

Gravesend STC

Leak Detection & Repair Plan

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Final



from
**Southern
Water** 

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1 Introduction

Failures in site processes or assets can lead to uncontrolled releases of liquids (e.g., sludge) to land and water as well as gases to air.

This document outlines our control measures for reducing these events and minimising the impact from these releases.

The generation of odour from the processing of sewage is primarily associated with the release of odorous Volatile Organic Compounds (VOCs) that are generated because of the anaerobic breakdown of organic matter by micro-organisms.

Since the main source of VOCs is the solid organic matter, the majority is generated from the operations involving the handling of sludge i.e., the processes applied to dewater, treat, and store raw sludge. These processes are generally considered to present the greatest risk of fugitive air emissions unless adequate controls are put in place.

To mitigate fugitive emissions to air, such as VOCs and methane, from treatment plants and associated infrastructure including pipework, combustion plants, conveyors and tanks, a site-specific Leak Detection and Repair (LDAR) plan forms part of the overall asset maintenance strategy.

The plan looks to decrease the risk to local sensitive receptors from VOCs, bioaerosols and odour, as well as to reduce the probability of and impact from any spills or leaks.

1.1 Document Overview

This LDAR plan has been written in line with the Environment Agency's 'Appropriate measures for the biological treatment of waste' guidance.

The overall LDAR plan is supported by site-specific aspects in relation to site processes, equipment, or procedures. Other site-specific information includes maps to identify the known locations (point and area sources) for potential fugitive emissions to air, and descriptions of any site-specific additional measures where applicable.

The LDAR plan forms part of the existing company Environmental Management System.

Leaks are considered most likely to occur at the points of weakness, namely connections, interconnection, joins and bends. The potential sources are identified on site-specific LDAR maps.

The plan will act to improve safety for site operatives, decrease exposure of local sensitive receptors to VOCs, bioaerosols and odour, as well as to reduce product losses.

An LDAR plan consists of five basic elements:

- Identifying and recording the location key components
- Leak detection
- Monitoring components
- Repairing or replacing components
- Recordkeeping

The plan includes the followings to identify leaks and carry out repairs or replacement of plant and equipment:



- Methods for locating unknown emission sources.
- Programme of work for monitoring and controlling emissions
- Leak mitigation measures
- Maintenance and repair programme

1.2 Identifying and recording the location of key components

The Gravesend Sludge Treatment Centre (STC) & Wastewater Treatment Work (WTW) site is split into the following Zones for LDAR inspection.

Area 1 – Gravesend WTW Site

Area 2 – Gravesend STC Cake, Cess & Sludge Import Areas

Area 3 – Gravesend Digesters, Biogas Gas Bag Storage and CHP Area

Area 4 – Gravesend dewatering area

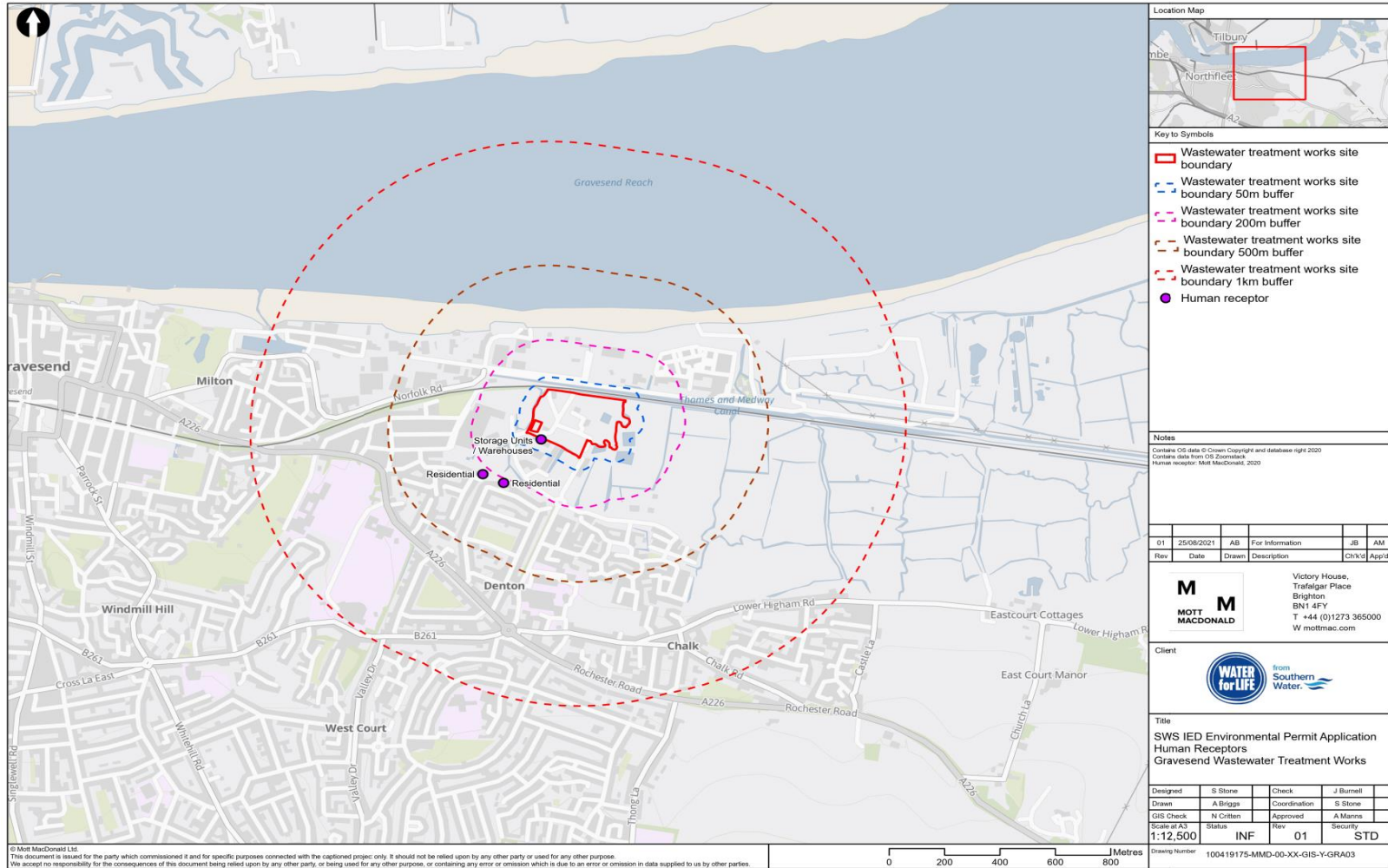
1.2.1 Key potential leak sources.

The most likely leak points within the zones include the following:

- double membrane roofs (air blower vent)
- roof and cover fixings
- pressure relief valves and vents
- feeding and digestate separation units
- gas pipework
- conveyors and presses
- combined heat and power plant (methane slippage)
- reception storage
- digestate storage
- biogas holder
- condensate pits and other sumps
- building containment
- Sludge Import Tanks.
- Sludge Storage tanks.
- Thickened Sludge Storage tanks.
- Digesters.
- Post Digestion Storage Tanks.
- Sludge Day Tank.

3 Local Sensitive Receptors

Sensitive receptors within 1km of the Site.



3.1 Summary of Receptors.

Within 50m

- Residential properties within the site access gates.
- Storage units and Warehouse adjacent to the site.

Within 250m

- Residential properties within the site access gates.
- Storage units and Warehouse adjacent to the site.
- Thames and Medway canal watercourse adjacent to the site boundary fence.
- Railway line adjacent to the site boundary fence.
- Business units and car show rooms adjacent to the site on the access roads.

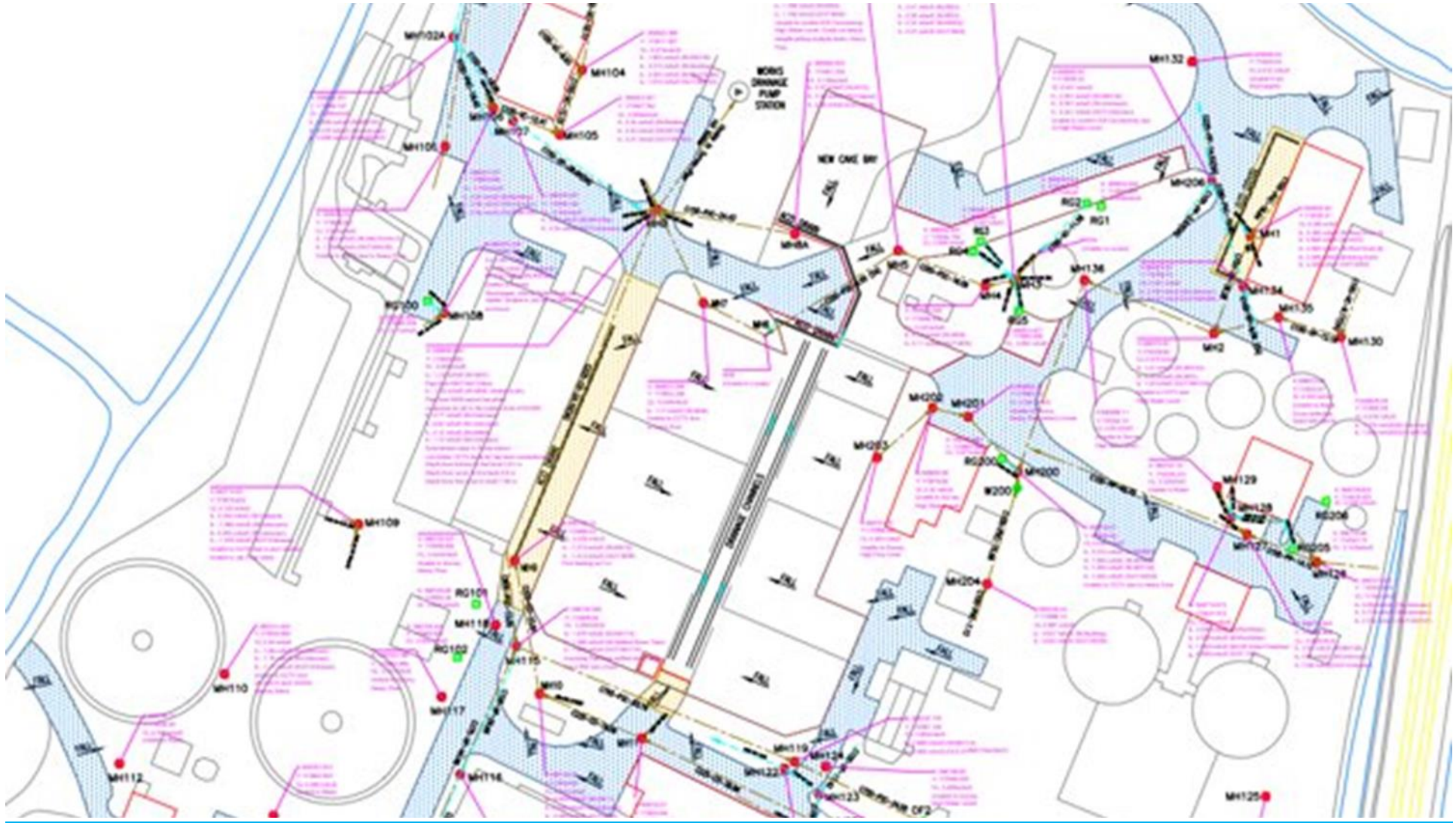
Within 500m

- Residential properties within the site access gates.
- Storage units and Warehouse adjacent to the site.
- Thames and Medway canal watercourse adjacent to the site boundary fence.
- Railway line adjacent to the site boundary fence.
- Business units and car show rooms adjacent to the site on the access roads.
- Gravesend reach beach within this 500m boundary line.
- Norfolk road.
- Residential properties fairly built-up Area.
- There is a School within this boundary Area.

Within 1000m

- Residential properties within the site access gates.
- Storage units and Warehouse adjacent to the site.
- Thames and Medway canal watercourse adjacent to the site boundary fence.
- Railway line adjacent to the site boundary fence.
- Business units and car show rooms adjacent to the site on the access roads.
- Gravesend reach beach within this 500m boundary line.
- Norfolk road.
- Residential properties fairly built-up Area.
- There is a School within this boundary Area.
- Residential properties at Chalk, Denton & Milton.
- A226 Rochester Road & other smaller roads in the built-up areas.

4 Site Drainage plan



5 Methods for locating emission sources.

The following activities are undertaken to identify potential emissions:

- Yearly Biogas maintenance & inspections are carried out by a Gas Safe Contractor, 6 monthly on Boilers, Flare stacks and Compressors.
- Trained operators carry out monthly Maintenance Scheduled Task (MSTs) on the Digester PVRVs (managed by a PTW)
- Trained operators completing regular site walks and sensory inspections.
- LDAR regular site surveys with faults documented and acted upon
- Identified leaks/ release points are tracked on site specific area maps. (On site Map)

Heading	Frequency	Method	Comments
Site – Specific Odour Management Plan (OMP)	Daily	Sniff Tests Risk Assessments if any unusual activities are likely to cause Odour	Operators to conduct daily ‘Sniff Test’ walks & react to any issues identified on these inspections.
On the Job Odour Training.	Onboarding and Annual Refresher	On the Job training with skilled operators and signed off by FPM	This is part of the Southern Water Training for new staff.
LDAR site surveys using Area maps for reference.	Daily	Carry out surveys in line with LDAR plan	Team records Surveys undertaken & logs identified issues in Site Diary. Remedial actions depend on the nature of the issue and in line with the LDAR guidance in this document.

5.1 Leak Detection & Monitoring Activities on site

All operational zones to be Checked Manually, Daily Visual Inspections.

During routine maintenance visual daily walkover surveys for pipework, tanks, ancillary plants (etc) is conducted to check for integrity, corrossions, spills, and leaks. The operator will also listen out for escape of gas from PVRV valves as part of this daily walkover. Any leaks from these valves are indicated by a hissing noise.

A 'Sniff Test' is also undertaken in accordance with the site's Odour Management Plans to further monitor fugitive emissions of potential sources of odour and bioaerosols. – During the Sniff test the operators will walk around the site observing if there are any odours or leaks present, the LDAR checks will be carried out during these tours of the site.

Gas Leak detection (methane gas analyser) is also installed on biogas holder/s to ensure any leaks from the inner bag are detected. Any leaks detected on the biogas system would always be fixed immediately by Southern Water due to the process safety risk posed by biogas.

All sludge treatment processes are covered or enclosed and odorous gases from tanks and treatment areas will be channelled to the odour control treatment units, therefore, the presence of odour from odour-controlled assets may indicate a leak. Where a leak is detected or suspected it is recorded in the Site Diary to be investigated.

The purpose of this section is to give clear guidance on the areas to be checked and what checks should be carried out, see map for details of areas.

5.2 Operator SOPs

The following Standard Operating Procedures are used to be proactive in reducing Leaks through completing regular checks.

These can be found on the Company Intranet [ProActive Maintenance Sharepoint area](#).

Process	Task No.	SOP Doc Name
Odour Control	PO0637	SOP_PO0637_STC_ODRCTL_COFIL
Chemical Dosing	PO0641	SOP_PO0641_STC_WATTRT_DGPMP
Sludge Thickening - GBTs	PO0642	SOP_PO0642_STC_THIKG_SLUTHK
Sludge Thickening - Picket Fence Thickeners	PO0643	SOP_PO0643_STC_THIKG_PFTHK
Sludge Thickening - Drum Thickeners	PO0644	SOP_PO0644_STC_THIKG_DRTHK
Poly Dosing System	PO0645	SOP_PO0645_STC_FLOCU_POLYE
Sludge Pumping	PO0648	SOP_PO0648_STC_PUMPG_SLPMP
Sludge screening	PO0668	SOP_PO0668_STC_SLURSC_CSCSC
Primary Digesters	PO0669	SOP_PO0669_STC_PRIMD_PDGST
Gas system	PO0670	SOP_PO0670_STC_GASHDL_CHPWR
Lime dosing plant	PO0671	SOP_PO0671_STC_SLGTRT_LIMES

Process	Task No.	SOP Doc Name
Centrifuge	PO0672	SOP_PO0672_STC_SLUDEW_CENFG
Cake Import	PO0675	SOP_PO0675_STC_RECAR_CAKRC
Cake Export	PO0662	SOP_PO0662_STC_CAKST_DISCH
STC Sludge Holding Tank	PO0679	SOP_PO0679_STC_THKND_TSTNK

An example of the typical content from an Action log is provided on the next page.

Site Zones	Leak/faults found	Actions Taken	Resource required
Zone 1 WTW	Example - Leaks on pipelines or tank spills	Contain leak. Close down process – isolate. Clean down area to process drain. Organise repair.	Clean-up crew. Asset Maintenance or Contractor to repair High level probe. If leak has not been contained follow 30 min pollution rule. Raise a pollution event.
Zone 2 STC Cake Sludge Import Area.	Example – Leak on delivery pipe or overflow of reception tank	Immediate action stop tanker discharge, contain leak. Inspect High level on tank if overflowing. Raise a task for High level probe. Raise a P1 job for repair. Raise a hazard.	Clean-up crew. Asset Maintenance or Contractor to repair High level probe. If leak has not been contained follow 30 min pollution rule. Raise a pollution event.
Zone 3 Digester Area Biogas Gas Bag Storage and CHP Area.	Example – Leak on digester	Contain leak. Shut down digester feeds – This is automated. Raise alarm and barrier area off. Raise an incident.	Process team to identify why the Digester is leaking and raise alarm. If leak has not been contained follow 30 min pollution rule. Raise a pollution event.
	Example – Leak on feed lines to sludge thickeners sludge release. aerosol from pipework	Contain leak. Close down Sludge feed system – isolate. Clean down area to process drain. Organise repair.	Asset Maintenance or Contractor to repair pipe or pump. If leak has not been contained follow 30 min pollution rule. Raise a pollution event.
	Example – PVRV valves chattering	Check systems - is CHP/ Flare working correctly.	Start Flare or organise for CHP repair or restart. Report release of Biogas as a pollution event.
Zone 4 Dewatering Area	Example – Leak on Post Digestion Storage Tank lines or Tank, Leak on lime storage tank or lines.	Contain leak. Close down PDST Sludge feed system – isolate leak if possible. Clean down area to process drain. Organise repair	Contain any leaks if safe do so. Assess Environmental impact. If leak has not been contained follow 30 min pollution rule. Raise a pollution event. Asset Maintenance or contractor to repair pipe, tank or pump.
	Example – Leak on wash water feed lines wash water release.	Contain leak. Close down Wash water system – isolate. Clean down area to process drain. Organise repair	Asset Maintenance or Contractor to repair Pipe or pump. Raise a pollution event.

6 Leak mitigation measures

6.1 EMS procedures

- The following Environmental Management System (EMS) operational procedures are in place to help manage the associated risks:
- EMS 260 Pollution Prevention - includes measures to identify and clearly mark underground services before demolition or construction work begins and the appropriate precautions taken to prevent damage to such structures.
- EMS 388 Waste permit breach and near miss reporting procedure – provides instructions on responding to permit breaches and actioning remediation. Condition 1.1 of a permit relates to compliance with an LDAR Plan.
- Gravesend STC has an OMP that requires an Environmental Risk assessment to be completed before any Anaerobic Digestion (AD) equipment is taken out of service for planned repair, the EA must also be notified if AD equipment is being taken offline.

6.2 Actions to be taken in the event a leak is found.

Once a leak is located site operatives will check whether a problem can be resolved immediately after completing a personal risk assessment, for example closing or tightening hatches, valves, or other loose connections.

Technicians can raise a job for maintenance or for issues that require further investigation and capital intervention. Smaller maintenance issues are solved in house and any major repairs are organised by a contractor e.g, pipe repair.

Any remedial work required on the site would be completed in accordance with water industry specifications.

Prioritisation for maintenance and repairs (and requirement for monitoring of fugitive emissions) is identified on a risk based LDAR programme of work.

Clean area after assessing the impact of any leak, check the Drainage plan to make sure any spills are contained appropriately to the right drains.

6.3 Prioritisation of repairs for leaks detected.

The high-risk assets are informed by the DSEAR and will be given priority for monitoring and repair as they pose the greatest risk of explosions, e.g., digesters and gas systems.

Level of risk decreases with estimated volumes and emission type:

- Assets containing post-digested sludge (e.g., reception storage) pose a risk of VOCs and bioaerosols.
- Post-digested sludge in digester storage, in cake silos etc have decreased levels of VOCs and bioaerosols.

- Methane slippage from combined heat and power plants are a lower risk with regard to sensitivity to receptors.
- Leaks from Sludge / Wash water lines and storage tanks will be managed by isolation of leaking lines, if possible, with containment of any released liquids and management of the contained liquids, the leak will then be assessed, and a pollution event raised as required.

Minor repairs and routine maintenance work are carried out continuously throughout the year during the working day, avoiding evenings and weekends, except in emergencies. Where possible, more major maintenance tasks are carried out in a planned manner according to priority and resources.

Odour and VOCs sensitive major maintenance tasks will be aimed to be undertaken during the winter period (between October and April), where appropriate. The emphasis in planning this maintenance is to minimise the time required to carry out the work, ensuring as far as possible, that odours and VOCs are contained or abated during the work and to deploy alternative odour suppression systems, if required.

Where a maintenance operation is likely to release quantities of odour likely to be detectable off-site, the relevant authorities and the Southern Water Regional Control Centre would be informed in advance.

6.4 Repairing or replacing components

Any repairs or replacement of Equipment will be conducted in line with the site-specific Odour Management Plan with a risk assessment for any work likely to cause an odour nuisance.

Please refer to the section Planning work activities to reduce the impact to Customers.

6.5 High Risk Asset inspections and repairs

For high-risk assets, such as pressure vessels, these are already covered by a formal inspection regime under "The Pressure System Safety Regulations 2000 written scheme of Examination.

Example – Low Temperature Hot Water Expansion vessel – Serial number – EV1:131A159528.

This work includes an annual inspection and working test, and a thorough exam that includes non-destructive testing of the pressure vessels. The working test and thorough examination are currently carried out in alternate years.

Following the identification of a leak that requires repairs the following mitigation measures are implemented whilst awaiting emergency gas maintenance contractors to carry out remedial works:

- Leak to be reported to the Environment Agency

- Sludge processing on-site is minimised and diverted to a controlled release point via the combined vacuum and pressure release valves on the Gas system and digesters.
- The leak source is surrounded with portable odour sprays as appropriate.
- Biogas is diverted to the CHP plant or gas burner.
- Environment Agency to be notified of the repair work, where appropriate or required by the OMP or permit.
- These works will be conducted in accordance with our site specific OMP including conducting risk assessment if required.

7 Maintenance and repair programme

7.1 Planned Maintenance Activities/ Sources of Information.

In order to mitigate any potential emissions to any receptors, it is important to routinely check the tightness of connections on flanges and valves, condition and security of mechanical components, fittings, and structures. If issues are found remedial actions are then raised for the Asset maintenance team or Gas Safe contractors if on Gas systems.

The Maintenance Task Manual includes a Maintenance Revision Form to allow for changes in procedure to ensure continuous improvement.

Procedures in the Maintenance Task Manual relating to processes and equipment posing a risk of fugitive emissions air include the LDAR plan consolidates existing measures, training and procedures undertaken by Southern Water regarding leak prevention, detection and repair including:

- You respond – 30-minute plan (response to pollution events)
- Site-specific Odour Management Plan
- Operation and Maintenance (O&M) Manuals
- Maintenance Task Manual – featuring procedures for inspecting for leaks, corrosion, damage as above for Tightness of connections etc.,

7.2 Proactive Maintenance tasks

Proactive Maintenance tasks can be found on the Company Intranet [ProActive Maintenance Sharepoint area](#).

The MSTs from these activities are recorded on a Southern Water Maintenance database.

- MF 0672 Biogas Glycol Pressure Relief Valve
- MF 0673 Boiler
- MF 0674 CHP
- MF 0676 Flare Stack
- MF 0677 Gas Audit- independent 'Gas Safe' registered consultants/contractors are required to undertake formal audits which include review of maintenance and remedial work.

- MF 0678 Gas Compressor/Booster
- MF 0679 Gas Condensate Receiver
- MF 0681 Gas Digester
- MF 0682 Gas Firewall/Heater
- MF 0683 Gas Flame Arrester/Filter
- MF 0684 Gas Holder (Membrane Type)
- MF 0686 Gas Pipework
- MF 0687 Gas Pressure/Vacuum Relief Valve
- MF 0688 Gas System Inspection
- MF 0689 Gas Valve
- MF 0890 Boiler – Biogas Dual Fuel (Interim Service)
- PO 0107 Biogas Pressure/Vacuum Relief Valve

7.3 Programme of work for monitoring and controlling emissions.

The LDAR plan consolidates existing measures and procedures undertaken by Southern Water regarding leak prevention, detection, and repair.

These can be found on the Company Intranet [ProActive Maintenance Sharepoint area](#).

Our inspection and maintenance activities are under ongoing review and the current work is looking to ensure alignment to BAT, including the following:

- Storage tank inspection including Digesters –testing and inspection of storage tanks to demonstrate integrity. Typically, through a combination of visual, hydrotesting and non-destructive testing (NDT) methods. Frequency is being revised to a condition-based basis by Asst Team and referenced standards updated to reflect best practice. Contractor support is required to complete the works required.
- Underground buried Pipe installation testing – Routine testing of buried pipe work by pressure testing lines, recording the test results and completing and identified remedial works Additional visual checks on walk arounds and LDAR checks of ground.
- All new builds on STC or AD sites will be designed to incorporate IED requirements like leak detection in design of tanks etc and above ground pipe work.
- Digester Pressure Relief valve release identification.
- Digester pressure relief valve release identification will be identified by Over Pressure alarms generated by the SCADA system.
- Warning pressure levels to be set to alert the operational team before an actual release event, so alarm set below actual release point to allow operations to investigate over pressure before events.
- Full Pressure release pressure alarms will be set to the actual pressure the relief valves are set to and will be reported and recorded as release events and records

kept on the SCADA system – these will be reported as Biogas releases via the pollution team.

- Daily Visual Checks - Operator walk around Visual Checks will be included in the daily Sniff Tests, Operators will record any leaks identified and react to the leaks by containing any spills, isolating equipment, stopping processes if possible and raising the alarm or incidents depending on the severity of the event, Operators will also report any pollution events.
- Digital thermal camera inspection for High level leak detection Aerosols (digesters and PDST's) – These will be completed by the Process team reporting any findings back to the operations team and raising jobs for any issues – For example pressure relief valve Aerosol releases identified on site checks.

7.4 Planning work activities to reduce the impact to customers.

Some of our activities can have a more significant impact on our customers, especially if they create significant odour/VOCs. These maintenance tasks will be aimed to be undertaken during the winter period (between October and April), where possible.

The emphasis in planning this maintenance is to minimise the time required to carry out the work, ensuring as far as possible, that odours and VOCs are contained or abated during the work and to deploy alternative odour suppression systems, if required.

Where a maintenance operation is likely to release quantities of odour likely to be detectable off-site, the relevant authorities and the Southern Water Regional Control Centre would be informed in advance.

The planning exercise also includes monitoring of weather forecasts to determine if appropriate conditions are anticipated to complete the required works.

7.5 Competent staff - Operator Pollution Training

The following training is provided in support of our LDAR objectives.

Courses can be found on the Intranet>WorkDay system (login required) or through the Southern Water Learning & Development Team (learning&development@southernwater.co.uk).

Training	Method
Pollution Training for All Operational Staff	Online training
You Respond – 30 min plan	Response to pollution events Online training tracker/ Plus on-site training
On the Job Pollution training	On the Job training with skilled operators and signed off by FPM

Training	Method
Clever Nelly process Knowledge training	E-mail-based question & answer
Operator Daily LDAR audit training	On the Job training carrying out LDAR audits & recording / reacting to findings.

The LDAR plan consolidates existing measures and procedures undertaken by Southern Water in regard to leak prevention, detection and repair including:

- You respond – 30-minute plan (response to pollution events), see Appendix A
- Operators sign-off at various levels from 1 - 3– Skill Progress Levels sign-off for pay rewards.
- Site-specific Odour Management Plan
- Weather data is used to plan activities that could emit odour by using the forecasting tool to avoid wind directions to customers when planning odorous maintenance activities.

8 Record keeping

Recording of LDAR related activities is through site-held records and electronic reporting. An example of the data collated is provided below.

Site name & catalogue number – Gravesend STC & WTW.	Completed/not completed	Comments / Issues found / corrective actions taken / Job number.
Date of LDAR	20/06/23	
Name of Person conducting daily inspections.	A. Operator	
LDAR Zone 1 – WTW	Yes	
LDAR Zone 2 – STC, Sludge treatment.	Yes	
LDAR Zone 3 – Digesters, Biogas system, Biogas Bag.	No	
LDAR Zone 4 – Centrifuge and Dewatering Area.	Yes	Leak detected on Centrifuge feed line, spill kit used to contain spill and centrifuge stopped and job raised for repair.
Areas not checked – For any reason explain why it was not checked – Unsafe/ F10 construction site etc.	Zone 3 Gas Safe work going on in an area stopping access etc.	
Items found that require attention	<i>Description of issue and record Job Number raised for repairs etc. Also include what containment, clean ups have been conducted.</i>	

	As above leak on centrifuge feed line, job raised for repair Job number is 123456.
Review Items found to learn from previous issues leak paths	<i>Look for common themes to identify next steps and share with the rest of the business and improvements made.</i>

Revision Tracking

Revision	Date	Author	Review	Approve
00	23.10.23	PG		
01	26.01.24	PG		