



European cross-country oil pipelines

Monitoring the safety and environmental performance of Europe's oil pipelines

Introduction

The Concawe Oil Pipelines Management Group (OPMG) has collected data on the safety and environmental performance of oil pipelines in Europe since 1971. Information on annual throughput and traffic, spillage incidents and in-line inspection activities are gathered yearly by Concawe via on-line questionnaires. The results are analysed and published annually to show the yearly performance and also a full historical analysis since 1971, effectively creating an evergreen document updated every year. The following article provides an introduction to the content of the latest 2015 report, which can be downloaded from the Concawe website at www.concawe.be.

Concawe pipeline inventory

To date, Concawe has collected 45 years of spillage data on European cross-country oil pipelines. At nearly 37,500 km, the current inventory includes the majority of such pipelines in Europe, transporting some 751 million m³ per year of crude oil and oil products. The 63 companies that reported in 2015 operate 141 pipeline systems split into 647 active sections running along a total of 33,903 km as well as 26 sections covering 2068 km which are currently (but not permanently) out of service.

When the Concawe survey was first performed in 1971, the pipeline system was comparatively new, with some 70% being 10 years old or less. Although the age distribution was quite wide, the oldest pipelines were in the 26–30 year age bracket and represented only a tiny fraction of the inventory. Over the years, a number of new pipelines have been commissioned, while older ones have been taken out of service. Although some short sections may have been renewed, there has been no large-scale replacement of existing lines. In 2015 4.6% of the total inventory was 10 years old or less, while 22,947 km (63.8%) was more than 40 years old. The 2015 age profile is shown in Figure 1.

The Concawe inventory data is a valuable resource for pipeline operators because it allows them to monitor trends in the causes of spill incidents and undertake remedial action at an early stage. In particular, it is important to identify any issues that are related to the age of the pipelines.

Historical analysis of spillages 1971–2015

Over the 45-year survey period, 489 spills have been caused by factors other than product theft, and the frequency of such spills has progressively decreased. In the past five years, however, the rate of incidence of product theft has increased considerably, leading to spills that are related to external factors rather than the condition of the pipeline infrastructure.

Several step changes in the inventory surveyed by Concawe over the years make the absolute spillage numbers difficult to interpret. The spillage frequency (number of spills per 1000 km pipeline, per year) is therefore a more meaningful metric. Excluding theft related spills, the 5-year moving average spillage frequency has reduced from around 1.1 in the mid 1970s to 0.17 in 2015 (Figure 2). When theft is included, however, the 2015 spillage frequency increases to 0.95.

Figure 3 shows the rapidly increasing trend in spillage incidents related to product theft from 2010 to 2015, and the importance of coordination between law enforcement agencies and pipeline operators to address this growing challenge. Since 1971, 186

Figure 1 European oil pipeline age distribution in 2015

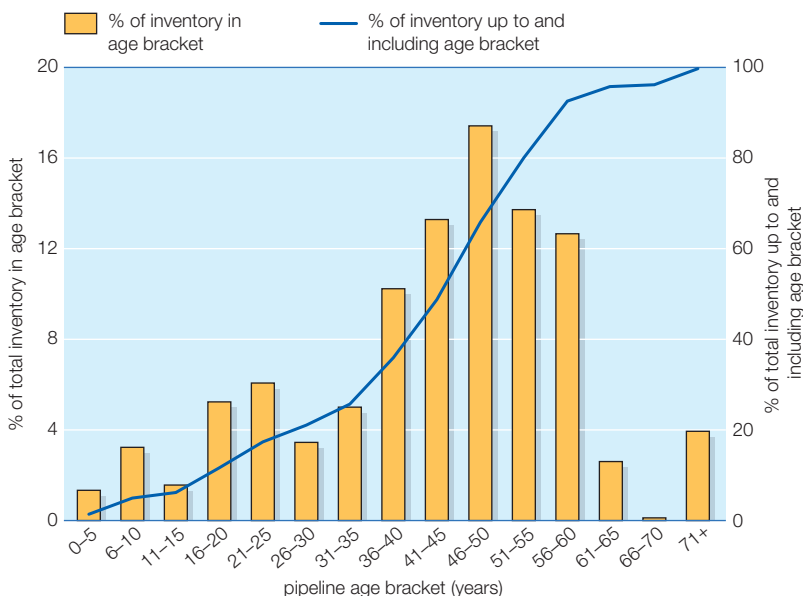




Figure 2 45-year trend in spillage frequency (all pipelines, excluding theft)

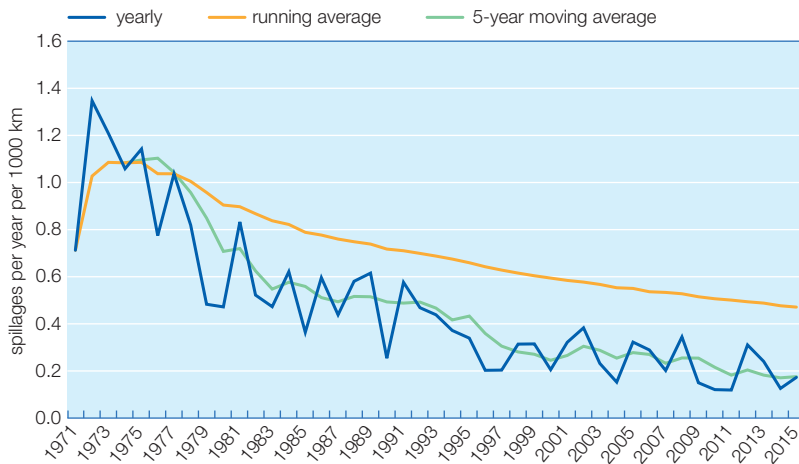


Figure 3 Evolution of the number of theft-related incidents since 2010

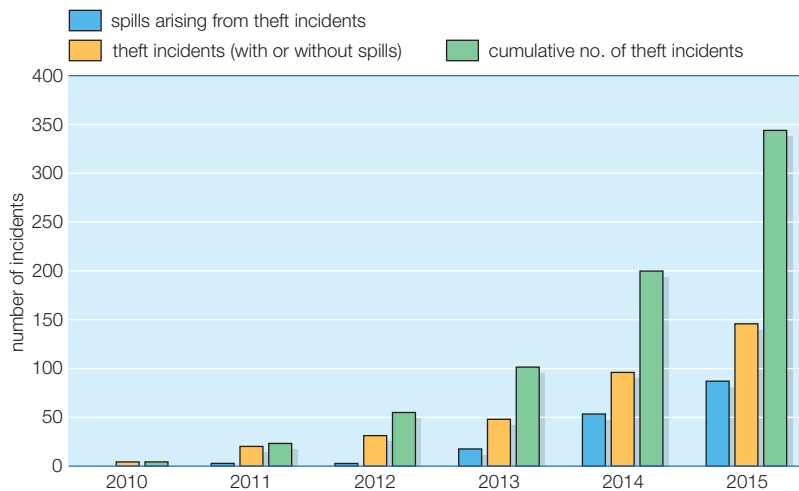
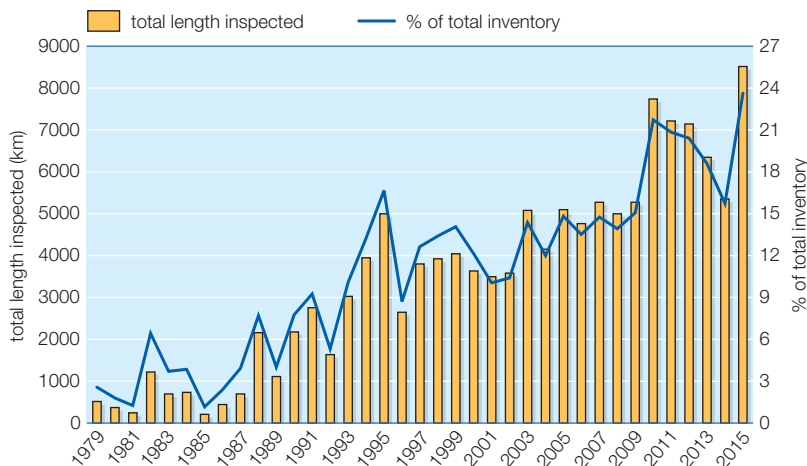


Figure 4 Total annual portion of the inventory inspected by inspection pigs



spillages have been caused by intentional damage by third parties, with 2 resulting from terrorist activities and 6 from vandalism. The remaining 178 were caused by attempted or successful product theft, and 158 of these were reported in the past three reporting years.

In-line inspection

The Concawe survey also collects summary data on in-line inspection activities undertaken by pipeline operators to detect any weaknesses in pipeline sections. Separate records are kept for metal loss, crack detection and for geometry (calliper) inspections. In 2015 the 63 companies who reported inspected a total of 93 sections with at least one type of inspection pig, covering a total combined length of 15,394 km. Most inspection programmes involved the running of more than one type of pig in the same section so that the total actual length inspected was less at 8,487 km (24% of the inventory).

As shown in Figure 4 the use of inspection pigs for internal inspection of pipelines grew steadily up to the mid-1990s, stabilising around 12% of the inventory every year. This further increased to around 15% in the first decade of the new millennium and reached 20% in the early years of the current decade. Following a short-term decline from 2010 to 2014, 2015 shows the highest figure ever recorded, resuming the long-term upward trend.

Summary

Analysis of 2012 to 2015 spill incident data shows that while the number of spill incidents due to product theft has greatly increased, the number of spillages associated with all other causes is continuing to decrease. In 2015, 6 reported spillages were due to causes other than product theft, corresponding to 0.17 spillages per 1000 km of pipeline. This is equal to the 5-year average and below the long-term running average of 0.47, which has been steadily decreasing over the years from a value of 1.1 in the mid 1970s. There were no reported fires, fatalities or injuries connected with these spills. In addition, 87 spillages were related to product theft attempts, which is a huge increase compared to the already high figure of 54 reported in 2014. Theft



attempts caused a total of 28 spillage incidents between 1971 and 2012, and as many as 159 in the last 3 reporting years.

The annual Concawe survey was updated in 2016 to allow the collection of data on all theft incidents (irrespective of whether a spill took place). The first set of data from the new survey shows that a variety of connection techniques were used by the thieves and that in 10% of cases the pipeline was not breached. Automatic leak detection systems were able to detect 35% of the attempts, even though the abstraction flow rates were consistently under $1 \text{ m}^3/\text{h}$ (suggesting that the thieves have an understanding of the operator's detection capabilities). Most connections were located in open countryside, with the collection point being close to the pipeline, although in 4% of cases the distance was in excess of 1 km. Storage facilities were reported in 20% of cases, however in only 12% of cases was this greater than 1 m^3 .

Overall, based on the Concawe incident database and reports, there is little evidence that the ageing of the European pipeline system implies a greater risk of spillage. Analysis of 2012 to 2015 spill incident data shows that while the number of spill incidents due to product theft has increased, the number of spills associated with all other causes is continuing to decrease. The development and use of new techniques, such as internal inspection with inspection pigs, hold out the prospect that pipelines can continue reliable operations for the foreseeable future. Concawe pipeline statistics, in particular those covering the mechanical and corrosion incidents, will continue to be used to monitor performance.