European Gas Pipeline Incident data Group

EGIG

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What is EGIG?
12 operators organize incident statistics

- **European operators** of gas transmission pipeline systems:
  Belgium  Czech republic  Denmark  Germany  Finland  France  Italy  Netherlands  Portugal  Spain  Switzerland  UK

- **Covering and exposure**
  122,000 km  1970 – 2004  2.8 million km. yr

- **Report**
  > Every 3 years
  > 6th report is placed on the internet ([WWW.EGIG.nl](http://WWW.EGIG.nl))
Objectives of EGIG

- To communicate about the safety performance
- Provide a reliable and realistic picture of incident frequencies
- Basis for statistical use
- To analyse the causes of incidents
- To improve safety performance
Evolution of the exposure

Exposure [km yr]

Year [-]
EGIG: The input
Defined System and defined incidents

System
- Transport of gas
  - Steel transmission pipelines >15 bar
  - Outside the fences of installations
  - Onshore

Incidents
- Incidents with unintentional release
Annual number of incidents

Number of incidents [-]

Year [-]
Detection of incidents

Type of detection
- Public
- Patrol
- Contractor
- Unknown
- Distribution companies
- Company staff
- Landowner
- Other
- Client
- Online inspection

Percentage of incidents [%]
- Pinhole-crack
- Hole
- Rupture
# The EGIG parameters

<table>
<thead>
<tr>
<th>System</th>
<th>Incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter</td>
<td>How detected</td>
</tr>
<tr>
<td>Pressure</td>
<td>Leaksizel</td>
</tr>
<tr>
<td>Year of construction</td>
<td>Cause of incident</td>
</tr>
<tr>
<td>Type of coating</td>
<td>Ignition</td>
</tr>
<tr>
<td>Cover</td>
<td>Consequences</td>
</tr>
<tr>
<td>Grade of material</td>
<td>A free text</td>
</tr>
<tr>
<td>Wall thickness</td>
<td></td>
</tr>
</tbody>
</table>
EGIG: The output
The EGIG figures output

Failure frequencies, distributions and/or probabilities

- Calculated from total exposure and 5 year moving average to observe trends and also to observe the distribution of incidents and leaksize per cause.

- Calculated from partial exposure to observe influence of design parameters on the causes and consequences of incidents.
## General Incident failure frequencies

<table>
<thead>
<tr>
<th>Period [year]</th>
<th>Number of Incidents [-]</th>
<th>System Exposure [km.year]</th>
<th>Failure frequency [per km.year]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970-2004</td>
<td>1123</td>
<td>2.770.000</td>
<td>0.000041</td>
</tr>
<tr>
<td>1970-2001</td>
<td>1061</td>
<td>2.410.000</td>
<td>0.000044</td>
</tr>
<tr>
<td>2000-2004</td>
<td>100</td>
<td>570.000</td>
<td>0.00017</td>
</tr>
<tr>
<td>2004</td>
<td>23</td>
<td>122.000</td>
<td>0.00019</td>
</tr>
</tbody>
</table>
Evolution of the primary failure frequencies

Frequency per 1000 km·yr

Year [-]

- Entire period
- Last 5 years
### Estimated probabilities per leak size

<table>
<thead>
<tr>
<th>Size of leak</th>
<th>Ignition probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pinhole or crack</td>
<td>0.03</td>
</tr>
<tr>
<td>Hole</td>
<td>0.02</td>
</tr>
<tr>
<td>Rupture &lt;= 16”</td>
<td>0.09</td>
</tr>
<tr>
<td>Rupture &gt; 16”</td>
<td>0.30</td>
</tr>
</tbody>
</table>
Using these figures for risk analysis

- Decisions on future developments depend on historical statistical data.

- EGIG statistics are used together with other parameters which are based on poor or even no knowledge:
  - Ignition probability,
  - Probability of being exposed,
  - Effect-consequence relations
  - Etc

- Not everything (measure or situation) can be quantified.

- Used as an additional method in certain countries: Shall give different national demands.

- Misused for far-reaching decisionmaking: because QRA has significant limitations.
Pipelines compared to other transport modes

A pipeline is safer (per ton.km) if:
- ca 5000 tankcars
- ca 2000 railroad tankcars
- ca 1000 inland waterway vessels
are needed to transport a flammable gas

A pipeline: safest transport mode for continuous mass transport of gas
Analysis EGIG figures
Relation cause-size of leak

![Bar chart showing frequency of different causes of leaks per 1,000 km/yr.](chart.png)

- **External Interference**: Highest frequency
- **Construction defect./Material failure**: Moderate frequency
- **Corrosion**: Low frequency
- **Ground movement**: Very low frequency
- **Hot-tap made by error**: Even lower frequency
- **Other and Unknown**: Lowest frequency

The chart displays specific leak types:
- **Pinhole-crack**
- **Hole**
- **Rupture**
Primary failure frequencies per cause
(5-years moving average)
External interference:
diameter class and size of leak

Frequency per 1,000 km·yr

- Pinhole-crack
- Hole
- Rupture

Diameter class [inches]

0-4  5-10  12-16  18-22  24-28  30-34  36-40  42-46  48+
External interference:
Depth of cover class and size of leak

![Bar chart showing frequency per 1,000 km/yr for different cover classes and leak sizes.]

- **Cover class [cm]**: 80-100 vs. 100+
- **Frequency per 1,000 km/yr**:
  - 0.2 to 0.0
  - 0.18 to 0.1
  - 0.16 to 0.14
  - 0.12 to 0.1
  - 0.1 to 0.08
  - 0.08 to 0.06
  - 0.06 to 0.04
  - 0.04 to 0.02
  - 0.02 to 0.0

**Legend**:
- Pinhole-crack
- Hole
- Rupture
External interference:
wall thickness class and size of leak

Wall thickness class [mm]

Frequency per 1,000 km yr

- 0-5: Pinhole-crack (0.1), Hole (0.4), Rupture (0.1)
- 5-10: Pinhole-crack (0.1), Hole (0.4)
- 10-15: Rupture (0.01)
Construction:
Year of construction and size of leak

Year of construction:
- <1954
- 1954-1963
- 1964-1973
- 1974-1983
- >1984

Frequency per 1,000 km·yr:
- Pinhole-crack
- Hole
- Rupture

Frequency distribution for different years of construction.
Corrosion:
year of construction and size of leak

Frequency per 1,000 km yr

Year of construction

- Pinhole-crack
- Hole
- Rupture
Corrosion:
wall thickness class and size of leak

![Graph showing frequency per 1,000 km yr for different wall thickness classes and leak types.](image)

- **Wall thickness class [mm]**: 0-5, 5-10, 10-15
- **Frequency per 1,000 km yr**:
  - Pinhole-crack
  - Hole
  - Rupture

Legend:
- Pinhole-crack
- Hole
- Rupture
Analysis of these figures

- **External interference**
  - 75% of serious incidents
  - And 90% of these incidents: <10mm wall th. <28” diam.

- **Ground movement**
  - 10% of serious incidents
  - And 90% of these incidents: <10mm wall th. <1975

- **Construction**
  - 10% of all incidents
  - And 90% of these incidents: <1983

- **Corrosion**
  - 1% of serious incidents
  - And 90% of these incidents: <1974
Conclusions & Recommendations
Conclusions and recommendations

- **Pipelines: a safe transport mode**
  - most recent overall incident frequency 0.00017 [per km. year]
  - the failure frequency seems to stabilize.
  - A safe alternative in the case of mass transport

- **Integrity**
  - 10-20% of all serious incidents
  - international standards,
  - primarily a responsibility of the operator
  - pipelines must be treated as transport

- **External interference**
  - > 75% of all serious incidents
  - We have still a job to improve.
  - As traffic safety also a responsibility of authorities
Questions?