KUALA LUMPUR 2012 WORLD GAS CONFERENCE

25th world gas conference

"Gas: Sustaining Future Global Growth"

WOC 3 SG 3.2 – Gas Transmission 2009-2012 Triennium Report

Pipeline Integrity Threats, Influence of Stakeholders & Environmental Footprint

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Presentation Content

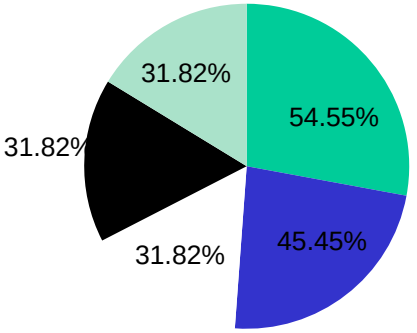
- Background
- Analysis of Survey Questionnaires
- Excerpts of Best Practices, New Technologies & Lessons Learnt
- Conclusions
- Recommendations

Background

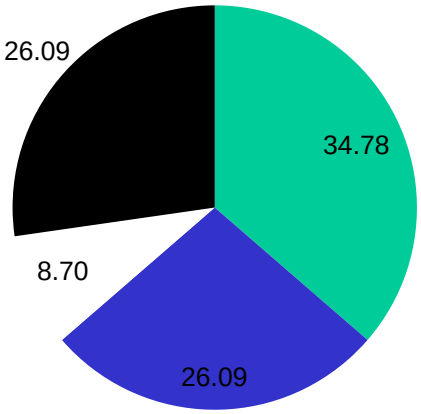
- In this triennium, SG 3.2 took the responsibility of further investigation of last triennium's work which had concluded that 3rd party interference and external corrosion are the biggest threats to pipeline integrity.
- For Triennium 2009-2012, WOC 3's SG 3.2 assigned to investigate the followings:-
  - most important integrity threats and the effectiveness of threats reducing/mitigating measures, and
  - the requirements of national & international safety and environmental regulations; and cooperation of pipeline operators/stakeholders with regulators in establishing the regulations.
- Questionnaires were developed based on the following sub-topics:-
  - Pipeline integrity threats i.e. focusing on external interference (3rd party), external corrosion, SCC, ground movement, human/operator error & material defects and construction error.
  - Influence of stakeholders i.e. focusing on increasing or decreasing trend of requirements of safety regulations/rules & possibility of pipeline operators in influencing the establishment of regulations/rules.
  - Environmental footprint i.e. focusing on the responsibility of pipeline operators to measure their own environmental footprint and to define measures to reduce emissions.
- 22 countries corresponds to 24 companies responded to the survey questionnaires.
- To add more value, total of 29 best practices, new technologies & lessons learnt were consolidated from the companies.

Analysis of Survey Questionnaires (1/5)
- Main excerpts from pipeline integrity threats (1/3)

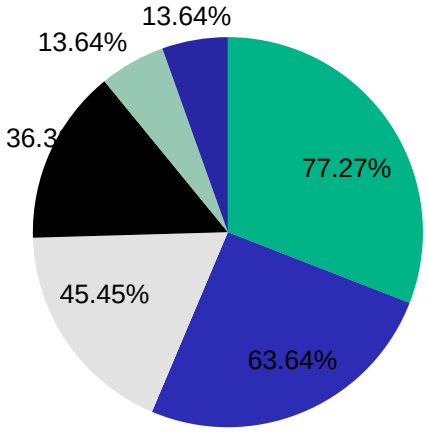
Actions to mitigate external interference, external corrosion & geotechnical problems.



- Public awareness
- Patrol of pipeline
- Proper identification (warning sign)



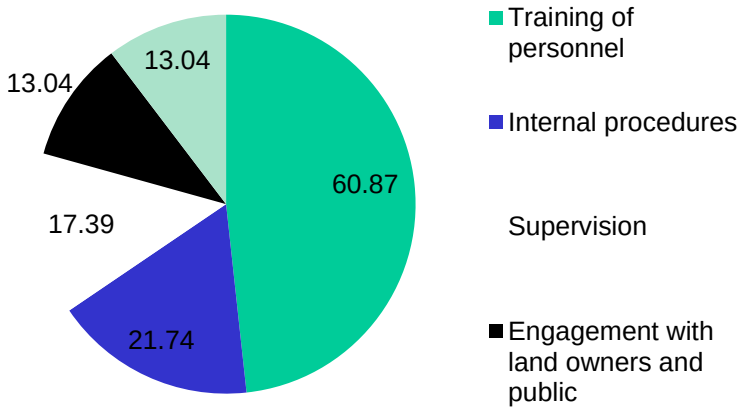
- Frequent surveillance
- Slope monitoring
- GIS mapping

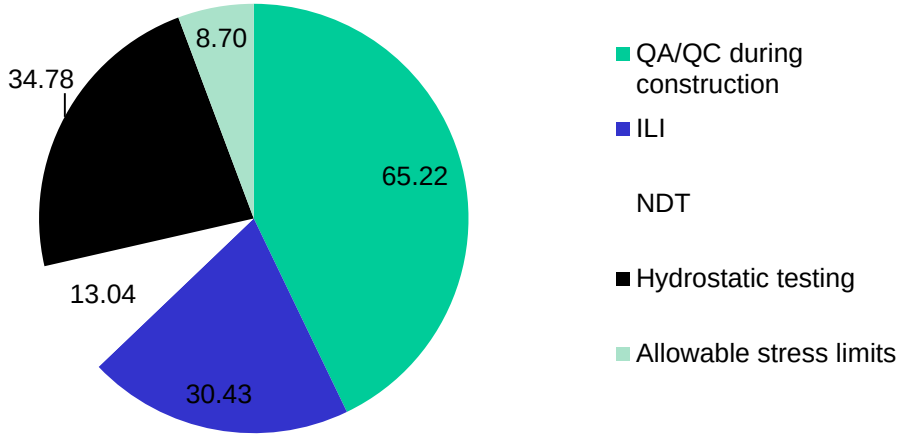


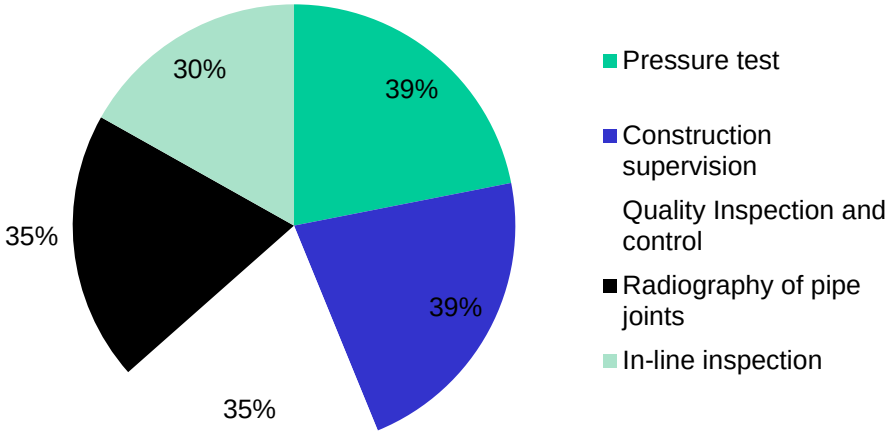
- Cathodic protection (Installation / Operation and Monitoring)
- Inspection by intelligent pig (ILI)
- Consideration in the design (material, route survey, sacrificial anode) and construction
- Specific survey for particular pipeline locations (DCVG / ACVG / PM)

Analysis of Survey Questionnaires (2/5)
- Main excerpts from pipeline integrity threats (2/3)

Actions to mitigate human/operator error, material defects & construction error.

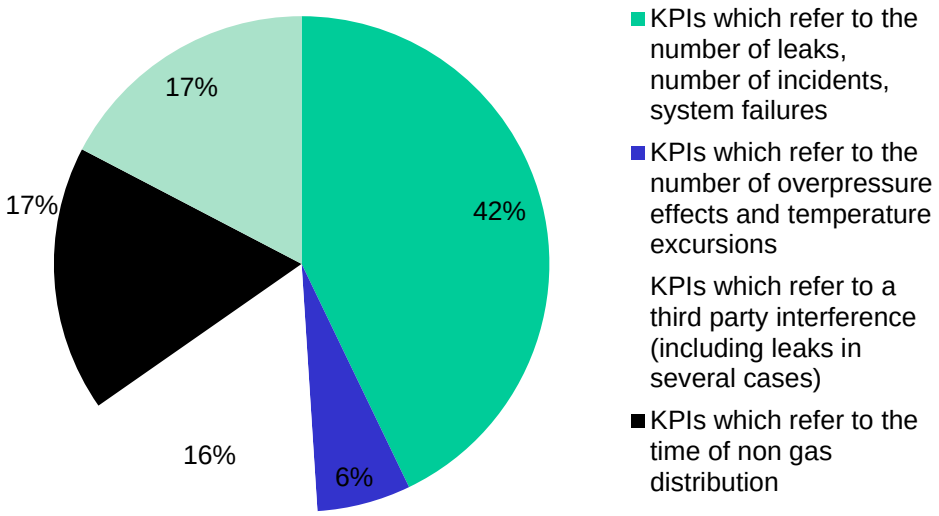


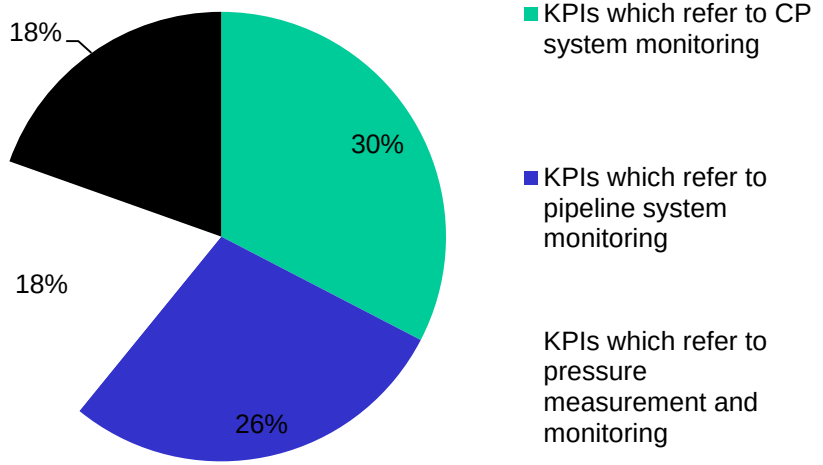




Analysis of Survey Questionnaires (3/5)
- Main excerpts from pipeline integrity threats (3/3)

Usage of lagging and leading KPIs to measure effective of mitigation actions.

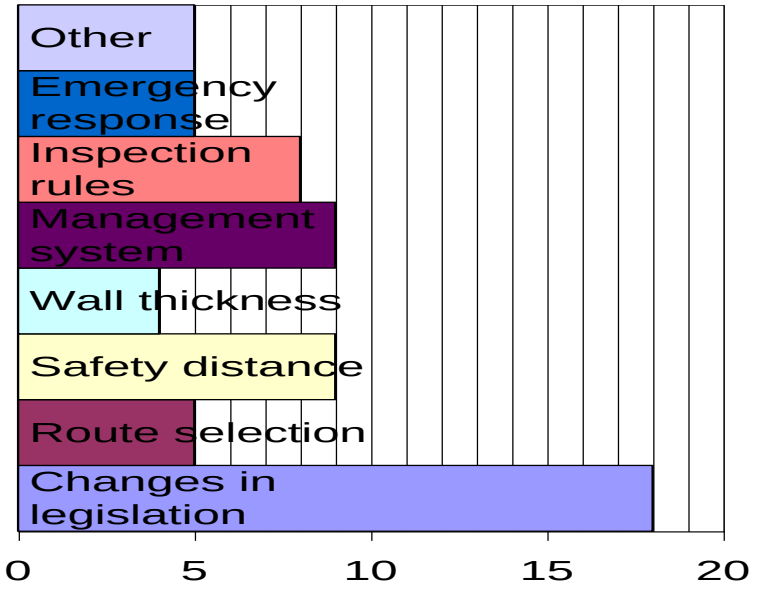




Analysis of Survey Questionnaires (4/5) - Main excerpts from stakeholders influence on regulations

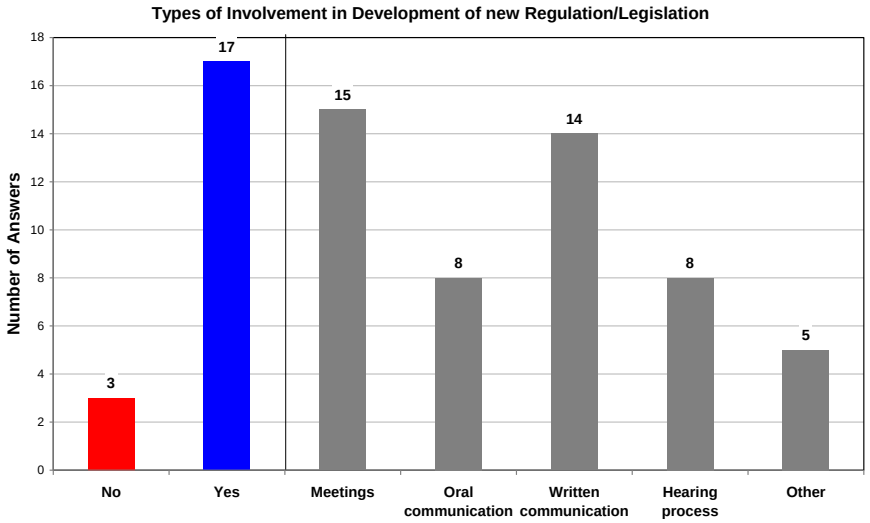
Most countries have changes in safety and environmental legislation, the top three areas are pertaining to safety distances, safety management systems, and inspection rules.

Most changes in legislation are of a prescriptive nature, but there is a trend towards goal setting requirements, for example in old gas countries such as Russia, Germany, and France.



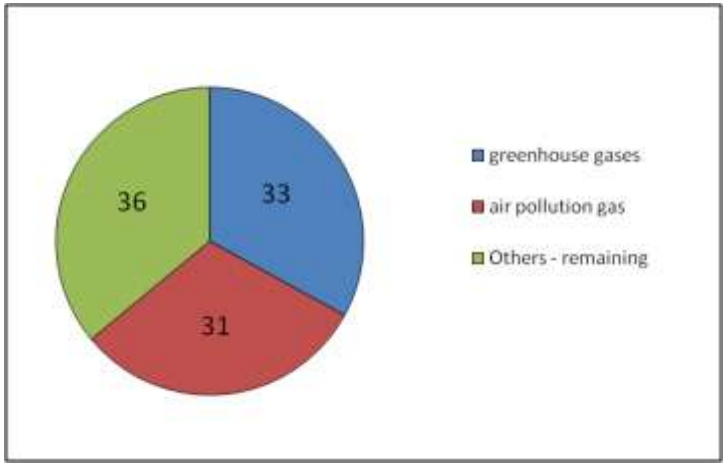
The big majority of transmission companies are involved in the development / setup of new regulative/legislative requirements.

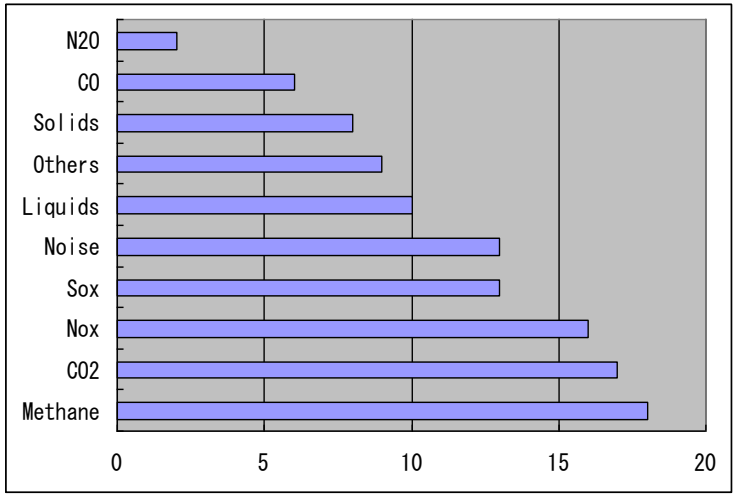
Most frequently takes places by participation in meetings or by written communication.



Analysis of Survey Questionnaires (5/5)
- Main excerpts from environmental footprint

Please specify the name of environmental footprint that your Gas Transmission Company pays attention to in its gas transmission system and rank the items of such footprint in order to importance.

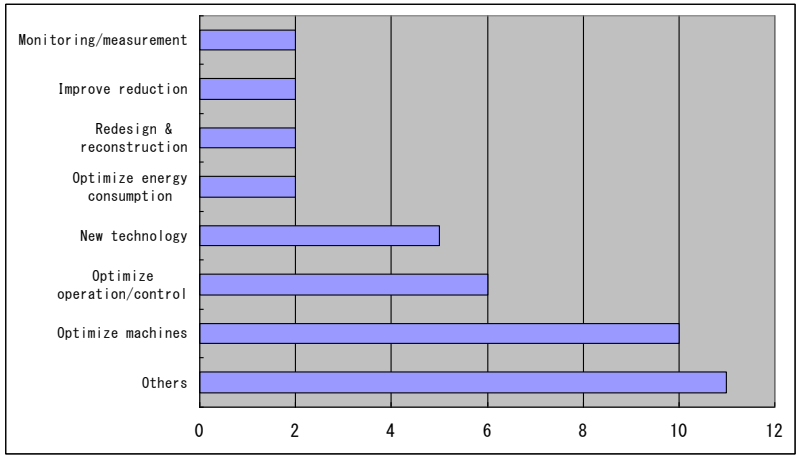




Others : Particulate matter, NH3, Tetrahydrothiopene(THT)

Does your Company have the practices/methodologies/ technologies to reduce the emission of the footprint ?

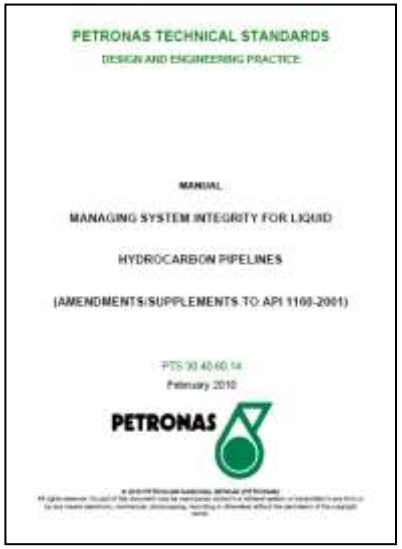
As practices for reduction of emission, optimizations are performed in many companies. New technologies are also introduced in some companies.

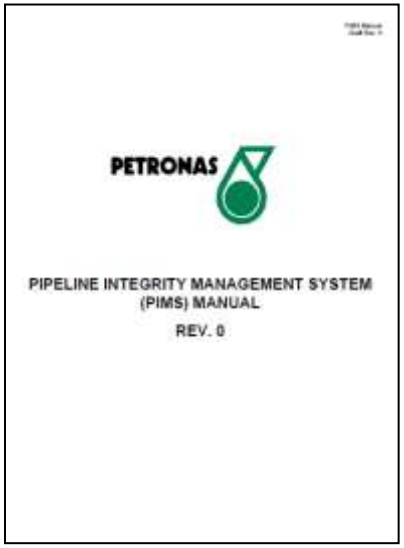


Others : Chemical process, safe handling, N/A

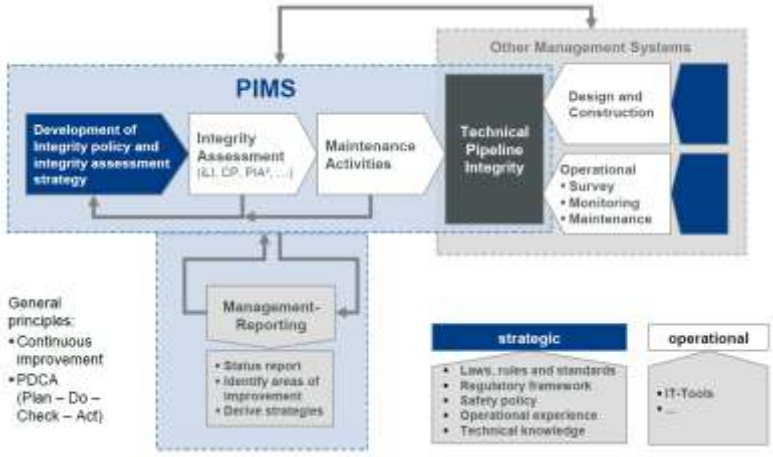
Excerpts of Best Practices, New Technologies & Lessons Learnt (1/9)
- Integrity management codes & procedures (1/2)

1) PETRONAS' Pipeline Integrity Management Standards & Manual





2) The E.ON Ruhrgas / Open Grid Europe approach towards Pipeline Integrity Management



Excerpts of Best Practices, New Technologies & Lessons Learnt (2/9)
- Integrity management codes & procedures (2/2)

3) Pipeline Integrity's Key Performance Indicators (KPIs) per ASME B31.8S-2010

Performance Measures		
Measurement Category	**Lagging Measures**	**Leading Measures**
Process/activity measures	Pipe damage found per location excavated	Number of excavation notification requests, number of patrol detects
Operational measures	Number of significant ILI corrosion anomalies	New rectifiers and ground beds installed, CP current demand change, reduced CIS fault detects
Direct integrity measures	Leaks per mile (km) in an integrity management program	Change in leaks per mile (km)

4) Gassco's Barrier Integrity KPI

Excerpts of Best Practices, New Technologies & Lessons Learnt (3/9)
- Incident databases & public communication (1/2)

1) EGIG's Pipeline Incident Guideline

An extensive analysis of data covering the period 1970 to 2007 has lead to the following overview of failure frequencies:

Period	Number of incidents [-]	Total system exposure [km.yr]	Primary failure frequency [1000 km.yr]
1970-2007	1,172	$3.15.10^6$	0.37
1970-2004	1,123	$2.77.10^6$	0.40
2003-2007	88	$0.62.10^6$	0.14
2007	14	$0.13.10^6$	0.11

2) UKOPA's Pipeline Products Loss Incident Report

The incident frequency over eight consecutive 5-year periods up to the end of 2008 is shown in Table 2.

Period	Number of Incidents	Total Exposure [1000 km.yr]	Frequency [Incidents per 1000 km.yr]
1969 - 1973	30	54.749	0.548
1974 - 1978	23	71.168	0.323
1979 - 1983	25	83.716	0.299
1984 - 1988	44	90.979	0.484
1989 - 1993	20	96.087	0.208
1994 - 1998	9	101.799	0.088
1999 - 2003	5	105.792	0.047
2004 - 2008	7	109.295	0.064

Table 2

Excerpts of Best Practices, New Technologies & Lessons Learnt (4/9)
- Incident databases & public communication (2/2)

3) Public Communication Guideline for Emergency

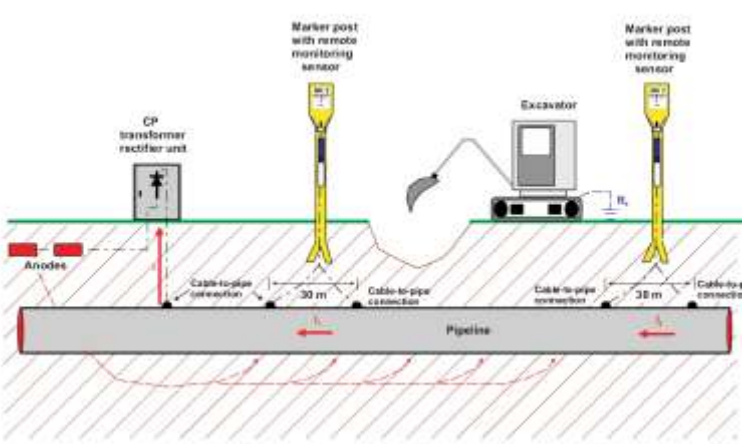
In this way **API RP 1162 Public Awareness Programs for Pipeline Operators** was developed.
Why Public Awareness?

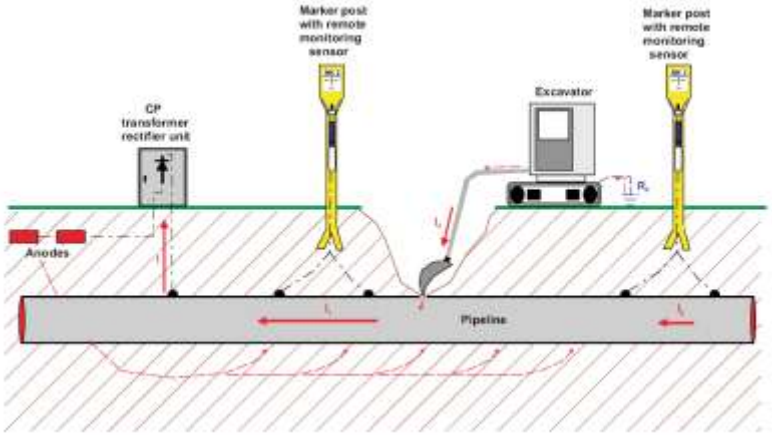
- Reduces third party damages to pipelines
- Reduces injuries & property damage as a result of damages to pipelines
- Educates stakeholders about the hazards of pipeline releases
- Educates stakeholders about recognizing releases
- Educates stakeholders about what to do in the event of a release

Incorporated by reference into US DOT's 49 CFR Parts 192 and 195 in 2005, API RP 1162 is a Recommended Practice (RP) for pipeline operators to use in development and management of Public Awareness Programs.

Excerpts of Best Practices, New Technologies & Lessons Learnt (5/9)
- Specific integrity threats – 3rd party interference (1/2)

1) E.ON Ruhrgas / Open Grid Europe's Detection of Third Party Impact by Remote CP Potential Monitoring





2) Un-manned Aerial Vehicle (UAV) Technology for Pipeline Surveillance and Leak Detection - PETRONAS' S100 UAV

Excerpts of Best Practices, New Technologies & Lessons Learnt (6/9)
- Specific integrity threats – SCC & external corrosion (2/2)

3) TGS' Stress Corrosion Cracking (SCC) Mitigating Practices

i. NACE SP0204

The NACE International Standard Practice for SCC Direct Assessment (DA) (NACE 2008) is the primary industry standard for identifying SCC sites using the four-step Direct Assessment methodology.

ii. ASME B31.8S

The American Society of Mechanical Engineers (ASME) Standard B31.8S (ASME 2004) deals with the integrity management of gas pipelines. One of the threats considered is SCC. Appendix A3 of B31.8S describes an integrity management plan to assess and mitigate the threat from high-pH SCC and, by extension, of near-neutral pH SCC.

iii. CEPA SCC Recommended Practices 2nd Edition

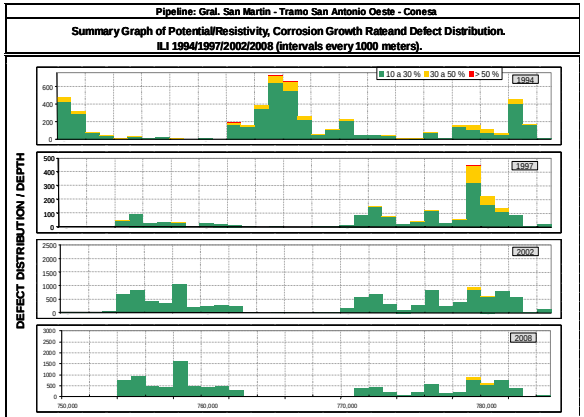
The Canadian Energy Pipelines Association (CEPA) has recently published the 2nd edition of its Recommended Practices (CEPA 2007). The CEPA RP deals exclusively with near-neutral pH SCC and covers all aspects from detection, through assessment, mitigation, and prevention.

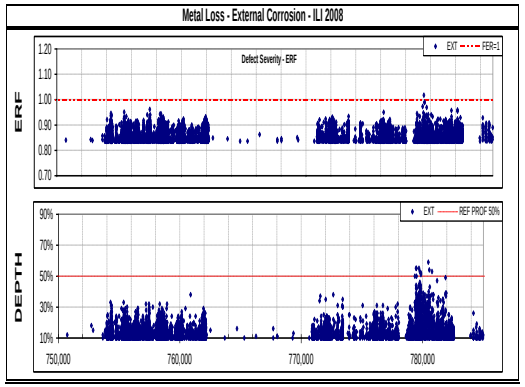
4) NACE Standards on Corrosion Management

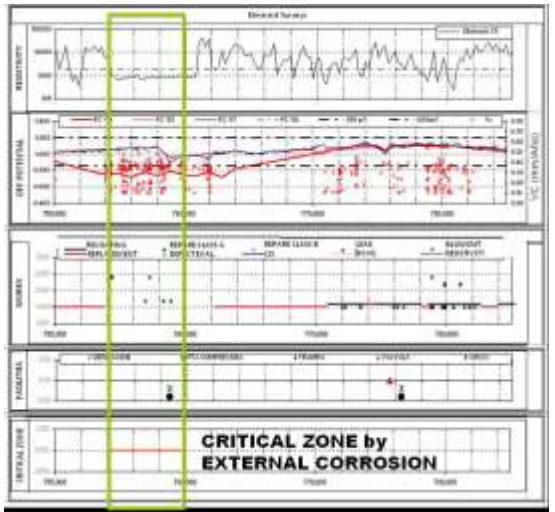
i. NACE Standard Practice 0169 - Control of External Corrosion on Underground or Submerged Metallic Piping Systems

This standard presents acknowledged practices for the control of external corrosion on buried or submerged steel, cast iron, ductile iron, copper, and aluminum piping systems.

5) TGS' Detection of Critical Zones due to External Corrosion







Excerpts of Best Practices, New Technologies & Lessons Learnt (7/9)
- Stakeholders' influence in regulations

1) PETRONAS' Media Response Procedure

The Media Relations Strategies are:

i. Maintain a close and cordial relationship with the media.
ii. Monitor and analyse sensitive news coverage on critical issues that can affect the image and reputation of PETRONAS.
iii. Establish the Company as the authentic source of information by responding in a prompt and accurate manner to the media enquiries.
iv. Coordinate and manage press conferences and interviews with the Company's appointed official spokesperson(s), as and when necessary.

Media Relations guidelines during a crisis

i. All media relations work during a crisis involving the local and foreign press shall be handled by PETRONAS Group Corporate Affairs (GCA).
ii. During a crisis situation the Managing Director/CEO in consultation with GCA, shall take complete charge with the assistance of an authorised spokes person as and when required.
iii. All media releases and statements shall be prepared and issued upon consultation with GCA.
iv. All media enquiries shall be directed to GCA for appropriate response. The responses to the media shall take into consideration every possible implication to Company, especially the legal and business impact.

What constitutes a Crisis

A crisis is any emergency situation or incident that may have impact on operation, people, image, environment and property, and runs the risk of:
- Escalating in intensity/serenity
- Falling under close media/governmental scrutiny
- Interfering with normal operations
- Jeopardising the image of the Company
- Impacting the Company's revenue in any way

Whether an incident will attract Media attention, the following questions should be considered:

i. What is the likely HSE impact of the incident on the surrounding nearby community?
ii. Will the HSE impact escalate and affect other people?
iii. Is the incident the first of its kind, or has it occurred and reported before by the Media?
iv. Are there reports of similar incidents during the past few days?
v. Are journalists calling for detail coverage on the incident?

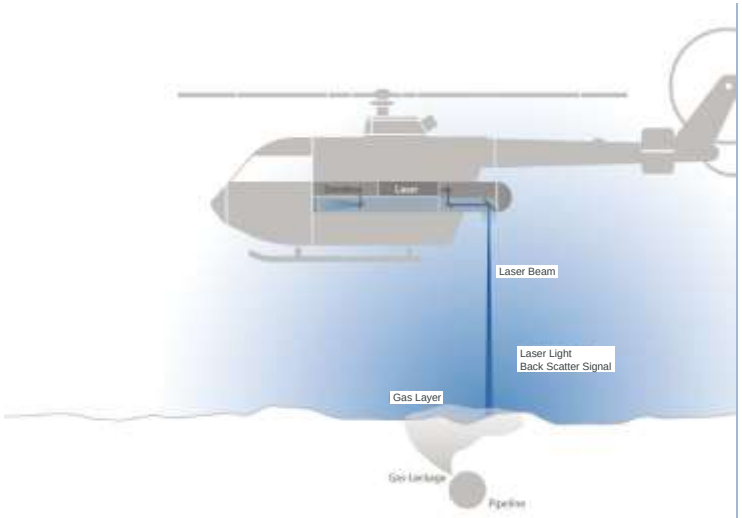
Excerpts of Best Practices, New Technologies & Lessons Learnt (8/9)
- Environmental footprint reduction and mitigation (1/2)

1) Tightness Checks on Gas Facilities and Above-ground Piping Components with GasCam

Principle

The measurement principle is based on FTIR-Spectrometry (Fourier Transformed Infrared Spectrometry). The GasCam is equipped with light sensitive detector elements arranged in a focal plane array. These elements respond to the characteristic emission or absorption of infrared radiation by methane molecules. The filter wheel between the camera lens and the array has several interference filters. The pass band of one of the filters has been selected for the spectral range of methane. The other filter does not match the absorption line of methane and serves as a reference filter. From the comparison of the differently filtered signals, it is possible to draw conclusions as to the presence of methane in the ambient air.

2) Leak Detection in Natural Gas Pipelines by CH_4 Airborne Remote Monitoring (CHARM)



Detection Principle

Natural gas detection systems used for monitoring the tightness of buried pipelines must be capable of identifying even the smallest traces of methane. The CHARM® technology is based on the Differential Absorption Lidar (DIAL) measurement principle, an established active remote sensing method for detecting different gases in the atmosphere. The LIDAR (Light Detection And Ranging) technique involves transmitting a laser light and detecting and analysing the light back-scattered spherically by the atmosphere or a solid target object like the ground.

Excerpts of Best Practices, New Technologies & Lessons Learnt (9/9)
- Environmental footprint reduction and mitigation (2/2)

3) Mobile Flaring

Conclusions

- Pipeline system integrity should be managed from design, construction, testing, commissioning, operation, maintenance & abandonment using sound practices according to proven codes, standards, procedures, best practices and technologies.
- Managing pipeline integrity mainly is about managing risk of failure i.e. leak and/or rupture and ensuring avoidance of leak and/or rupture by having appropriate control and applying mitigation measures so that the risk is controlled within the As Low as Reasonably Practicable (ALARP) region.
- Pipeline operators uses lagging and leading KPIs to measure the effectiveness of threats reducing/mitigating measures.
- In formulating safety & environmental regulations, stakeholders i.e. the government authorities, the public, the pipeline operators and the media need to play its own individual role so that the regulations can be of a 'win-win' situation taking into considerations of safety and economic progress of the host country.

Recommendations

- We recommend for pipeline operators to adopt the best practices, new technologies and lessons learnt in accordance to your organisation's requirement and as you see fit.
- The investigation/study of WOC 3's SG 3.2 in 2009-2012 triennium sets an important 'scene' for the 2012-2015 triennium as the triennium will look into the details of a Pipeline Integrity Management System focusing on documentation (manuals, procedures, guidelines), technical & behavioral competencies of managers, engineers, technicians, and software/tools to assist personnel in managing integrity of pipeline system.