OVERVIEW AND PROSPECTS ON PREVENTION AND PROTECTION MEASURES RELATED TO PIPELINE INTEGRITY

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The Global Energy Challenge:
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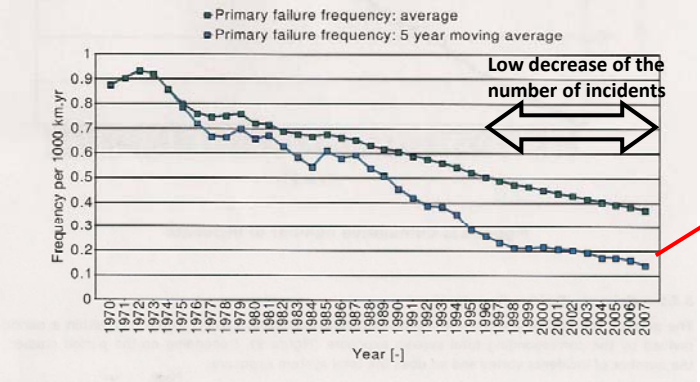
Contents

A new challenge for pipeline safety

Example of transmission pipelines



Breakthrough needed

Source: EGIG Report dec 2008

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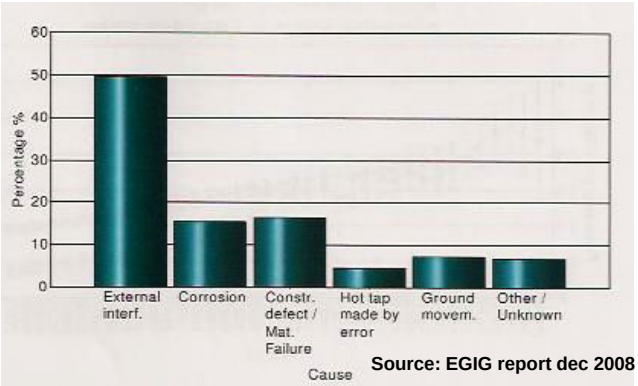
External Interference - EI: a key point for pipeline safety

Example of transmission pipelines



Source: EGIG report dec 2008

Today:
EI = 50% of incidents

Several approaches for limiting EI and their consequences

- Design
- **Prevention**
- **Surveillance**
- **Protection**
- **Warning**

→ **New technologies and methodologies applicable to transmission and distribution pipelines**

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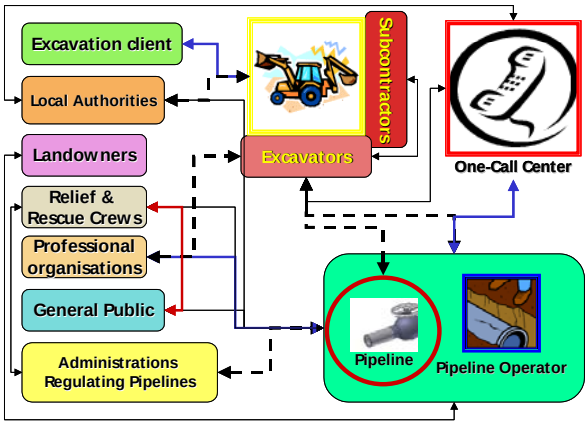
Prevention: one call center

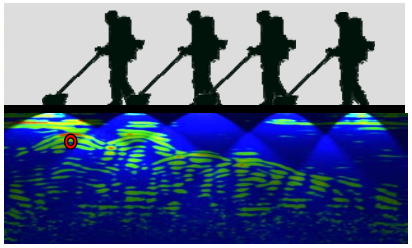


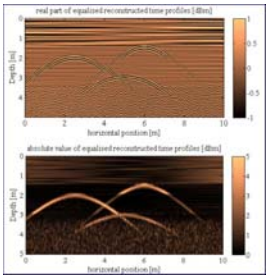
Objective: Coordination of stakeholders

Sketch of relationships between stakeholders concerned by infrastructure buried in the public domain

Prevention methods: identification of buried pipelines

Example: georadar





Such systems, applicable to metallic and non metallic pipes have been developed for more than 15 years

Questions: Ability to detect buried structures with accuracy?
Field operability in the full diversity of environments?
Qualification of the quality of interpretation?

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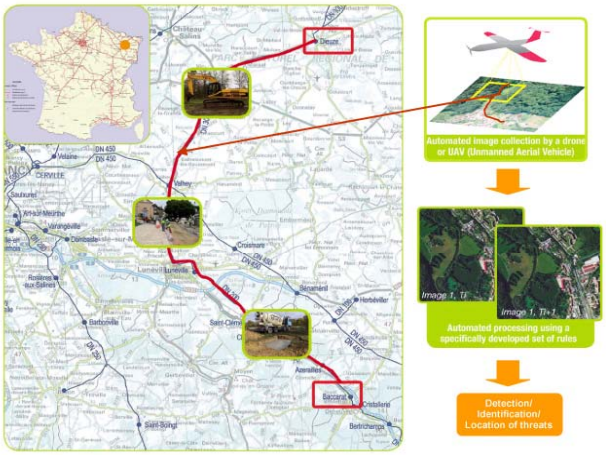
Aerial Surveillance: promising developments of automation



Automated analysis with comparison of pictures taken by planes or drones at different time periods

R&D joint projects:
- EU (IntegRisk)
- NA (PRCI)

Protection: physical barrier between the excavator and the pipe

Solutions :

- Polyethylene slabs
- Concrete slabs
- Other techniques: coloured backfill over pipes, geotechnical mesh…

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What threats for buried pipelines and for their protection?

From HSE and GDFSUEZ studies:

- Excavators are used in 70 % of construction sites in urban zones and 80 % of construction sites in rural zones
- More than 90% of excavators used in rural sites (100 % for urban sites) have a mass lower than 32 tonnes

→ **« Reference » « threat »: 32 tonnes excavator**

Criteria to qualify appropriate protection systems

Field tests have been conducted to evaluate protection systems

32 t excavator prepared to hit a concrete slab

- Sufficient mechanical resistance for stopping the excavation
- Identification by the excavator driver of the presence of gas pipes
- Maintain the efficiency of cathodic protection for steel pipes
- Easy to install and as cheap as possible

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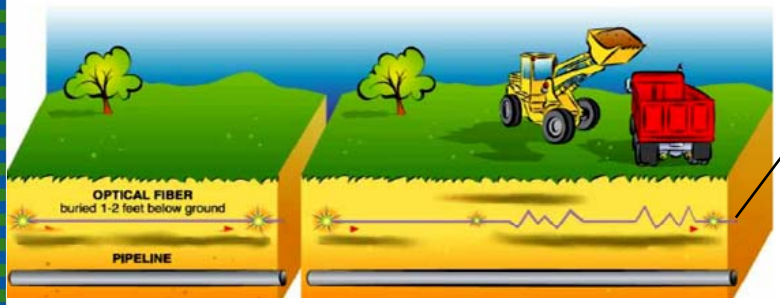
Warning methods : use of laser interfometry in optical fibers to detect approaching ground works



Analysis of the optical signal

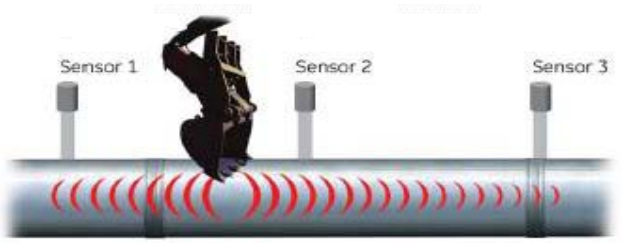
Four challenges

- technological challenge: how to identify the real threats?
- installation and maintenance of such systems?
- operations: how to include this system in operational procedures?
- cost vs efficiency

Warning method: impact detection

Detection of acoustic vibrations caused by an impact due to External Interference:

Prevention for on-going public works in the vicinity of pipelines



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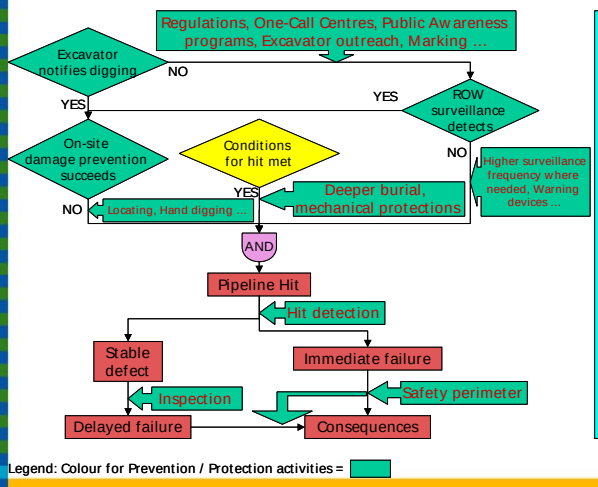
Human factor is present at all levels of protection and prevention

Sociology and psychology can bring methods to facilitate the good use by operators, of EI prevention and protections methods

New approaches in industry :
- Cognitive REliability Analysis Method (CREAM)
- Functional Resonance Analysis Method(FRAM)
- Bow Tie - Model

Main points:
• documentation about incidents: updating and consultation
• understanding, assessing and modelling the behaviour of Multiple Loosely Related Stakeholders facing the safety of buried pipelines

Assessing the efficiency of prevention and protection methods



SYSTEMATICALLY DOCUMENT ALL EVENTS TO POPULATE THE EVENT MODEL

Simplified bow-tie model of external interference incidents and associated preventive & protective actions (green).

Key points for fault tree interpretation:
- data collection
- use of sensitivity analysis
- include human and organisational factors

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Summary and conclusions

- Prevention of external interference on pipelines has reached a level of maturity: going beyond requires a breakthrough

- Many techniques have been developed but much work is still to be done to include them in operational processes
  → Field tests and experimentations of procedures are an obligation

- Efficiency of EI prevention and protection methods is not limited to technological aspects
  → An integrated approach involving all stakeholders is necessary

- Organisational and human factors are a key point for the choice of methods adapted to pipelines

Thank you for your attention!