

GASOLINE PIPELINE – LEAK DETECTIONS SYSTEMS

GENERAL REVIEW

1. INTRODUCTION

At a meeting between HSE and UKOPA (Rod McConnell) pipeline leak detection systems (LDS) were discussed on the basis that HSE's methodology for pipeline spillage's ensures continual spillage growth over an extended period which is not considered realistic. Additional data may be very helpful for convincing HSE that these systems should be taken into account when assessing the duration and size of releases. The minutes of the meeting stated: -

HSE confirmed his view that unless LDS were mandatory, they were unable to take them into account, but that he would need to consult his field colleagues for details. HSE were very interested in what is in use and what pump shutoff and isolation facilities are available in the event of a leak. If UKOPA could provide some information it could be included in the Paper to Panel on gasoline risk assessment. HSE would require the following information: -

Details of UK gasoline pipeline systems?

Details leak detection systems on each system?

- How they operate,
- What size leak they can detect (what do suppliers claim?)
- What is actual experience?
- What checks, trials, tests are done?
- What is on-line time for the leak detection system?

Details of resulting actions on detecting a leak

- Where leak would be detected? – 24 hour manned?
- What are actions taken?
- How are pumps shutdown – remote or local? How long?
- Where are isolations?
- Are they field or remote?

2. CONCERNS

Leak Detection Systems are generally part of safety notices (that were) for major cross-country pipelines and considered by the industry as good practice. Shorter systems (distribution lines, jetty lines etc) may not be equipped with sophisticated system and if made mandatory it may not be economic to do so. HSE would either regulate based on mandatory requirements or the minimum standard.

What would HSE consider mandatory?

- Having a leak detection system?
- Having a leak detection system that will measure a minimum leak size?
- Having a leak location system?
- Having a leak detection system with a defined performance?
- Having enabled automatic shutdown?

The implications would need to be carefully considered in all applications before credit is requested.

3. DETAILS OF UK GASOLINE PIPELINE SYSTEMS?

The main multiproduct pipeline systems in the UK (based on mileage and throughput) are: -

- The Esso/Mainline system (Managed by Esso)
- UKOP (Managed by BPA)
- GPSS (Managed by OPA)
- Finaline (Managed by Total)
- Grangemouth – Finnart Pipeline (Managed by BP)

4. LEAK DETECTION SYSTEMS

4.1. Volume Balance

Some UK Pipeline system utilise a Volume Balance (VB) method of leak detection, generally these are bespoke systems built by the SCADA vendors. VB compares the volume of product ingressing the line with that egressing it.

Modified Volume Balance (MVB) is an enhanced version of the VB method whereby a dynamic bulk modulus is used to take into account the characteristics of different multi-products in line when calculating the pipeline inventory.

The volume comparison is carried out at a number of frequencies typically 30 seconds, 1 minute, 5 minutes, 1 hour, 4 hours and 24 hours, varying thresholds are put on each check to highlight different leak sizes, i.e. large for the smaller durations to small for the larger duration's.

The accuracy and therefore minimum detectable leak size is dependant on instrument accuracy and repeatability namely flow, pressure, temperature and pipeline length/diameter. The minimum detectable leak will reliably be around 1% of flow rate.

4.2. Statistical Models

Statistical analysis methodologies which correlate a number of parameters, including VB and MVB indices, over the long and short term and transients. With this type of system the fluctuations due to normal operation are filtered out leaving only those recognised as a leak, greatly reducing the number of false alarms. Minimum leak detected are claimed to be around 0.5% - 1.0% of flowrate.

4.3. Complex Theoretical Models

Real time models use theoretical correlations to model the hydraulics of the pipeline and highlight deviations from the model as a leak. Claimed performance similar to 4.2.

4.4. System Checks

Checks on the leak detection system are generally done on an ad hoc basis to check both the system performance and the operator's response. Calibration of the base instrumentation is generally done as part of planned maintenance. The availability of the computer-based system should be at least 99% on a par with the SCADA systems.

Periodic verification involving actual controlled releases of product is normally carried out as part of commissioning and ongoing maintenance.

4.5. Actions On Leak Alarm

Automatic shutdowns of the pipeline are feasible. However in general the approach is to provide the information to the pipeline operator to assess and determine whether it is a leak and to carryout the appropriate action which in most if not all occasions would be to shutdown the pipeline and isolate the sections to determine in which the leak has occurred / or is real.

It is equally likely that small leaks, within the detectable range of the leak detection system, would be picked up by manual line balance checks carried out hourly by most pipeline operators, regardless of leak detection system availability.

The pipeline systems in 3 above are 24hour manned and remote controlled. Remote isolations of field valves vary between systems.