tanks (PSTs). Only 2 or 3 PSTs are operated at any given time with the rest serving as standby. The PSTs are auto-desludged by pumps. Ferric dosing of crude sewage occurs upstream of the primary tanks to aid primary settlement. Ferric dosing is also used for hydrogen sulphide suppression.

Settled sewage is treated in a conventional activated sludge process consisting of 3 No. aeration lanes with fine bubble aeration. Mixed liquor is settled in 3 No. radial final settlement tanks. Return activated sludge (RAS) is continuously removed from the final settlement tanks (FSTs) and returned to the aeration lanes. Surplus activated sludge (SAS) is returned to the PSTs for co-settlement.

Secondary treated sewage effluent and settled storm sewage is discharged to the Swale Estuary.

The site has liquid sludge reception facilities. Imported sludge makes up around 2/3 of the total dry solids treated. Cake is imported on rare occasions, and is not treated, only stored in the cake bays.

Indigenous primary sludge and imported sludge are screened and stored in 3 No. post screened sludge storage tank (225m^3 each) before being thickened by 2 No. duty / standby gravity belt thickeners and stored in 1 No. thickened sludge storage tank (518m^3). Thickened sludge is fed to 2 No. conventional mesophilic anaerobic digesters operating at round 35°C. Digested sludge is stored in 2 No. post-digestion sludge storage tanks before being dewatered by 2 No. duty, standby centrifuges. Dewatered digested cake is stored on-site before being transported off-site for agricultural use. Biogas produced by the digesters is used by CHP to generate electricity. Centrate and decant liquor from the sludge thickeners gravitates to the site liquor pumping station and are returned to the end of the inlet channel.

The main sludge treatment processes are covered or enclosed. Odorous air is extracted by 2 No. duty, standby fans and dispersed via the stack. The site is situated in a remote and windy location away from residential areas.

The CHP unit on-site has been in operation in 2004. It is powered by biogas and has a thermal rated input of 1.1MWth. Therefore, the Site falls within the scope of the Medium Combustion Plant Directive (MCPD) since the thermal rated input is greater than 1MWth. The existing CHP unit will not be required to meet MCPD requirements until 2030 because it is an existing medium combustion plant (MCP). The CHP unit is due to be upgraded and, in that event, an appropriate permit variation would be sought to comply with regulations.

Temporary storage of imported cake (raw or digested)

Raw cake can be stored whilst awaiting available capacity at other sites for on-going treatment (anaerobic digestion or direct dewatering).

Digested cake can be stored to allow for extended maturation where capacity is not available elsewhere.

Acceptance of liquid sludge waste (digestate) at post digestion, for dewatering

Post digested liquid sludge (digestate) from other Southern Water sites enters at the post digestion tanks, for dewatering at the centrifuges. The process aligns with the above description of the anaerobic digestion from the post digestion tanks onwards.

3 Residues generated on site

3.1 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 is stored within 1 No. double membrane inflatable bag type holder, constructed of Type IV fabric which is resistant to UV and microbial degradation. The base of the holders are 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 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.

3.2 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 gas oil and diesel for the boilers and generators respectively. Their consumption will be monitored, based on purchase records.

Water treatment chemicals are stored on impermeable surfaces in a contained area. Polymer is stored in sealed intermediate bulk containers (IBCs) or bags located in bunded areas.

The Southern Water purchasing procedures are included in EMS471. 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.
- Centrifuges and thickeners.
- 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.

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 pre-established material specifications. 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.
- Regular preventative maintenance will ensure 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 3.1: 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 (DURON TM/MC -E SYNTHETIC 5W-40)	$30m^3$	~15,000 litres ($15m^3$)	Used to fuel generator 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_QUE January 2024.
Polymer (Cationic Polyacrylamides) • Kemira SUPERFLOC C-6598 • Kemira SUPERFLOC C-498HMW powder	8 X 1050kg as liquid in IBC 8 X $1m^3$/750kg bags	43.2 tonnes consisting: 25.2 tonnes 18 tonnes	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_QUE January 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
Anti foam - Kemira kemfoam X2500	$1m^3$	1 tonne	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_QUE January 2024.
Ferric sulphate solution 11-14%	$14m^3$	180 tonnes	Used as a coagulant to enhance solids removal within the primary settlement and tertiary treatment. Ferric dosing also reduces H2S potential. The main hazards are detailed in the safety data sheet shown in 790101_MSD_MSDS_QUE January 2024.
Oils including Lubricant Oil (Tufgrease plus / WYMARK GREASE OG)	1000ltrs – Engine clean oil tank 1000ltrs – Engine Waste Oil Tank 150ltrs – Engine 200trs – Engine make-up 200lts- Oil Change 700ltrs – Jacket water and air conditioning system, 100ltrs - Spare Plus ~50kg Lubrication Oil		Used by engines and jacket water and air conditioning systems. Lubrication oils used for lubricating equipment. The main hazards are detailed in the safety data sheet shown in 790101_MSD_MSDS_QUE January 2024.
Compro68 compressor fluid	$0.205m^3$	$0.82m^3$	Used for gas mixing. The main hazards are detailed in the safety data sheet shown in 790101_MSD_MSDS_QUE January 2024.
Calcium Oxide, Lime (solid granules)	100t		Granular lime is used to stabilise wet biosolids product on an ad hoc basic (such as during adverse weather conditions). The main hazards are detailed in the safety data sheet shown in 790101_MSD_MSDS_QUE January 2024.
Carbon filters - Carbon AddSorb VA4 - Activated Carbon		1 tonne	Used in the single carbon tank for hydrogen sulphide removal. The main hazards are detailed in the safety data sheet shown in 790101_MSD_MSDS_QUE January 2024.

3.3 Waste

The waste streams, listed in the 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 3.2: 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 can't be prevented.			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 reused		Waste oils are removed through licensed contractor and sent for reprocessing.	
Centrate	Sludge thickening and sludge dewatering				Returned to the WTW for treatment	
Biogas	Anaerobic digestion				Transferred to CHP unit for electricity and heat production	Excess burnt in biogas burner
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 tanker to prevent this waste occurring.	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
Solid sewage cake / Biosolids	Dewatered digested sludge / Liming or 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		
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 contractor and recycled.	Wooden Pallets	Bulk, non-tanker deliveries
Carbon filters	Associated with single carbon tank for hydrogen sulphide removal.	Periodic replacement		Re-generation		In rare occasions, where carbon cannot be regenerated, it will be sent to landfill

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

Table 3.3: 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	3696	2 X Digesters	Tanks
Sludge	Liquid	N/A	237 (each)	2 X Post Screened Sludge Storage Tanks	Tanks
Sludge	Liquid	N/A	518	Thickened Sludge Storage Tank	Tank
Sludge	Liquid	N/A	271 (each)	2 X Post Digestion Storage Tanks	Tanks
Sludge	Liquid	N/A	270	Sludge Reception Tank	Tank
Sludge Cake	Solid	N/A	<600	Cake Bays	Bays
Biogas	Biogas	UN1971	<1200 Max	Biogas Holder ($570m^3$) Digester Headspace ($326m^3$)	Gas bag Digesters Pipelines Flare stack CHP Engine

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

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

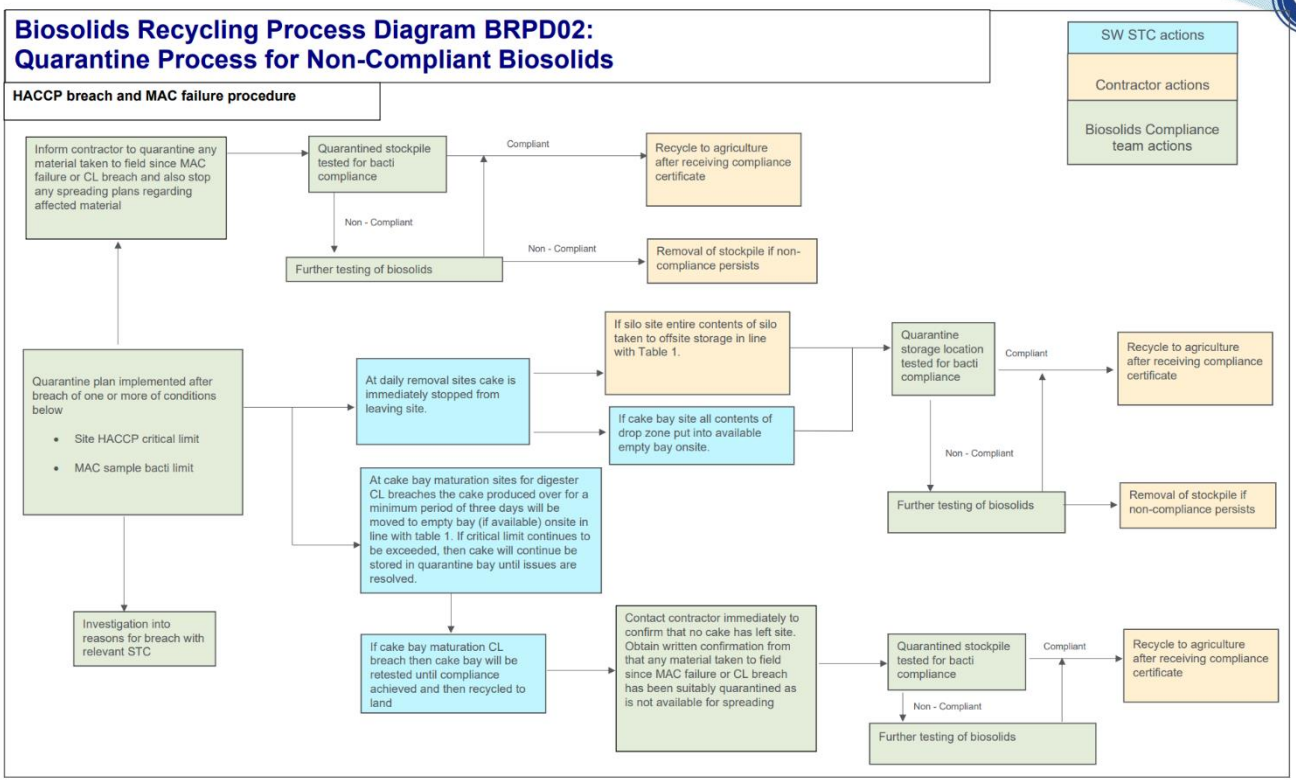
Biosolids are subjected to regular quality assurance (QA) sampling and analysis for E. *coli* in line with the Biosolids Assurance Scheme (BAS). If any QA samples fail the relevant maximum allowable limit for E. *coli*, then the material should be quarantined.

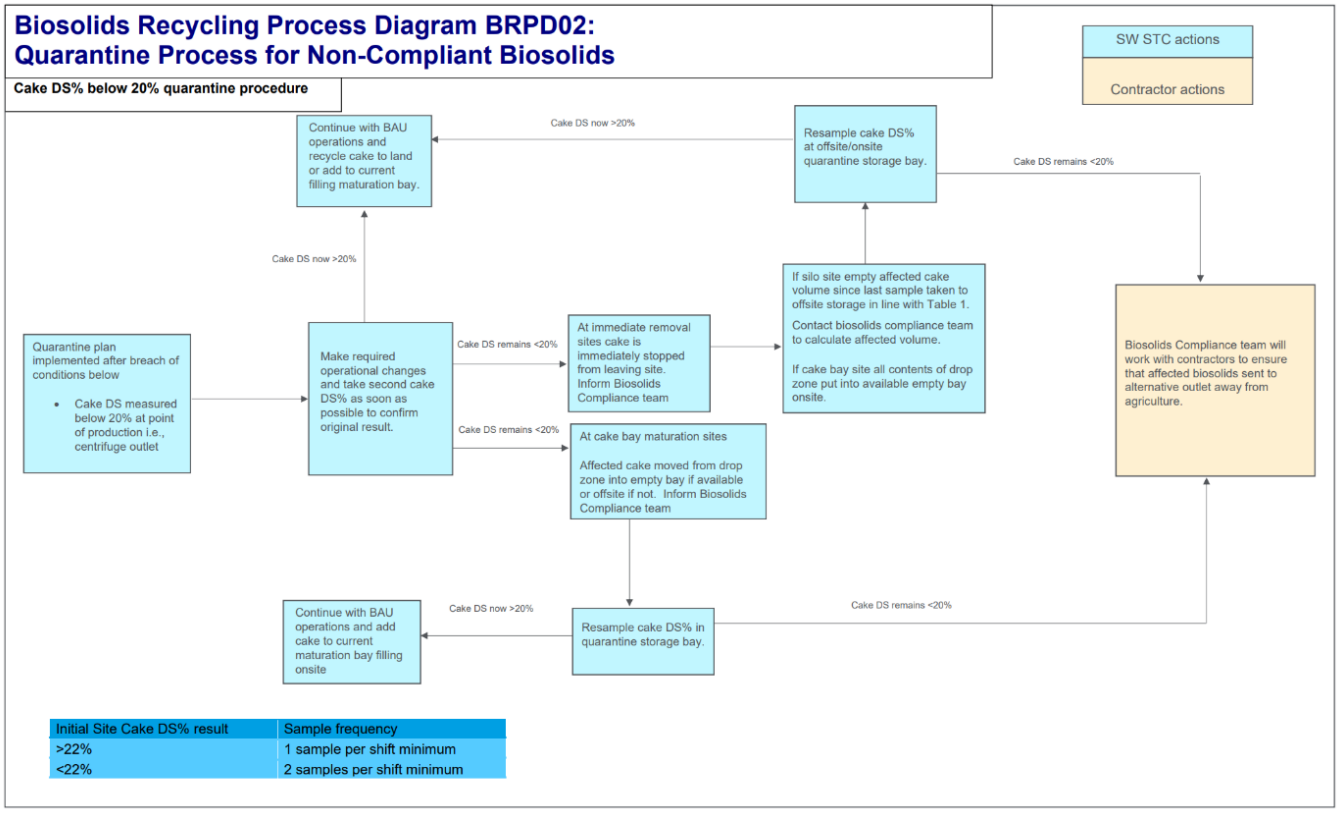
Three situations when biosolids need to be quarantined are detailed below:

- **Hazard Analysis Critical Control Point (HACCP) limit breach:** 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.


Biosolids Recycling Process Diagram BRPD02:
Quarantine Process for Non-Compliant Biosolids
HACCP breach and MAC failure procedure
SW STC actions
Contractor actions
Biosolids Compliance team actions
Inform contractor to quarantine any material taken to field since MAC failure or CL breach and also stop any spreading plans regarding affected material
Quarantined stockpile tested for bacti compliance
Compliant
Recycle to agriculture after receiving compliance certificate
Non - Compliant
Further testing of biosolids
Non - Compliant
Removal of stockpile if non-compliance persists
Quarantine plan implemented after breach of one or more of conditions below
Site HACCP critical limit
MAC sample bacti limit
At daily removal sites cake is immediately stopped from leaving site.
If silo site entire contents of silo taken to offsite storage in line with Table 1.
If cake bay site all contents of drop zone put into available empty bay onsite.
Quarantine storage location tested for bacti compliance
Compliant
Recycle to agriculture after receiving compliance certificate
Non - Compliant
Further testing of biosolids
Removal of stockpile if non-compliance persists
At cake bay maturation sites for digester CL breaches the cake produced over for a minimum period of three days will be moved to empty bay (if available) onsite in line with table 1. If critical limit continues to be exceeded, then cake will continue be stored in quarantine bay until issues are resolved.
Investigation into reasons for breach with relevant STC
If cake bay maturation CL breach then cake bay will be retested until compliance achieved and then recycled to land
Contact contractor immediately to confirm that no cake has left site. Obtain written confirmation from that any material taken to field since MAC failure or CL breach has been suitably quarantined as is not available for spreading
Quarantined stockpile tested for bacti compliance
Compliant
Recycle to agriculture after receiving compliance certificate
Non - Compliant
Further testing of biosolids


Biosolids Recycling Process Diagram BRPD02:
Quarantine Process for Non-Compliant Biosolids
Cake DS% below 20% quarantine procedure
SW STC actions
Contractor actions
Continue with BAU operations and recycle cake to land or add to current filling maturation bay.
Cake DS now >20%
Resample cake DS% at offsite/onsite quarantine storage bay.
Cake DS remains <20%
Cake DS now >20%
If silo site empty affected cake volume since last sample taken to offsite storage in line with Table 1.
Contact biosolids compliance team to calculate affected volume.
If cake bay site all contents of drop zone put into available empty bay onsite.
Biosolids Compliance team will work with contractors to ensure that affected biosolids sent to alternative outlet away from agriculture.
Quarantine plan implemented after breach of conditions below
Cake DS measured below 20% at point of production i.e., centrifuge outlet
Make required operational changes and take second cake DS% as soon as possible to confirm original result.
Cake DS remains <20%
At immediate removal sites cake is immediately stopped from leaving site. Inform Biosolids Compliance team
Cake DS remains <20%
At cake bay maturation sites
Affected cake moved from drop zone into empty bay if available or offsite if not. Inform Biosolids Compliance team
Continue with BAU operations and add cake to current maturation bay filling onsite
Cake DS now >20%
Resample cake DS% in quarantine storage bay.
Cake DS remains <20%
Initial Site Cake DS% result
Sample frequency
>22%
1 sample per shift minimum
<22%
2 samples per shift minimum

If quarantining is required, then the material should be held on site in an empty bay, until compliant QA results are received from the lab 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 DS% content, then the 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 in an empty bay, then the Site Manager should liaise with the Southern Water Biosolids Compliance Team to arrange alternative storage.

4 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 4.1 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 4.1: Residues list, fate and potential improvement

Description of residues	Management method	WFD Fate	Proposal/potential improvement
IBCs 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, SWS 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
Wooden pallets and plastic packaging	Bulk, non-tanker deliveries to STC activities involving chemicals etc	**Recycled -** Removed by licensed waste contractor and recycled.	No improvement opportunities foreseen or proposed. Current route considered to be BAT

Description of residues	Management method	WFD Fate	Proposal/potential improvement
Odour Control Unit 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	**Recovered –** removed from site by licensed waste contractor **Disposed** - Disposal via adjacent WwTW following treatment	No improvement opportunities foreseen or proposed. Current route considered to be BAT
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** SWS Waste Framework Contractor MTS Cleansing Services has an enterprise company called Composting Facilities Services. All SWS 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	**Disposed** - Disposal via adjacent WwTW following treatment	No improvement opportunities foreseen. Current route considered to be BAT

Description of residues	Management method	WFD Fate	Proposal/potential improvement
	for processing at the adjacent WwTW		
Centrate	Sludge thickening and sludge dewatering process waters, removed. Released to site drainage, via a liquor return monitoring point and pumping station 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
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
Carbon Filters	Used to remove hydrogen sulphide to ensure CHP engine remains efficient and does not wear out. Replaced as necessary.	**Recovered –** Re-generation at CPL Activated Carbon Immingham	No improvement opportunities foreseen or proposed. 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.).

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

5 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 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 apply a Duty of Care by ensuring waste is removed by a suitable licenced waster carrier.

6 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.