



Safety & Risk Management Services

## Incident Investigation

Germanischer Lloyd – Service/Product Description



## Incident Investigation

**Service Title:** Safety Systems Management Services

**Lead Practice:** GL Safety and Risk (UK)

## Contents

**Page 3 Service Description and Values Generated**

**Page 4 - 5 Detailed Method Statement**

The detailed method statements explain how the work is conducted, which inputs are required and which outputs and results can be expected.

- a:** Collection of Evidence
- b:** Interpretation / Analysis
- c:** Results / Conclusions
- d:** Scope of Experience

**Pages 6 - 7 Case Studies and Examples**

- a:** Services to the UK Gas Industry
- b:** Transmission Pipeline Incident Investigation

## Service Description and Values Generated:

The failure of a component or piece of equipment can result in damage to the equipment and, in the oil and gas industry, result in a release of hydrocarbon fuel. This in turn can result in a fire or explosion.

It may be necessary to investigate such an incident to comply with statutory requirements or company policies and procedures. The investigation of an incident may also help improve safety standards and performance by identifying underlying causes, enabling designs or procedures to be changed, thereby preventing similar incidents occurring.

Germanischer Lloyd (GL) has over 25 years experience of undertaking on-site technical investigations into incidents and failures associated with transmission and distribution pipelines, storage and processing plant and offshore platforms. On-site investigations are supported by a range of sophisticated instrumentation within our laboratories, mathematical models to predict the consequences of incidents and metallurgical and engineering assessments to determine the causes of failures.

The service can include an immediate response to investigate incidents, production of reports to meet statutory requirements and provision of expert witness support if criminal or litigation proceedings result.



# DETAILED METHOD STATEMENT

In the event that an incident occurs, there is often a requirement to undertake an investigation into the source of the incident. The actual requirements of the investigation depend on the legislation and regulations where the incident occurred.

The investigation should be undertaken in a methodical manner to gain information on the cause of the incident.

A typical investigation would include the following steps:

## a. Collection of Evidence

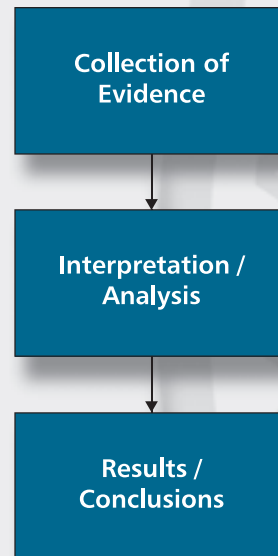
This would include some or all of the following:

- Site investigation. In order to undertake such investigations successfully, it is important for investigators to attend onsite as soon as practical in order to obtain forensic evidence before it is lost.
- Meeting/interview personnel on site at the time of the incident.
- Access to log of actions preceding and during the incident.
- Access to training records.
- Review of equipment involved in the incident including equipment specification, installation logs and maintenance schedules.
- On-site inspection or testing such as
  - testing the integrity of an item with NDT techniques
  - pressure testing an item
  - testing possible leak paths using SF6
  - measuring vibrations in pipework that could lead to failure due to fatigue

## b. Interpretation / Analysis

This should result in information on the cause of the incident and may include the following actions:

- Inspection and examination of equipment involved in the incident. This may involve off-site examination of key items using techniques such as:
  - metallurgic analysis
  - analysis of corrosion
  - material properties of items or equipment
- Analysis of human factors, actions and procedures from data and information collected.
- Practical simulations
- Mathematical modelling of the incident
- Analysis to determine the root cause of the incident.



## c. Results / Conclusions

The production of factual technical reports can meet the requirements of the relevant regulations. Other information or support that may be provided includes:

- Expert Witness support in cases that lead to prosecution, litigation or appearance in Coroners' Courts
- Lessons learnt which can help prevent other incidents occurring
- Information on failures in design or operating procedures

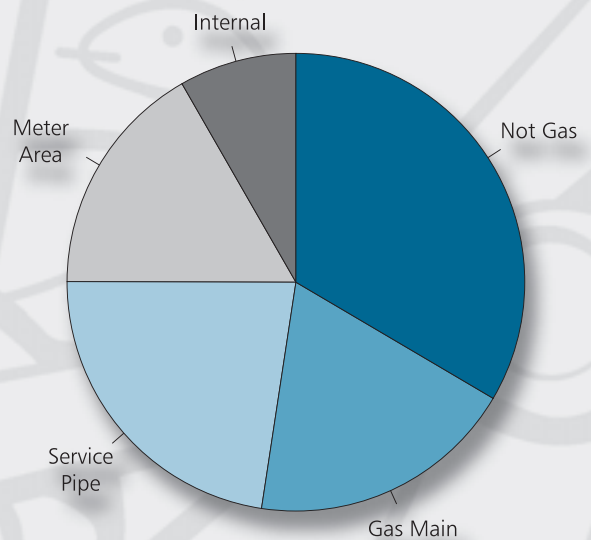
In order to undertake a thorough investigation it is important to have an experienced team of investigators including support personnel who can undertake off-site analysis if required.

## d. Scope of Experience

GL have been investigating incidents from the early 1970's. These have been predominantly for the UK gas industry although incidents have been investigated around the world for both the gas industry and other industries. A typical breakdown of the type of incident investigation shows that the majority of the incidents investigated have involved natural gas.

For incidents involving natural gas the majority investigated have been a fire or explosion in a domestic property in order to satisfy the UK Gas Safety (Management) Regulations. Other gas-related incidents investigated include:

- Offshore gas releases
- Transmission pipeline fire
- Gasholder failure (including terrorist attack)
- Component/equipment failures
- Fire/explosion in commercial premises



# CASE STUDIES

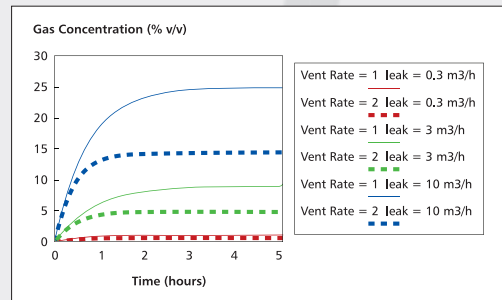
## a. Services to the UK Gas Industry

**Date:** Ongoing  
**Customer:** UK Gas Distribution Companies  
**Savings:** Regulatory compliance on incident investigation

In the UK when there is a release of gas that could have resulted in a fire or an explosion, there is a statutory duty under the UK Gas Safety (Management) Regulations to undertake an investigation to determine the source of the release and the reason for it. GL provides a rapid response 24/7 standby service in connection with gas-related fire and explosion incidents in the UK and are recognised experts in this important and challenging field. The service includes the attendance of experienced incident investigators to undertake forensic investigations onsite, subsequent laboratory analysis, and preparation of factual technical reports to meet regulatory requirements.

To support the onsite investigators GL have experts in the gas industry who can provide technical expertise to an incident investigation. Areas of expertise include:

- Fracture mechanics and material properties of pipes
- Gas tracking / movement through soils
- Gas build up
- Ignition
- Explosion physics (flame propagation, pressure generation)
- Fire chemistry / physics
- Metallurgy
- Response of structures to flame / pressure
- Corrosion mechanics
- Extensive laboratory and test site facilities.



## b. Transmission Pipeline Incident Investigation

**Date:** 2008  
**Customer:** South America Gas Transporter  
**Savings:** Identification of incident cause

A rupture of a natural gas transmission pipeline occurred in South America in 1998. The released gas ignited, resulting in the deaths of 9 workers. The incident resulted in widespread damage, with only one surviving witness. GL's role was to assist in reconstructing the events both before and after the failure occurred, with particular emphasis on the cause of ignition and the company's emergency procedures.

The investigation involved an initial trip to South America, to visit the scene of the incident and to interview the surviving witness and others, and to gather evidence from documents, photographs, etc held in various locations, including the client's offices and the premises of the emergency services. Mathematical modelling techniques were used to model the gas release behaviour, and a detailed assessment was undertaken to identify the most likely source of ignition. A local university undertook laboratory analysis of the failed pipeline, and their report was reviewed. Company procedures were also reviewed. On completion of the work, a second trip was made to South America to report on the findings.

The investigation enabled the sequence of events to be reconstructed, and the most likely cause of ignition to be identified.



## Safety & Risk Management Services

Safety Case and Compliance Consultancy

Hazard Identification Studies (HAZID)

Hazard Operability Studies (HAZOP)

SIL Studies (Safety Integrity Level)

Consequence Evaluation (Fire, Release, Explosion, Dispersion), Including CFD

EER Analysis (Escape, Evacuation, Rescue) (GL-Aeneas)

Quantitative Risk Analysis (QRA)

Decision Support (Risk Based Layout Studies)

Performance Standards

Large Scale Hazards Testing (Spadeadam)

- **Incident Investigation**

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