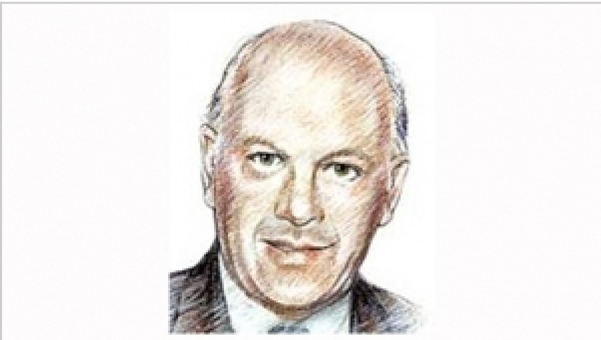
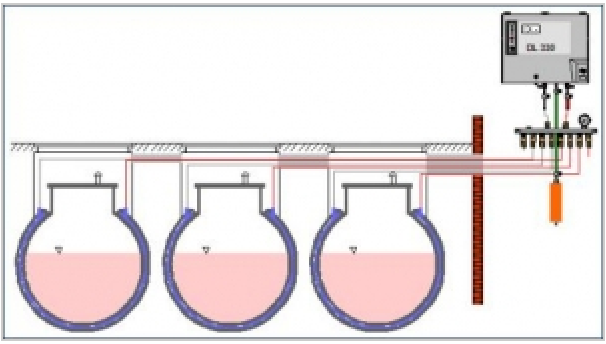
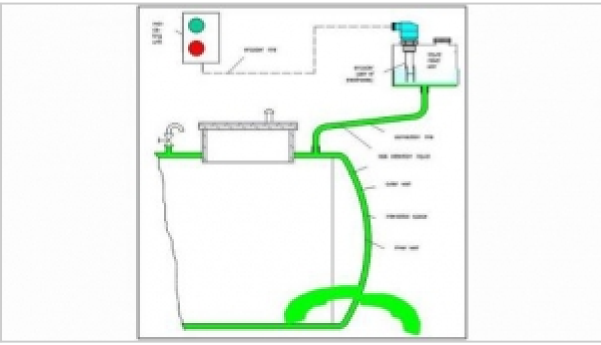
Choosing the Correct Leak Detection for Tanks

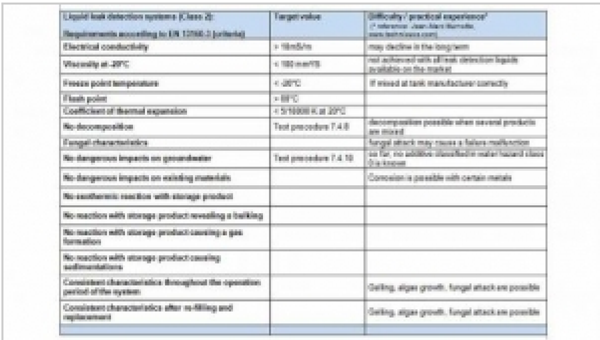
Note: Please click on the images in the gallery to enlarge them.

In more recent years the oil industry has developed a far more responsible attitude to the design and operation of petrol stations than when I was a young regulator in London during the mid 1960's. Safety and environmental responsibility are now an essential requirement for those involved in the construction and maintenance of a filling station. One of major contributors to safety and environmental security in this field has been the use of leak detection devices as an important tool for the designer.

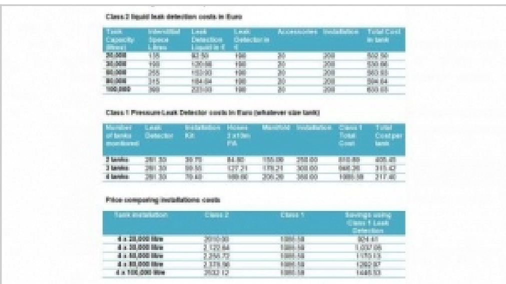


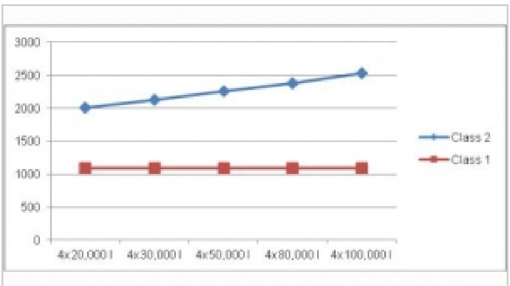


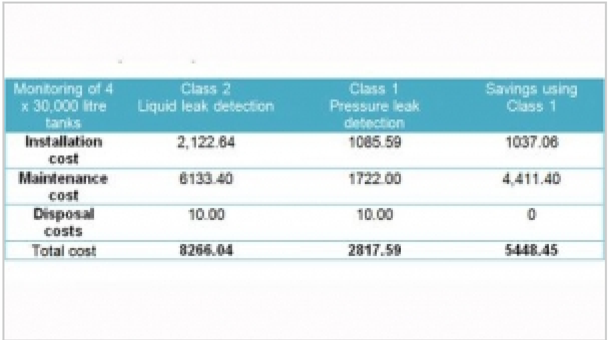




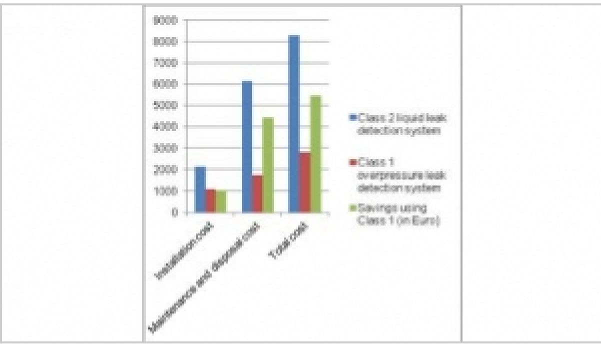
Liquid leak detection systems (Class 2) Requirements according to EN 13160-3 (criteria)	Target value	Difficulty / practical experience
Electrical conductivity	> 10mS/m	may decline in the long term
Viscosity at -20°C	< 100 mm²/S	not achieved with all leak detection liquids available on the market
Freeze point temperature	< -20°C	If mixed at tank manufacturer correctly
Flash point	> 60°C	
Coefficient of thermal expansion	< 5/10000 K at 20°C	
No decomposition	Test procedure 7.4.8	decomposition possible when several products are mixed
Fungal characteristics		fungal attack may cause a failure malfunction
No dangerous impacts on groundwater	Test procedure 7.4.10	so far, no additive classified in water hazard class 0 is known
No dangerous impacts on existing materials		Corrosion is possible with certain metals
No exothermic reaction with storage product		
No reaction with storage product revealing a bulking		
No reaction with storage product causing a gas formation		
No reaction with storage product causing sedimentations		
Consistent characteristics throughout the operation period of the system		Gelling, algae growth, fungal attack are possible
Consistent characteristics after re-filling and replacement		Gelling, algae growth, fungal attack are possible

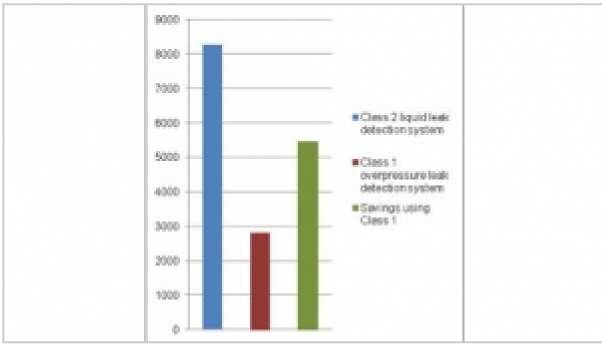






Monitoring of 4 x 30,000 litre tanks	Class 2 Liquid leak detection	Class 1 Pressure leak detection	Savings using Class 1
Installation cost	2,122.64	1085.59	1037.06
Maintenance cost	6133.40	1722.00	4,411.40
Disposal costs	10.00	10.00	0
Total cost	**8266.04**	**2817.59**	**5448.45**





Introduction

The leak detection standards (EN 13160 1-7) were first developed as a common European standard over 10 years ago. The standards have been welcomed by regulators, manufacturers and users alike, and I notice these have even been acknowledged by many practitioners around the world as an excellent standard to follow.

That said after 10 years the industry are now moving on and the standards are at present being revised and it has become apparent to me that for underground storage tanks the more enlightened user is progressing towards the more trustworthy and dependable Class 1 detector which is either pressure or vacuum dependant and away from the more traditional Class 2 liquid system which had historically been used on underground tanks across Europe for many years – but has some disadvantages.

There are technical, environmental and economic implications in choosing and operating a Class 1 leak detection system and I will examine some of these.

The only leak detectors that are now permitted under tougher environmental legislation in several European countries including Germany, Austria, Switzerland, Italy, Belgium, parts of the UK (on a risk based approach) is the Class 1 system.

In addition I notice that BP, Shell and other leading operators are specifying Class 1 as they continue to take their safety and environmental responsibilities seriously.

Let us examine the two systems Class 1 and Class 2.

Leak Detection Systems

Class 1

[see image 2]

These systems operate either using air or nitrogen pressure or by pulling a vacuum on the interstitial space. They detect a leak above or below the liquid level of a double wall system – in fact keeping the tank under a “test pressure” all of its working life.

Once a leak is detected fuel can be removed from the tank before any product enters the environment.

Class 2

[see image 3]

These systems operate using a liquid filled interstitial space and are based on the pressure generated by the height of the header tank over the storage tank generating enough pressure to detect a leak leading to a drop of liquid in the header tank signaling a leak in either wall of the tank.

Once one wall of the tank is breached liquid will either flow into the tank and contaminates the product or into the ground – in both situations contamination cannot be prevented. The liquid used in the interstice is based on “environmentally friendly” antifreeze but as standards and knowledge improve over the years the leak detection liquid is now considered by many to contaminate groundwater and drinking water.

In addition some of the liquids have been found in use over many years to develop fungal attack, algae growth and gelling therefore preventing the liquid from doing its job and detecting a leak.

Technical System Comparison

[see image 4]

EN 13160-3 Requirements for liquid leak detection systems

Cost Comparisons

The cost comparisons of using such systems are not an area in my expertise but by contacting underground tank manufacturers, leak detection suppliers and maintenance contractors I have been presented with some interesting figures which I will share with you on the costs of owning and maintaining leak detection systems.

[see images 5, 6 and 7: You will see from these figures that the larger the tank (and its interstitial space) the more cost effective it is to use the Class 1 system. The savings on the cost of the liquid increases as the tank size increases. There is also the cost of putting the liquid into the tank during the construction process. See the next graph which illustrates this point.]

Maintenance costs comparisons between Class 1 and Class 2

[see images 8 and 9]

Assumptions

- Petrol Station Forecourt with 4 tanks 30,000 litres capacity
- 20 years of operation
- Development costs not considered
- All prices in Euros
- Hourly labour charge assumed € 80
- Travelling expenses not included

Total cost of ownership over 20 years

[see images 10, 11 and 12

Summary

As a conclusion, it can be clearly demonstrate that the Class 1 leak detection system shows a system with inherent environmental and safety-related advantages on a Class 2 system.

The Class 1 system demonstrates that the operator is responsible and meets all the safety and environmental requirements expected of them by safety and environmental regulators.

In addition from the figures I have been shown it also has economic advantages for those operating service stations over Class 2 systems.

A. Environmental advantages of Class 1 pressure leak detection system:

- A real “leak prevention system”, still environmentally very safe even when a leak is found
- It keeps the tank under “test” the whole of its working life
- If there is a leak there is no contamination of stored product
- If there is a leak there is no risk of contamination of the environment

B. Technical advantages of Class 1 pressure leak detection system:

- Several underground tanks may be monitored using only one leak detector

- There are no risks in the Class 1 system such as algae growth, gelling and crystalline dispersion, that may be present in Class 2 systems
- There is no possible reaction of the leak detection medium (air) with the storage product and if required, nitrogen can replace air as the leak detection medium
- Function test without access to the underground tank manhole chamber are also possible

C. Economic advantages of Class 1 pressure leak detection system

- Considerable advantages in installation cost in all typical applications, depending on number and capacity of tanks
- Considerable time and cost reduction at the annual maintenance
- Average cost savings per station of around two-thirds, that is according to the example more than 5,500 Euros

Jamie Thompson joined the London County Council in 1961 and trained as a Petroleum Inspector and ended up as Principal Petroleum Inspector for the London Fire Brigade the largest petroleum authority in Europe. He has specialised in petroleum standards, construction, legal enforcement, equipment approval and new design of Petrol Filling Stations for well over 40 years. He is currently chairman of European Standards committee (CEN TC 393) dealing with equipment for service stations, which has produced 23 European standards relating to filling stations. He also chairs CEN TC 265 WG8 on underground and above ground storage tanks, and sits as a European contributor to the Underwriter Laboratory standards for fuel tanks and fuel lines in the USA. He was Editor of the APEA Technical Journal “The Bulletin” for 23 years and as Chairman of the technical committee of the APEA he is involved in the publication of the APEA/EI Guidance on design and construction of filling stations known as the Blue Book.