performance of european cross-country oil pipelines

statistical summary of reported spillages – 2002

Prepared by the CONCAWE Oil Pipelines Management Group's Special Task Force on oil pipeline spillages (OP/STF-1)

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ABSTRACT

This annual report covers the performance with regards to hydrocarbon spillage of 35,592 km of on-shore oil pipelines in Europe in 2002. Incidents are analysed by cause and the effectiveness of the clean up is recorded. Direct repair and clean-up costs are reported. The inventory of European oil pipelines covered by this annual report is essentially the same as for the 2001 exercise. Performance in 2002 was marginally better than the long-term average. Third party activities remain one of the main causes of spillage incidents, although this year, corrosion caused a slightly larger number of incidents. The report also gives the annual intelligence pig inspection statistics.

KEYWORDS

Clean-up, CONCAWE, intelligence pig, oil spill, pipeline, soil pollution, spillage, statistics, water pollution

INTERNET

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SUMMARY

Nearly seventy companies and other bodies operating oil pipelines in Europe currently provide statistics for the CONCAWE annual report on the performance of cross-country oil pipelines.

These organisations operate some 250 different service pipelines, which, at the end of 2002, had a combined length of 35,592 km, very similar to that for 2001. Volume transported in 2002 was 724 Mm^3 of crude oil and refined products, which is 2.3% higher than in 2001. Total traffic volume in 2002 amounted to 125 x 10^9 m^3 x km, 4.6% down on 2001.

There were 14 reported oil spillages from pipelines during 2002 (12.6 per year on average since 1971). There were no associated fires or injuries. The gross spillage was 2185 m^3, equivalent to 3.0 parts per million (ppm) of the total volume transported. A total of 1867 m^3, i.e. 85% of the spillage was recovered or safely disposed of. The net oil loss into the environment amounted therefore to 318 m^3, or 0.4 ppm.

The causes of the oil spillages are attributed to:

- Mechanical failure 1 incident
- Operational 0 incidents
- Corrosion 6 incidents
- Natural hazard 1 incident
- Third party activity 6 incidents

This report also provides comparative data for the five-year period 1998 to 2002 and a comparison of the 2002 performance versus the annual average of all reported incidents since 1971. The 2002 performance was slightly worse than average with slightly more than the long-term average number of spillages (14 versus 12.6). However, the system length is now much longer than in earlier years. The gross and net spillage volumes per 1000 km of pipeline were about 67% and 25%, respectively, of the long-term averages. Nine of the spillages required extensive clean-up campaigns that exceeded six months duration or were particularly costly. The overall costs for repairs and clean-up of all incidents amounted to 4.4 million €.

Also included is the record of intelligence pig inspection activity in 2002 and the historical record since the technique was first used in 1970. In 2002, 61 inspections were completed using metal loss and/or crack detection pigs, 29 times in conjunction with geometry pigs, covering 3098 km of pipeline. In addition 8 inspections (729 km) were made using geometry pigs only.

To date, 80% of the current pipeline inventory has been inspected at least once using intelligence pig techniques.

1. INTRODUCTION

This report presents statistical data relating to spillages from cross-country oil pipelines reported for calendar year 2002 with comments and comparisons for the five-year period 1998 to 2002 and an overall comparison since 1971. Similar studies for preceding years are available as a series of CONCAWE reports [1,2,3] and the 30-year (1971 to 2000) performance statistics have been analysed and reported separately [4]. Prior to 1994, the reports covered only the oil industry owned oil pipelines. Since 1994, however, the non-commercially owned pipelines have been incorporated into the reports, and the spillages from these pipelines have been retroactively added to the CONCAWE database from 1988. Last year, three additional countries were covered: the Czech Republic, Hungary and Slovakia (crude oil lines only).

Every endeavour is made to ensure that the content of this document is as complete as possible. In this connection, a comprehensive inventory of cross-country pipelines has been compiled and has been updated in the course of 2002 by CONCAWE with the active cooperation of pipeline operating companies throughout Europe. A general map of European land-based oil pipelines is attached to this report. ***Link to map of Refineries and Oil Pipelines in Western Europe***.

Offshore pipelines (as distinct from estuary crossings by onshore lines) are excluded.

The reported spillage volumes are approximate. Gross spillages of less than 1 m^3 are taken into consideration only when their impact on the environment was noteworthy.

The costs comprise direct costs of the spillage incidents for pipeline repair and site clean-up/restoration and exclude any consequential costs such as loss of income or legal costs.

The inspection activity using intelligence pigs is reported for 2002 versus 2001, for the 5-year period 1998 to 2002 and the overall inspection status for the currently operational pipeline inventory since the first intelligence pig inspection was carried out in 1970. The data are reported both in terms of the length (km) inspected and the number of individual sections. A single inspection may involve one or more passes of the intelligence pig over the same section.

Caution should be exercised if statistics recorded in this report are to be utilised for comparison or application to any specific pipeline system.

2. EUROPEAN PIPELINE PERFORMANCE

2.1. GENERAL DATA

The total length of crude oil and petroleum products cross-country pipelines in operation in the monitored European countries at the end of 2002 was 35,592 km, calculated from data provided by approximately 70 operating companies. The pipeline network consists of about 290 separate lines. The reported length is almost the same as that reported for 2001. There are no new pipelines although a number of previously unrecorded pipeline sections have been added to the database. Two pipeline sections (73 km) have been removed from the operational pipelines inventory. Revisions to the lengths of existing pipelines make up the balance (e.g. elimination of unused loops). The continuing process of breaking down the records on pipelines into their piggable sections has slightly increased the number of sections this year.

In total, 724 Mm^3 of crude oil and refined products was transported through the pipeline system in 2002. This resulted in a total traffic volume of 125 x 10^9 m^3 x km, of which products amounted to 36.3 x 10^9 m^3 x km.

2.2. DETAILS OF SPILLAGE INCIDENTS

In 2002, 14 incidents were recorded in which reportable oil spillages occurred. A summarised analysis of causes and spilt volumes is shown in **Table 1**. **Figures 1 and 2** illustrate the effectiveness of the clean-up operations and the time required. Details of each incident are given in **Appendix 1** which also includes a list of the categories of causes for spillage, consistent with the approach used for the previous reports.

Table 1 ***Summary of causes and spilt volumes for 2002 incidents***

Category	**Number of Incidents**		**Spilt volume (m^3)**			**Average volume per incident (m^3)**	
(by cause)	**Pipeline**	**Pump/ Receipt Station**	**Gross**	**Recovered**	**Net**	**Gross**	**Net**
A. Mechanical failure	1	-	10	0	10	10	10
B. Operational	-	-	0	0	0	-	-
C. Corrosion	5	1	493	415	78	82	13
D. Natural hazard	1	-	250	230	20	250	20
E. Third party activity	6	-	1432	1222	210	239	53
Total	**13**	**1**	**2185**	**1867**	**318**	**156**	**23**

Figure 1 Effectiveness of clean-up efforts

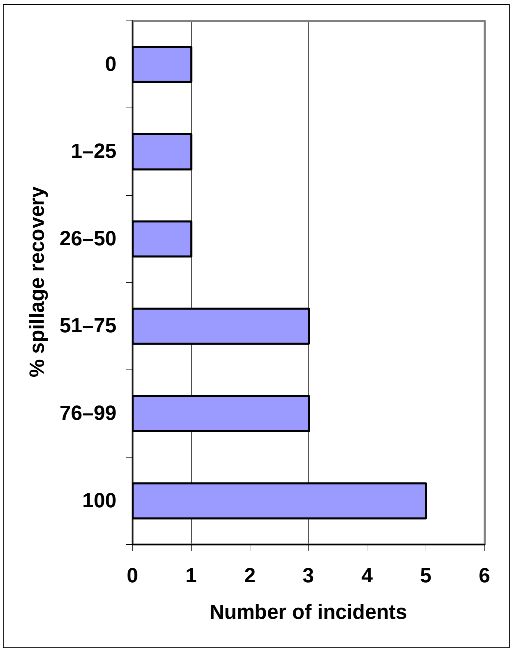
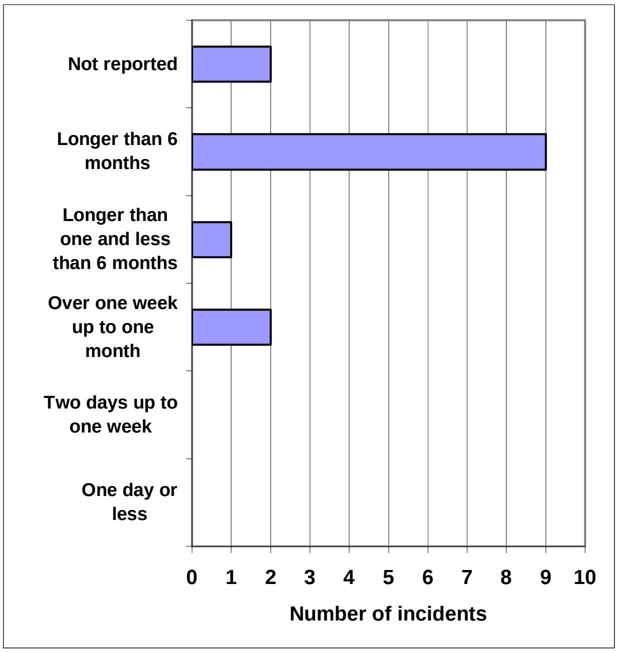
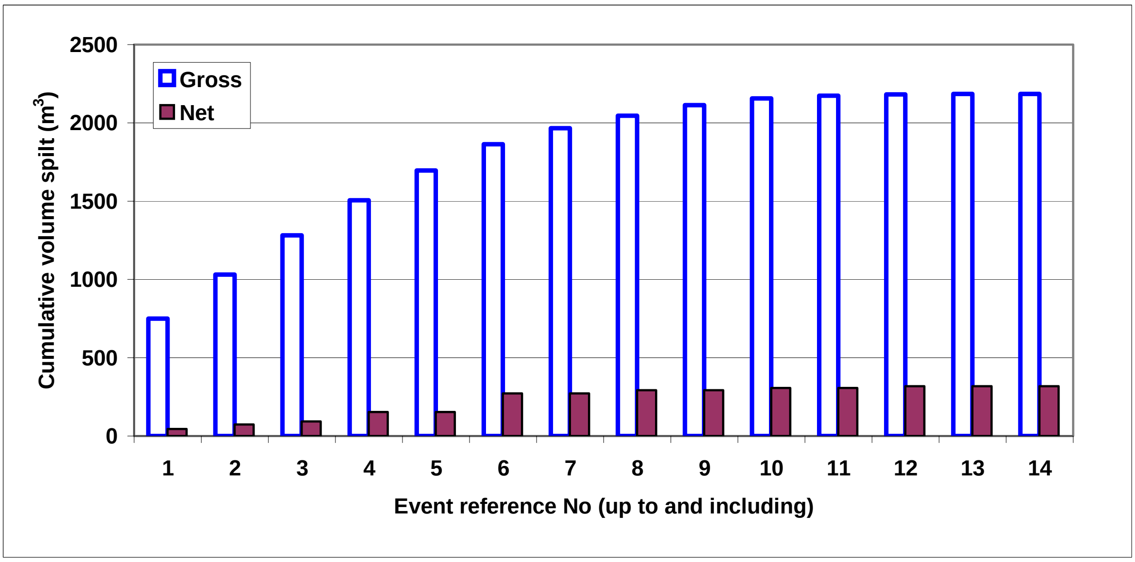


Figure 2 Clean-up time



Total net loss to the environment was 318 m^3. The volume recovered amounted to 1867 m^3, equivalent to 85% of the gross volume spilled (2185 m^3). The cumulative spill sizes are shown in **Figure 3**.

Figure 3 Cumulative spilt volumes



Most of the 14 spillage incidents in 2002 required extensive clean-up programmes. Seven spillages are categorised as causing significant soil pollution (i.e. >1000 m^2 of ground affected) and the largest spill affected no less than 20,000 m^2. Three of the spillages affected water courses but none affected underground potable water sources. The repair and clean-up costs were some 4.4 million € although no costs were recorded for three of the spills.

2.3. CAUSES

The 14 spillages of 1 m^3 gross or more that were reported in 2002 are categorised below.

2.3.1. Mechanical failure

There was one spillage categorised as mechanical failure that caused a spillage of 10 m^3 gross, none of which was recovered. The leak was from a defective pipeline insulation joint and the presence of oil on the ground was reported by a third party. Some 325 m^2 of ground was affected and subsequently cleaned up which took 20 days. A small amount of oil entered a water course.

2.4. OPERATIONAL

There were no spillages in the operational category during 2002.

2.4.1. Corrosion

There were six spillages caused by corrosion, five external and one stress corrosion cracking. The total gross and net spillage was 492 m^3 and 78 m^3 respectively.

An area of external corrosion approximately 100 mm by 8 m affected a 20" pipeline laid within a port area where the soil was saturated with sea water. The crude oil spillage was detected by routine monitoring by the pipeline operator. Gross spillage was 100 m^3, all of which was recovered. The cost of repairing the corrosion was 150,000 €, and the clean up of the site cost a further 2 million € and took over one month. Since the spillage, the pipeline has been inspected by a geometry pig and an ultrasonic metal loss pig.

Water entered under the thermal insulation of a pipeline used to transport hot fuel oil. Reaction between a flame retardant in the foam and water generated hydrochloric acid causing a spot of corrosion (pin-hole). The leak was spotted by a third party and the pipeline shut down for corrective action. It was repaired by sleeving the line and an intelligence pig run was carried out afterwards. The line was then left full of gas oil. Whilst the pipeline was shut down, another small leak was observed some 200 m away from the first. Both leaks were small and assessed by an independent consultant to be only about 0.5 m^3 which is below the normal threshold for reporting. However, taken together, the total volume was approximately 1 m^3. Also, extensive soil contamination occurred, partly because oil entered water drain systems and spread out further around other neighbouring pipelines. In fact, the contamination from the second leak looked worse, despite the line being shut in at the time. Clean-up took 6 months and cost 1 million €. Both this and a similar line are now out of service whilst renovation is planned for 2004.

External corrosion of piping within a tank farm / pump station but downstream of the high pressure pump, caused a weak area approximately 6 mm in diameter in a 6" pipeline. A hole, about 1 mm in diameter formed in this area and about 400 m^2 of ground was contaminated with oil. The leak was reported by staff. Repairs to the pipeline cost about 20,000 €. Clean-up was continuing 6 months after the incident.

An area of generalised corrosion with localised pitting in a 10" pipeline caused a spillage of 80 m^3 of product. The leak was first observed by a mechanical contractor for the pipeline company who happened to be on site. Almost simultaneously, a drop in pressure and increase in flow rate was observed by the control room staff. Although recovery operations collected 60 m^3 of free product, 3000 m^2 of soil was contaminated. Clean-up was still ongoing after 6 months.

Corrosion caused a pinhole leak in the welded end of an 8" pipeline carrying jet fuel. A programme of replacing all these joints was in progress, and the leak was discovered during this programme. Approximately 70 m^3 was spilt in an industrial area and virtually all the oil was recovered. The pipeline had last been inspected by a metal loss intelligence pig in 1998.

2.4.1.1. Stress Corrosion Cracking

Unintentional closure of a pressure control valve caused a pressure surge in a 12¾" pipeline. The maximum allowable operating pressure of the pipeline was not exceeded but the pipeline broke at a weak point where there was an area of stress corrosion cracking. Gross spillage was 225 m^3 of gasoil of which 167 m^3 was recovered. The area of ground affected was 400 m^2 with the cost for clean up (which took over 6 months) of 375,000 €.

2.4.2. Natural hazard

A slow movement of earth caused a 1" drain line to be pushed away from the body of an isolating valve causing the joint to rupture. 230 m^3 of free product was recovered but an area of 5000 m^2 was contaminated in an industrial area. Clean up is expected to take over one year.

2.4.3. Third party activity

There were six incidents caused by third parties, comprising four due to accidental direct damage, one caused by malicious damage (theft) and one due to incidental damage where failure resulted from damage to the pipeline in the past. These third party spillages totalled 1156 m^3 gross, 842 m^3 net.

A contractor working for the pipeline company damaged a 16" line carrying crude oil. 750 m^3 of crude oil escaped of which 705 m^3 was recovered. Some 20,000 m^2 of ground was contaminated and the clean-up cost 360,000 € and took over 6 months.

An operator working for the pipeline company damaged a 30" crude oil pipeline. The pipeline was shut in at the time so only 1 to 2 m^3 of oil escaped. Virtually all of this was recovered although 0.3 m^3 entered a water course. Repairs to the pipeline cost 7000 €, clean-up cost 60,000 € and disposal of contaminated soil cost 5000 €.

Despite being aware of the presence of the pipeline which was shown by permanent markers, a ditching contractor struck an 8" pipeline and damaged it with machine claw marks and associated cracks. During pressure testing, a pin hole developed allowing approximately 170 m^3 of jet fuel to escape. 50 m^3 of this was spilt on the ground and was recovered but 120 m^3 entered a water course. Damage to the environment was assessed as medium and lasted for less than 6 months.

A third party digging a ditch punctured a 20” crude oil pipeline. The line is surveyed weekly and had last been inspected three days before the incident. Some 280 m^3 of oil was spilt of which 70 m^3 was recovered and a further 180 m^3 was removed and safely disposed of together with soil. Approximately 12,000 m^2 of soil was contaminated. Repairs to the pipeline cost 22,000 €, the clean up took over 6 months and cost 138,000 € while the cost of disposing of contaminated soil cost 131,000 €.

An attempt was made to steal oil from a 12” crude oil pipeline. A “hot tap” was attempted using a drill and a manual valve. This resulted in the spillage of 40 m^3 of oil of which 25 m^3 was recovered. 6000 m^2 of ground was contaminated. The clean-up took less than 6 months and cost 100,000 €.

There was one failure caused by incidental damage. That is, where the pipeline had been damaged at some point in the past which eventually led to a failure. An 8” pipeline transporting gasoline suffered a pinhole leak which was detected by the automatic detection system. Approximately 190 m^3 was spilt in an industrial area, all of which was recovered and there was no long term effect on the environment. The pipeline, which had last had a metal loss pig run in 1992, had been damaged by some unknown machinery, despite being buried by 4 m of cover. Machine claw marks were found on the pipe which had removed the coating and caused corrosion. In this area, there are a number of pipes, many of which are well below the surface. It is believed that work on a water pipeline directly above this line caused the damage.

3. COMPARISON WITH PREVIOUS YEARS

The comparative numbers of spillages and spillage volumes for the period 1998 - 2002, and the long-term overall percentages for the numbers and volumes of spillages since 1971, are given in **Tables 2** and **3**. The latter data are also presented graphically in **Figures 4** and **5**.

In 2002, the occurrence of 14 spillages represents a similar performance to that achieved in 2001, but slightly worse than the long-term average of 12.6 spills per year. However, taking into consideration the fact that the length of pipelines included in the survey has increased over the years, it is a somewhat better than average result as measured by the frequency (0.39 per 1000 km/year in 2002 versus a long-term average of 0.53 spills per 1000 km/year).

In terms of spillage volumes, 2002 was also worse than the previous four years although over one third of the gross spillage (14% net) resulted from one incident (see **Figure 3**). The 2002 total gross spillage volume at 2185 m^3 is similar to the long term average (2154 m^3) but the net spillage volume, at 318 m^3 is much lower than the long term average of 950 m^3. Relative to the total length of pipeline under survey, however, the performance was significantly better than the long-term annual average (54 m^3 gross and 8 m^3 net in 2002 compared to a long-term average of 93 m^3 and 41 m^3).

- There was one spillage in the "mechanical failure" category in 2002 leading to a net spillage of less than 10 m^3. The data recorded since 1971 show that 3.0 spillages per year, contributing 28% of the total net spillage volume, result from this category of incident.
- There were no spillages in the "operational" category. The long-term average performance is 0.9 incidents per year, and the contribution to net volume spilled is 4%.
- There were six "corrosion" spills in 2002, five external and one stress corrosion cracking, and 78 m^3 net was spilled. Long-term, corrosion has accounted for 3.8 incidents per year, which contributes 16% of the total net spillage.
- For the first time in nine years, a spillage resulted from a "natural hazard" which has a long-term average incidence of only 0.5 spillages per year and contributes 3% of the net spillage volume.
- There were six spillages in 2002 amounting to 210 m^3 net due to "third party activity". Of these, four were due to direct accidental damage, one resulted from incidental damage where the pipe had been damaged at some time in the past and the last resulted from an illegal connection used for theft from the pipeline. Unusually, this involved crude oil. Long-term, the third party category is the largest single cause of spillages causing 4.4 incidents per year and at 48% is also the largest contributor to the net volume spilled.
- A total of 52 spillage incidents were recorded over the five-year period 1998 to 2002. All but four caused some temporary environmental pollution. Slight pollution of soil and water resulted from 37 and 3 cases respectively. Significant soil contamination arose from 11 incidents which required more extensive oil containment and clean-up efforts to restore the environment. There was one incident affecting potable water resources.

Table 2 Five-year comparison by cause, volume and effect: 1998 – 2002

	1998	1999	2000	2001	2002	1998-2002
COMBINED LENGTH (km x 10^3)	30.0	29.9	30.8	35.6	35.6	-
COMBINED THROUGHPUT (m^3 x 10^6)	680	674	672	708	724	-
COMBINED TRAFFIC VOLUME (m^3 x km x 10^9)	123	125	126	131	125	-
			Number of Incidents			
MECHANICAL FAILURE						
Construction	-	-	-	2		2
Material	-	1	1	3	1	6
OPERATIONAL						
System	-	-	-	-	-	-
Human	1	1	-	-	-	2
CORROSION						
External	4	1	-	2	5	12
Internal	-	-	1	1		2
Stress corrosion cracking					1	1
NATURAL HAZARD						
Subsidence	-	-	-	-	-	-
Flooding	-	-	-	-	-	-
Other	-	-	-	-	1	1
THIRD PARTY ACTIVITY						
Accidental	3	2	3	3	4	15
Malicious	2	-	-	4	1	7
Incidental	1	1	1	-	1	4
	11	6	6	15	14	52
NET SPILLAGE INCIDENTS						
0 - 10 m^3	5	1	4	11	7	28
11 - 100 m^3	6	3	-	4	6	19
101 - 1000 m^3	-	2	2	-	1	5
In excess of 1000 m^3	-	-	-	-	-	-
POLLUTION RESULTING						
None	1	-	1	-	2	4
SOIL						
Slight	9	5	5	13	5	37
Significant	1	1	-	2	7	11
WATER COURSES						
Slight	-	-	-	-	3	3
Significant	-	-	-	-	-	-
POTABLE WATER	-	-	-	1	-	1

Table 3 Comparison with previous years

1. Volume spilt per cause (m^3)

Main category	1998	1999	2000	2001	2002	1998-2002
A. Mechanical failure	30 (1)	- (-)	175 (1)	853 (5)	10 (1)	1068 (8)
B. Operational	486 (2)	7 (1)	- (-)	- (-)	0 (-)	493 (3)
C. Corrosion	250 (1)	199 (4)	10 (1)	113 (3)	493 (6)	1065(15)
D. Natural hazard	- (-)	- (-)	- (-)	- (-)	250 (1)	250 (1)
E. Third party activity	561 (5)	310 (6)	175 (4)	184 (7)	1432 (5)	2662 (27)
Gross spillage	1327 (11)	516 (6)	360 (6)	1150 (15)	2185 (14)	5538 (52)
Recovered	660	345	276	970	1867	4118
Net loss	667	171	84	180	318	1420
Average net loss/incident	74	16	14	12	23	26
Average net loss/1000 km	22	6	3	5	9	9

Figures in parentheses denote number of incidents

2. Comparisons since 1971

Main category	Number of incidents		Net volume spilled %	
	2002	Average per year 1971-2002	2002	1971-2002
A. Mechanical failure	1	3.0	3	28
B. Operational	-	0.9	-	4
C. Corrosion	6	3.8	25	16
D Natural hazard	1	0.5	6	3
E. Third party activity	6	4.4	66	48

Note: The non-commercially owned pipelines data are in the database from 1988 onwards. Pipelines in Hungary, the Czech Republic and Slovakia (crude lines) were added in 2001.

Figure 4 Five-year comparison: length, throughput and relative spillage

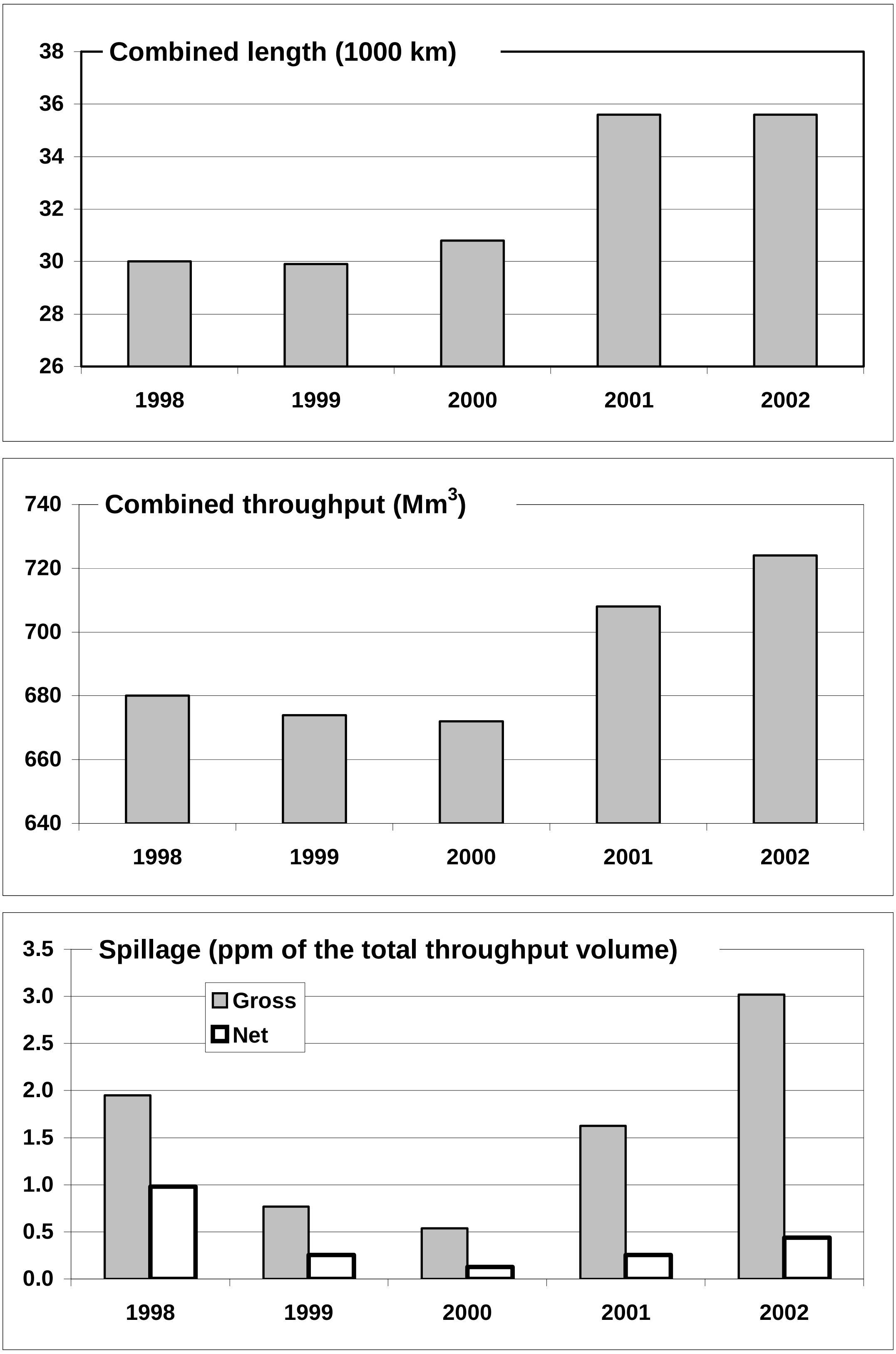
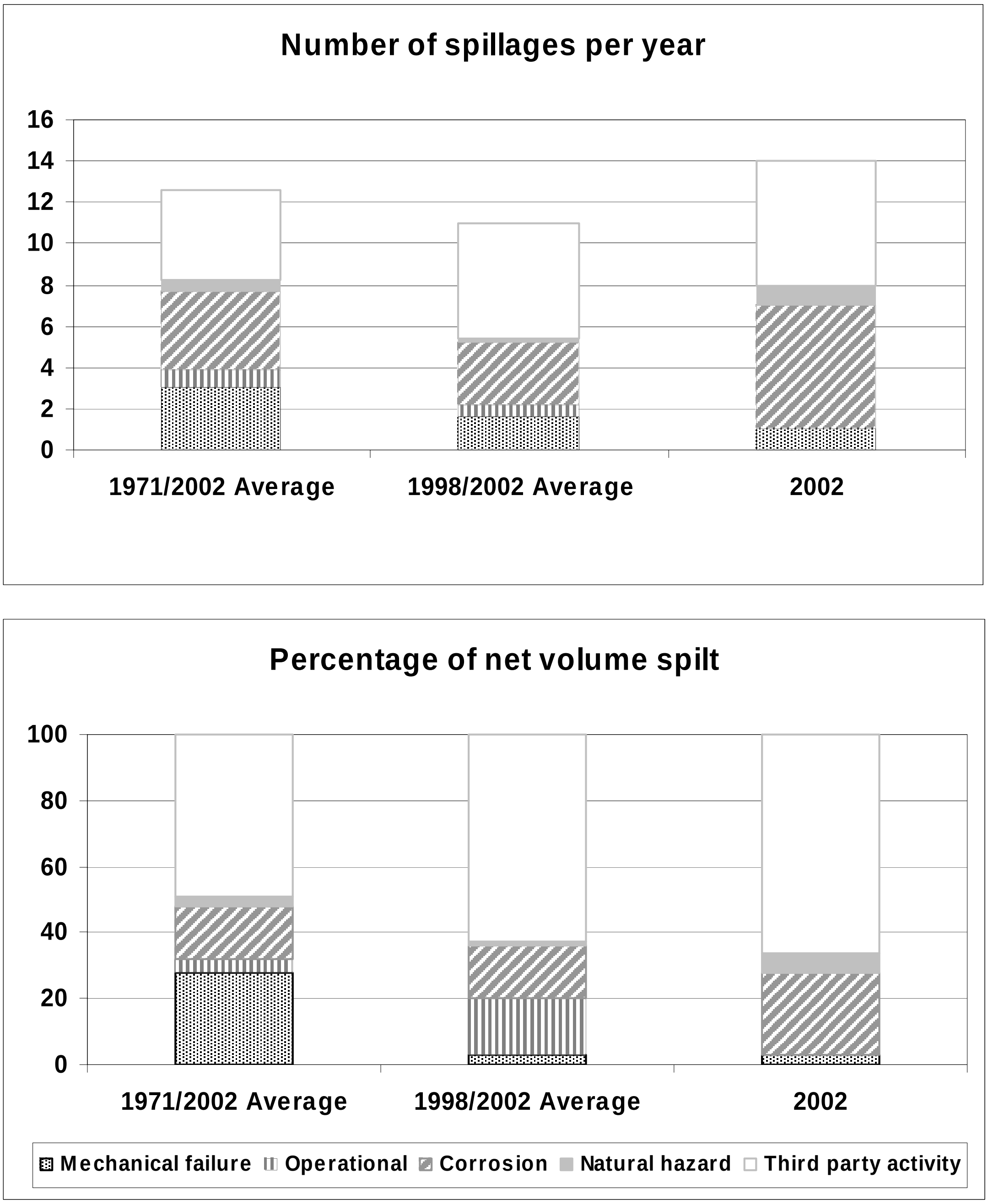


Figure 5 Long-term comparative spillage data per cause



4. INTELLIGENCE PIG INSPECTIONS 2002 STATISTICS

An assessment of the condition of a pipeline can be obtained by sending intelligence gathering pigs through a section of pipeline and analysing the recorded data to define a programme to validate the location and establish the nature and severity of indicated defects. This is followed up with suitably prioritised defect monitoring or repair actions. The intelligence pigs used to prevent leaks have one of three basic functions. There are metal loss measurement and crack detection pigs that record imperfections within the pipe material and on the internal or external walls. These use ultrasonic or magnetic techniques. The third type is the geometry pig that measures the internal pipe diameter and takes roundness measurements. This is the second year that crack detection inspections have been specifically identified. Previously such data were combined with the metal loss type, and efforts continue to split these data retroactively.

Each inspection of a pipe section can involve one or more passes of either one or more types of pig. Annual records are kept of completed inspections for the three types of pig and the length (km) and number of sections inspected.

Table 4.1 Length (km) of pipeline inspected using intelligence pigs

Inspection year	Metal Loss Pig	Crack Detection Pig	Geometry Pig	Total Pipeline Inventory
2002	2925	902	2643	34,596
2001	2453	997	1341	35,575
5-year Average	3395	596	2393	32,398

In 2002, metal loss intelligence pig inspection activity measured in kilometres fell just short of the average over the last 5 years. This year however, crack detection pig activity was above average and geometry pig inspections were average. Some 8% of the inventory was inspected using metal loss pigs, 2.5% using crack detection pigs and 7% using geometry pigs.

Table 4.2 Number of pipeline sections inspected using intelligence pigs

Inspection year	Metal Loss Pig	Crack Detection Pig	Geometry Pig	Total Inventory of Sections
2002	52	11	36	643
2001	42	14	20	643
5-year Average	54	6	36	590

In 2002, 59 inspections used metal loss and/or crack detection pigs, 29 times in conjunction with geometry pigs. In addition, 2 inspections used crack detection pigs only and 8 inspections used geometry pigs only.

Table 4.3 Coverage of intelligence pig inspections since first used (i.e. 1970-2002)

Type of Inspection	**Pipeline Sections No.**	**Pipeline Length km**
Metal loss and/or crack detection only	144	8367
Geometry only	6	704
Pipewall & geometry	294	17,381
Total inspected	444	26,452
Total Inventory (2002)	643	34,596

The data in this table are calculated for the pipelines in service at end 2002, ignoring the pipelines which have been shut down, many of which were never inspected in their lifetime. Over the period that intelligence pigs have been in use, 5734 km of pipelines have been shut down. If these had been retained in the data set analysed, they would have distorted the interpretation of the results. For example, 3923 km of closed pipelines were never inspected during their service lives. The never-inspected length in the operational inventory (7807 km at end 2002) should decrease in future years.

Since the first recorded intelligence pig inspection in 1970, some 74% of the current pipeline inventory length and 67% of the inventory pipeline sections have been inspected at least once using any one of the pig types. Most of these have included the use of metal loss and/or crack detection pigs with only 1% inspected by geometry pig only. The use of geometry pigs has been included at least once in 50% of length and 44% of sections.

The total number of inspections on existing pipelines made to date is 1369, comprising 867 using metal loss, 39 using crack detection and 463 using geometry pigs. There are insufficient data on crack detection to provide repeat inspections.

Table 4.4 Repeat metal loss pig inspections by pipe sections, 1970-2002

Inspections	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
No. of sections	218	245	94	49	21	10	7	3	2	2	3	0	0	2

Note. Covers only pipelines still active in 2002. Total number of metal loss pig inspections = 867.

Table 4.5 Repeat geometry pig inspections by pipe sections, 1970-2002

Inspections	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
No. of sections	356	202	63	22	8	1	1	0	1	2	0	0	0	0

Note. Covers only pipelines still active in 2002. Total number geometry pig inspections = 463.

The above tables show that repeat inspections (2 or more) have been carried out on 193 and 98 pipeline sections, respectively, using metal loss and geometry pigs. Few trends for repeat inspections intervals are yet apparent.

5. REFERENCES

1. CONCAWE (1969) Oil spillages from pipelines - Western Europe - statistical summary of reported incidents 1966 - 1968 inclusive. Document 3874. Brussels: CONCAWE

2. CONCAWE (1972) Spillages from oil industry cross-country pipelines in Western Europe. Statistical summary of reported incidents 1966 - 1970. Report No. 2/72. Brussels: CONCAWE

3. CONCAWE Performance of oil industry cross-country pipelines in Western Europe. Statistical summary of reported spillages. Reports No. 2/73, 1/74, 5/74, 7/75, 7/76, 9/77, 3/78, 6/79, 10/80, 2/82, 11/82, 9/83, 12/84, 9/85, 7/86, 8/87, 8/88, 9/89, 6/90, 4/91, 4/92, 2/93, 5/94, 4/95, 4/96, 7/97, 6/98, 3/99, 3/00, 4/01, 1/03. Brussels: CONCAWE

4. CONCAWE (2002) Western European cross-country oil pipelines 30-year performance statistics. Report No. 1/02. Brussels: CONCAWE

APPENDIX 1

DETAILS OF 2002 SPILLAGE INCIDENTS

Categories of spillage cause

Main		Secondary		
		a	b	c
A	Mechanical failure	Construction fault	Material fault	
B	Operational	System malfunction	Human error	
C	Corrosion	External	Internal	Stress Corrosion Cracking (SCC)
D	Natural hazard	Landslide / subsidence	Flooding	Other
E	Third party activity	Direct damage – accidental	Direct damage – malicious	Incidental damage

No.	Pipeline		Spillage (m^3)				Cause				Damage			
	Pipeline or Pump Station	Pipe spec. Diameter/Thickness mm (inch)	Commodity	Spilled	Recovered	Net	How Discovered	Category		Origin	Potable/ Other water Pollution	Soil Pollution Area (m^2)	Estimated Cost (€)	Clean-up time
1	P/L	X-52 405 x 5 (16" x 0.20")	Crude oil	750	705	45	Surveillance by PL staff	E(a)	Accidental damage	Operator working for pipeline company damaged line	No / None	20,000	360,000	Over 6 months
2	P/L	5LX-46 600 x 7.9 (24" x 0.32")	Product	250	230	20	Third party	D(a)	Earth movement	A drainline from an isolating valve was pushed away from the valve	No / None	5000	N/A	Over 1 year
3	P/L	5L-X-42 325 x 6.35 (12¾" x 0.25)	Product	225	167	58	Automatic detection system	C (c)	SCC	High pressure caused a rupture at an area affected by Stress Corrosion Cracking	No / None	400	375,000	Over 6 months
4	P/L	5L-B 200 x 7.36 (8" x 0.28")	Product	190	190	0	Automatic Detection System	E(c)	Incidental Damage	Machine claw marks were found on the pipeline and damage to the coating	No / None	None	N/A	N/A
5	P/L	5L-B 200 x 7.36 (8" x 0.28")	Product	170	50	120	Routine monitoring p/l operator	E(a)	Accidental damage	Pipeline damaged by ditching operations	No / Yes	N/A	N/A	Over 6 months
6	P/L	X-60 508 x 7.11 (20" x 0.28")	Crude oil	100	100	0	Routine monitoring p/l operator	C (a)	External Corrosion	General corrosion over an 8 m length	No / None	500	2,150,000	Over 30 days
7	P/L	X-52 255 x 6.35 (10" x 0.25)	Product	80	60	20	Third party	C (a)	External corrosion	General corrosion with localised pitting	No / None	3000	10,000	Over 6 months
8	P/L	? 200 x ? (8" x ?)	Product	70	70	0	Found during replacement programme	C(a)	External corrosion	Corrosion of welded end joints	No / None	None	N/A	N/A
9	P/L	X-52 300 x 5 (12" x 0.20")	Crude oil	40	25	15	Third party	E(b)	Third party theft	Illegal connection (hot tap/manual valve) - spillage during thefts	No / None	6000	100,000	Over 6 months
10	P/S	5L-B 150 x 4.4 (6" x 0.17")	Product	17	17	0	Pipeline operator's staff	C (a)	External corrosion	Corrosion close to manifold	No / None	400	27,000	Over 6 months
11	P/L	St.35.29 CSN 1042-1941 200 x 9 (8" x 0.28")	Product	10	0	10	Third party	A(b)	Materials fault	Defective pipeline insulation joint	No / Yes	325	60,360	20 days
12	P/L	5L-B 762 x 12.7 (30" x 0.5")	Crude oil	2	2	0	Third party	E(a)	Accidental Damage	Operator working for pipeline company damaged line	No / Slight pollution of water	40	72,000	10 days
13	P/L	X-52 508 x 8 (20" x 0.3")	Crude oil	280	250	30	Third party	E(a)	Accidental damage	Line punctured by third party digging a ditch	No / None	12000	291,000	Over 6 months
14	P/L	5L-B 254 x 7.14 (20" x 0.28)	Fuel oil / gasoil	1	1	0	Third party	C(a)	External corrosion	Corrosion under the insulation on a hot fuel oil line caused two small leaks	No / None	4000 and 10,000	1,000,000	190 days
			TOTAL	**2185**	**1867**	**318**							**4,445,360**	

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