Technical Note

Leak detection and repair plan summary

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The generation of odour from the processing of sewage is primarily associated with the release of odorous Volatile Organic Compounds (VOCs) that are generated as a result 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.

In order 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 leak detection and repair (LDAR) plan will be in place for each of Southern Water's 16 sites with an Industrial Emissions Directive (IED) permit for biological treatment of waste, to comply with the Best Available Techniques (BAT) requirements.

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 following 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

The LDAR plan will be written in accordance with Environment Agency's 'Appropriate measures for the biological treatment of waste'[1]. Each applicable site will be covered by an overarching LDAR plan, with site-specific aspects appended to identify where processes, equipment or procedures may vary. 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

[1] Appropriate measures for the biological treatment of waste - consultation draft (publishing.service.gov.uk)

LDAR plan will form part of the existing Environmental Management System. For the majority of Southern Water's sites', the pipe network is mostly underground (although there are some exceptions). Leaks are 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 and includes (as a minimum and where applicable):

- 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

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
- Site-specific Odour Management Plan
- Operation and Maintenance (O&M) Manuals
- Maintenance Task Manual – featuring procedures for inspecting for leaks, corrosion, damage, tightness of connections and valves, condition and security of mechanical components, fittings and structures. Remedial actions are raised if need for further maintenance is required or faults are identified. 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 to air include:
  - 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
- Existing Environmental Management System operational procedures:
  - 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.

During routine maintenance visual daily walkover surveys for pipework, tanks, ancillary plants etc is conducted to check for integrity, corrosions and leaks. The operator will also listen out for escape of gas from whessoe 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 sites' Odour Management Plans to further monitor fugitive emissions of potential sources of odour and bioaerosols. 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 SW due to the process safety risk of 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. Whereby a leak is detected or suspected it is recorded in the Site Diary to be investigated.

Once a leak is located site operatives will check whether a problem can be resolved immediately, 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 possible capital intervention. Smaller maintenance issues are sorted in house and any major repairs are organised by a contractor eg pipe repair. Any remedial work required on the site would be completed in accordance with the 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:

- The high-risk assets are informed by the DSEAR and will be given first priority for monitoring and repair as they pose the greatest risk of explosions, e.g. digesters
- Level of risk decreases with estimated volumes and emission type:
  - Assets containing post-digested sludge (e.g. reception storage) pose a great 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

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.

For high-risk assets, such as pressure vessels, these are already covered by a formal inspection regime under the Pressure Regulations. 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 exam are currently carried out in alternate years.

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

- sludge processing on-site is minimised and diverted to a controlled release point via the combined vacuum and pressure release valve
- the leak source is surrounded with portable odour sprays as appropriate.
- biogas is diverted to the CHP plant or gas burner
- reported to the Environment Agency, where appropriate or required by the permit.