Industry template – OGI "leak/no-leak" method for quantification of small leaks and fugitive emissions

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1 Background and purpose

This document is an appendix to the *VOC emissions handbook*, which is Annex B to Offshore Norge Guideline 044. The document shall serve as the basis for any company-specific or installation-specific procedures and instructions for OGI/IR "leak/no-leak" measurements described in the VOC emissions handbook, Chapter 3.11.2 – Small gas leaks/fugitive emissions – sub-source 90.2.

The purpose of the industry template is to ensure that quantities of methane or nmVOC emissions from small leaks and fugitive emissions are measured/calculated and reported in a manner that ensures consistency over time and across operators, licences and facilities.

Leak detection using an IR camera forms the basis for calculating/quantifying small leaks and fugitive emissions using the OGI "leak/no-leak" method. IR cameras are also used for other purposes, for example leak detection as the basis for companies' LDAR work.

This industry template addresses how leak detection using an IR camera is used for quantification of small leaks and fugitive emissions of methane and nmVOC as the basis for emissions reporting. The industry template also addresses how the OGI leak/no-leak method should be understood and applied to ensure consistent reporting.

2 Definitions

Small leaks/fugitive emissions are the result of gradual loss of tightness in components containing hydrocarbons in gaseous or liquid state. Typical sources are piping and equipment components such as valves, pumps, nipples, couplings of any kind, instruments and hose connections. These may be grouped as valves, connectors and other components. They are reported as sub-source 90.2 in Chapter 3 of the VOC emissions handbook.

Major leaks are those leaks reported in Chapter 8 and sub-source 90.1 in Chapter 7 of the annual emissions report (the definition is provided in the VOC emissions handbook, Chapter 3.11.1).

Certain operating companies use other definitions and also distinguish between small leaks and fugitive emissions. In connection with annual emissions reporting, no distinction is made between fugitive emissions and small leaks. Only the definitions above apply in the context of this industry template.

3 Elements of the OGI "leak/no-leak" method

The OGI "leak/no-leak" method depends on the following elements:

1. An installation-specific overview of components with leak potential
2. Leak detection using an IR camera
3. Calculation of emissions using the OGI "leak/no-leak" method, hereinafter referred to as the OGI method

4 Component overview

Components in the OGI context are valves and connectors and, where relevant, other components that may leak methane and other HC gases (nmVOC).

Well over 99% of the components in a process plant are valves and connectors. For most equipment, leakage can only occur through packing glands and connectors (e.g. flange connections). Experience also shows that the contribution from components other than valves and connectors is negligible.

The OGI method calculates emissions based on the number of components, divided into the number of components from which the IR scanning detects leakage (leak), and the number of components from which the IR scanning does not detect leakage (no-leak). The number of leaking components is obtained from the IR scanning, while the number of non-leaking components equals the total number of components on the facility minus the number of components from which leakage has been detected. Experience indicates that only in the order of 0.1 percent of components leak.

For most facilities, the component overview is provided in the facility's QRA overview (Quantitative Risk Analysis). This overview should include piping systems down to ¼" tubing or smaller, as well as grease plugs. If the QRA overview does not include grease plugs and components in the smallest pipe dimensions, the number of components in the QRA list should be multiplied by two in order to arrive at the number of components that shall form the basis for calculating "no-leak" emissions using the OGI method. The component database is updated in accordance with updates to the QRA.

5 IR scanning of components in HC-containing systems

5.1 IR camera

There are a number of types of IR cameras. Types that may be approved for leak detection of HC gases must have high sensitivity and a documented detection limit for methane of less than 1 g/hour when measured on a test bench. The FLIR GF320 and OPGAL EyeCGas camera types meet these requirements. Detection limits depend on the type of gas and the composition of the gas. At least 70–80% of natural gas is normally methane. As long as methane is the dominant component, it will determine the detection limit.

To simplify field work, the cameras should be explosion-proof (NS-EN50014). OPGAL EyeCGas meets the requirements, and there should also be an explosion-proof version of the FLIR GF320.

The range may vary depending on camera type. The OPGAL EyeCGas camera can be equipped with a telephoto lens (enhanced version). In this version, sensitivity increases (lower detection limit) and gives the camera a range of more than 20 metres. This means that almost all areas on an offshore installation can be reached. If a camera other than those referred to above is used, the range should be checked and it should be verified that the camera is equipped with a telephoto lens.

5.2 Requirements for IR operators

Operators of the IR camera should have solid training and experience in leak detection using an IR camera. When using a third-party provider, solid relevant experience should be required. Relatively few companies offer this service and can provide experienced operators.

If in-house personnel are used, they should have solid training beforehand. Suppliers of IR cameras offer such training. Such training may also be purchased from companies that offer IR scanning.

Composition of the OGI/IR screening team

For example:

- Select one person who is competent in calibrating and using the IR camera.
- Select one person from operations, or someone with good knowledge of the process/equipment layout, who can also assess whether a possible leak can be repaired immediately, without any interruption to operations, or whether a shutdown is necessary. Repairs without interruption to operations may only be carried out where this is acceptable from a safety perspective, for example on depressurised systems only.

5.3 Preparations and planning

All hydrocarbon-containing systems should be scanned systematically, area by area and system by system. Care should be taken to include instrumentation arrangements around equipment and control/regulating valves, and grease nipples. Experience to date shows that a very large number of leaks are detected from grease plugs and from threaded connections in tubing and small-bore piping.

- Execution should be planned on the basis of the operating company's procedures and routines. The following checklist may used to assist planning.

Example checklist for OGI/IR screening of equipment

- Agree on the timing of the screening.
- Assemble the screening team.
- Sign out the camera and check that the necessary accessories are included.
- Check the battery charge or, if necessary, charge the camera and test it.
- Apply for and receive a work permit.
- Print and bring leak tags for marking leaking equipment, including a waterproof marker for recording information on the tag. Note the equipment number and area code.
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- A work plan is prepared in cooperation with the IR operator.
- The operator's requirements for local marking of findings are communicated to the IR operator/IR team. It is recommended that the field operator establish standardised labels.
- Requirements for registration of findings are communicated to the IR operator/IR team. It is recommended that the operating company establish a standardised registration system. One of the commercial IR operators has a practice of writing a short, concise report for each leak finding (less than one page for each finding). This includes a picture of the component with reference to the leak point and some practical information. This report is useful for the field operator when the leak is subsequently to be remedied.
- Area maps should be obtained for plotting findings. Findings should be registered with TAG numbers for accurate identification.
- A hot work permit is required when using an IR camera that is not approved as explosion-proof.
- Work may be carried out without a hot work permit if a certified explosion-proof camera is used (EX-certified). Note that some companies do not recognise certificates issued by the equipment manufacturer (self-certified equipment).
- Plan the order in which areas are checked according to the weather forecast:
    - Strong wind makes leak detection difficult and often causes small fugitive emissions to be missed. It is difficult to set an exact threshold for the wind strength at which OGI is no longer appropriate to carry out. Wind strength and direction, as well as the layout of the area, should be assessed when determining whether the conditions are

suitable for inspections. It is recommended to select areas that are sheltered and postpone wind-exposed areas until the wind conditions have calmed down.
    - Rain presents a challenge in several ways. OGI cameras are generally specified with a high degree of ingress protection, IP54 to IP65, and should therefore withstand rainy weather, but experience indicates that this is not always the case. Experience suggests that there is usually an area sheltered from wind or rain, and that an effective inspection can still be carried out if well planned.

5.4 Inspection/scanning with the IR camera and registration of findings

- Scan all HC-containing systems with the IR camera. The facility's area classification map may be a useful aid.
- Components should be scanned against a clear and uniform background where possible. It may be difficult to see leaks if the background is a thicket of instruments and pipes.
- Take care to include all instrumentation, including tubing, etc., around valves and equipment.
- For systems and components located far from access points, it is recommended to use the IR camera's telephoto lens if fitted.
- For insulated pipes and components, focus should be placed on insulation joints around valves and instruments. Leaks from insulated components may emerge intermittently from the insulation at intervals of several seconds.

Tip:

Focus the camera on the areas of the equipment where leaks are most likely to occur. Guidance may be provided using illustrations/photos of equipment indicating possible leak points. The cameras usually cover relatively large areas at some distance, but resolution, camera type, etc. must also be taken into account. Leaks beneath insulation are problematic. The leak may emerge anywhere without the actual leak point being identified. In some cases, insulation material must be removed in order to locate the leak point(s).

- When a leak is found, the leaking component is marked locally using the operator's standard label. The finding number and other relevant data, in accordance with the operating company's routines, are added to the label using a waterproof marker.
- Findings are registered in consultation with the area responsible person in accordance with the operator's applicable procedures. Established practice may vary both between field operators and between IR operators. Some relevant elements are listed below:
    - A video clip of the leak is saved.
    - One or more still images of the component are taken.
    - The location of the finding is tagged with a label marked "Fugitive leak/gas leak" and a reference number/serial number, or registered in accordance with the operator's routines.
    - A list is kept containing equipment tag, reference number, LEL measurement (Lower Explosive Limit), description/comment, as well as image/video and registration. This may suitably be done in a registration form/database adapted for this purpose.
    - All findings are plotted on an area map/plot plan.
- When a leak is found emerging from insulation, the area responsible person should assess and decide whether the insulation should be removed immediately to identify the leak point, or whether this should be done at a later time. Access to an IR camera should be an important part of this decision, as it may be both difficult and time-consuming for operating personnel to identify the exact leak point without a camera.

- When a leak is found, an LEL measurement is carried out. The LEL measurement is performed by the area responsible person. When measuring, the IR camera should always be used to ensure that the measurement is taken at the correct location in relation to the leak and wind conditions.
- Some findings may be of such a nature that they can be remedied on site. They shall nevertheless be registered. See the next section for further details.

5.5 Remediation

- Assess all leaks detected during the IR scanning with regard to remediation, based on the size and criticality of the leak.
- Some leaks are of such a nature that they can be remedied on site immediately after detection. In such cases, the finding is registered, and it is also recorded that the leak has been remedied. The component is IR-scanned again immediately after the remediation to confirm that the component is tight and that the leak has stopped.
- Leaks seldom disappear by themselves and should therefore not be checked out of the leak log unless this can be confirmed by IR scanning.
- Where leakage from a valve packing gland has been detected, attention should be paid to the fact that the packing gland may be damaged if tightened too hard. Tightening of the packing gland should therefore only be carried out by relevant specialist personnel in the area. The risk of damage from overtightening the packing gland must be assessed against the option of “living with” the leak.

5.6 Post-processing (proposal)

- After the IR scanning has been completed, the information may be entered into a spreadsheet, database or other register. It may be useful to establish a link to the still image and the video clip.
- It may be useful to edit the image by adding the leak point as shown in the image.
- A brief report may be prepared for each finding (< 1 page). This is applied to the still image and provides information useful in connection with rectifying the leak.
- A summary report from the IR scanning may be prepared, providing an overview of the number of findings and other information that the field operator considers useful.
- The detected leaks may be marked on the facility’s plot plans in accordance with the company’s routines.
- Leak findings may be registered in the operating company’s leak log and other registers in accordance with the company’s procedures.

6 Calculation of emissions using the OGI method

The method for quantifying small leaks and fugitive emissions using the OGI method is described in the VOC emissions handbook, Chapter 3.11.2.