Storage of petrol – Leak detection – Tank and pipeline testing

Petroleum (Consolidation) Regulations 2014 (PCR) – Dangerous Substances & Explosive Atmospheres Regulations 2002 (DSEAR) – Petrol filling stations

FOREWORD

This guidance supersedes and expands on all guidance given in previous PETELs on the subject, and forms part of a series of PETELs issued as part of the PELG-PETEL series from 2012 onwards by the Petroleum Enforcement Liaison Group (PELG), a health and safety advisory committee hosted by the Energy Institute. It comprises representatives of the Retail Petroleum Industry, the Petroleum Enforcing Authorities (PEAs), UKLPG and the Environment Agency, with technical support from the Health and Safety Executive.

PETELs are a mechanism for PELG to promulgate advice, guidance and good practice with the purpose of:

- facilitating appropriate and consistent enforcement by PEAs; and/or
- advising to duty-holders on how to comply with the law.

The guidance is directed at those with a responsibility for the safe operation of facilities where petrol is stored and dispensed into vehicle fuel tanks, to enable them to comply with the relevant health & safety legislation; in particular their statutory duties under the Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR). The guidance is not meant to be prescriptive and alternative methods of controlling the risks of fire and explosion may be followed where these provide an equivalent level of safety. However, if this guidance is followed, site operators will normally be able to demonstrate their compliance with the law.

Important disclaimer

This guidance has been produced and reviewed as described in the foreword.

The Energy Institute (EI) shall have no liability arising out of or in connection with this guidance or its use or application whether in contract, tort (including but not limited to negligence), breach of statutory duty, under statute, by reason of misrepresentation or otherwise.

INTRODUCTION

1. This circular provides advice on leak detection at petrol filling stations and supersedes any previous advice on tank and pipework testing and is in addition to the advice contained in:

- PELG publication ‘Petrol filling stations – Guidance on managing the risks of fire & explosions’ (Red Guide)
Storage of petrol – Leak detection – Tank and pipeline testing


BACKGROUND

2. Site operators have a legal duty to control the risks associated with the keeping of petrol; this duty includes taking appropriate control measures to prevent leaks from occurring or to identify and control them at an early stage before harm can occur.

3. Historically leak detection, imposed through the Licensing provisions, of the Petroleum (Consolidation) Act 1928 (now repealed') had been based on periodic tank and pipework testing together with the identification of stock losses or gains by in-house inventory checking (wet stock control). This traditional approach has not provided sufficient protection during the periods between tank and pipework tests, due to a reliance being placed on the next test (an interval of a number of years) confirming a system's integrity or otherwise to the detriment of carrying out proper inventory control. Additionally there were difficulties for operators (or their employees) to analyses or interpret the large amounts of data generated by the inventory checking procedures and therefore not be aware that they may have a leak. A significant number of leaks have only been identified after petrol or vapours, had been detected off-site, by the occupiers of neighbouring properties and after the danger has occurred.

4. Developments in tank and pipework design together with improved systems of leak detection which operate continuously are proving to be more effective at preventing leaks. When a suitable leak detection system is in place there will not be a need for periodic tank and pipework testing (see paragraph 7).

5. Whilst some leak detection or prevention systems monitor the product level in the tanks, others do not. In the latter cases site operators may still need to carry out wet stock control to determine ullage volumes prior to road tanker deliveries and to help identify dispenser meter calibration inaccuracies or other stock variances.

6. The method of wet stock control and the degree of sophistication required will vary depending on site-specific needs and on any other control measures already provided for leak prevention and detection (Blue Book). Leak detection systems based on wet stock control or product loss will only identify a leak after petrol has escaped from the containment system. It may therefore be necessary for such systems to be supplemented by other measures at
Storage of petrol – Leak detection – Tank and pipeline testing

sites where a leak of petrol would cause a high risk of injury to people or where the site is located in an environmentally sensitive area. For example it may be necessary to provide secondary containment. (NB. Environmental matters are not enforced by PEAs).

RECOGNISED LEAK DETECTION AND PREVENTION SYSTEMS

7. Where an appropriate leak detection or wet stock control system is in place and is properly operated and monitored there should be no need to carry out tank or pipework leak testing. Systems where tank and pipework leak testing are not considered necessary for existing sites are detailed in tables 11.2a and 11.2 of the Blue Book. The Blue Book also discusses the classes for leak detection systems, which are derived from a European standard, and advises on the selection of appropriate systems for different types of sites. The classification of systems into classes is based on their capability and effectiveness. Generally the higher classes (with class 1 as the highest) have better leak detection capabilities and are more effective at reducing the amount of product lost.

8. The arrangements for leak prevention or detection, which may consist of a combination of different systems or methods, should provide effective control for the entire underground petrol containment facility including the tanks, suction or pressure lines, offset fill lines.

9. Typical examples of leak detection and prevention systems:

(a) For tanks:

- Double skin tanks with interstitial monitoring (Classes 1, 2 & 3).
- Dynamic leak detection based on certified contents measuring and analysing systems (Class 4a).
- Static leak detection systems (Class 4b).
- Monitoring wells with vapour or product sensors (Class 5).
- Statistical Inventory Reconciliation (SIR) (Class 6, 6a, 6b and 6c).

(b) For product pipework:

- Double skin pipework with interstitial monitoring (Classes 1, 2 & 3).
- Dynamic leak detection based on certified contents measuring and analysing systems (Class 4a). Note: These will not detect leaks in offset fill pipework.
- Monitoring wells with vapour or product sensors (Class 5).
- SIR (Class 6).
Storage of petrol – Leak detection – Tank and pipeline testing

- Pressure decay monitoring device. Note: These are only suitable for pressure lines.

(c) For vapour pipework:
- Double skin lines with interstitial monitoring (Classes 1, 2 & 3).
- Monitoring wells with vapour sensors (Class 5). Note: These are only effective for below ground pipework.

10. SIR, dynamic and static leak detection systems will only monitor losses from the wetted areas of the storage system. This is considered acceptable because of the ability of these systems to provide continuous and reliable leak monitoring at all operational levels within the tank. They are also able to detect gains in the tank contents which can indicate water ingress and a leak above (or below) the liquid level.

STATISTICAL INVENTORY RECONCILIATION (SIR)

11. SIR systems establish acceptable stock reconciliation profiles by statistical analysis of the daily losses and gains for each tank. As well as considering daily stock variances, SIR systems also consider the cumulative variances as a percentage of the cumulative sales in order to identify trends and any anomalies. They can be operated by independent third parties or by in-house personnel. **It is important, however, that the system chosen has a level of accuracy and reliability in detecting leaks that is commensurate with the risks identified at the site.** Systems operated by third parties can be particularly effective at identifying and resolving both actual leaks and apparent leaks caused, for example, by inaccurate meter pumps or fraud. Although they meet the criteria for a Class 6 leak detection system, third party operated systems may be able to perform to the same standards as Class 4 systems. They may also be evaluated by accredited test houses.

12. Site operators may use their own SIR system using traditional stock measurement systems including dipsticks. They may, however, experience difficulties in handling the data and in establishing acceptable stock reconciliation profiles. Unless site operators can demonstrate that their system is capable of reliably analysing the data and that their wet stock reconciliation profiles have been developed from the knowledge of a leak tight system then the SIR system should not be accepted as a Class 6 system. More detailed information on SIR can be found in the Red Guide (Appendix 1)
Storage of petrol – Leak detection – Tank and pipeline testing

CONTINUOUS INVENTORY MONITORING

13. Continuous inventory monitoring based on daily stock measurements to determine actual losses or gains may be an acceptable method of leak detection at low risk sites. Low risk sites in this context are sites where because of their location the on and off-site risks to people’s safety from leaking petrol are assessed to be low and where limited stock movement ensures that simple inventory monitoring will quickly identify any leaks. Such sites will normally have the tanks and pipework located at least 30 metres from residential accommodation, basements, cellars or underground tunnels and have a throughput of petrol of less than about 1,000,000 litres per year. In operating these systems site operators will need to establish acceptable variance profiles for each tank and be able to demonstrate that the system is a suitable and adequate measure to control the risk. Unless there are obvious reasons for any deviation from the established profile, site operators should take the necessary steps to check for leaking tanks or pipework.

ROLE OF TANK AND PIPEWORK TESTING

14. Tank and pipework testing still has an important role to play in the operation of petrol filling stations. Tank and pipework tests will be required:

(a) At new or redeveloped sites:
   • Prior to commissioning a storage tank that does not have an inbuilt leak prevention or detection system. This will normally be carried out by the manufacturer.
   • When damage has occurred or is suspected during the transportation or installation of a single or double skin tank.
   • Prior to commissioning pipework including connections to the tank.

(b) At existing sites:
   • After repairs or modifications to the petrol containment system.
   • When developing an in-house reconciliation system in order to confirm the integrity of the equipment and to determine loss profiles.
   • When either the wet stock reconciliation system or other factors give rise to suspicion of a leak from the petrol tanks or pipework.
   • Prior to bringing back into use a tank or product containment system that has been out of operation for more than 12 months.
   • When there is no recognised leak prevention or detection system in place or the system is unreliable, not working or not properly maintained. Normally the leak prevention or detection system should satisfy the criteria detailed in chapter 11 of the Blue Book.
Storage of petrol – Leak detection – Tank and pipeline testing

- For periodic integrity testing of the vapour pipework and when applicable, off-set fill pipework, where it is not adequately protected by the site leak detection system, as a minimum, once in every five years.
- When the risk assessment shows a specific need for tank and pipework testing.

ENFORCEMENT APPROACH

16. Petroleum Enforcing Authorities are advised:

- To ensure that petrol filling stations incorporate leak prevention or detection systems including SIR or continuous inventory monitoring that are appropriate to the on-site and off-site safety risks that could arise from undetected leaks of petrol.
- To ensure that leak prevention and detection systems are being properly maintained and operated.
- To ensure that where SIR systems are used to detect leaks that the data is presented in a form that readily shows the daily cumulative losses as a percentage of the sales for each tank. Additionally they are advised to question the basis of trigger levels that could indicate stock variances that need investigation.
- To ensure that where continuous inventory monitoring is used to detect leaks that a daily record is maintained in a form which clearly shows all gains or losses for each tank and associated pipework. Additionally they are advised to check that the operator has established 'acceptable variance profiles' to compare gains or losses which would need investigation.
- Not to seek tank or pipework testing, when the leak detection system adequately controls the risks from leaking petrol. Any need for tank or pipework testing to complement the leak detection system should arise from a specific risk assessment for that site and be agreed with the site operator.
- To consider the need for tank or pipework tests to confirm the tank or pipework integrity (or otherwise) when the site operator is unable to demonstrate that an effective leak detection system is in place and is being operated properly. In such cases testing is an interim measure to ensure the integrity of the product containment system and is **not** an alternative to the site operator's legal duty to prevent and identify leaks.
- To seek appropriate leak testing of the tanks or pipework when any of the circumstances described in paragraph 14 arise.
Storage of petrol – Leak detection – Tank and pipeline testing

REFERENCES

https://www.energyinst.org/pelg