TRAPIL

SOCIÉTÉ DES TRANSPORTS PÉTROLIERS PAR PIPELINE

How to deal with a large amount of features from an in-line inspection ?

COPEX 2010
BRUSSELS, March 25 & 26

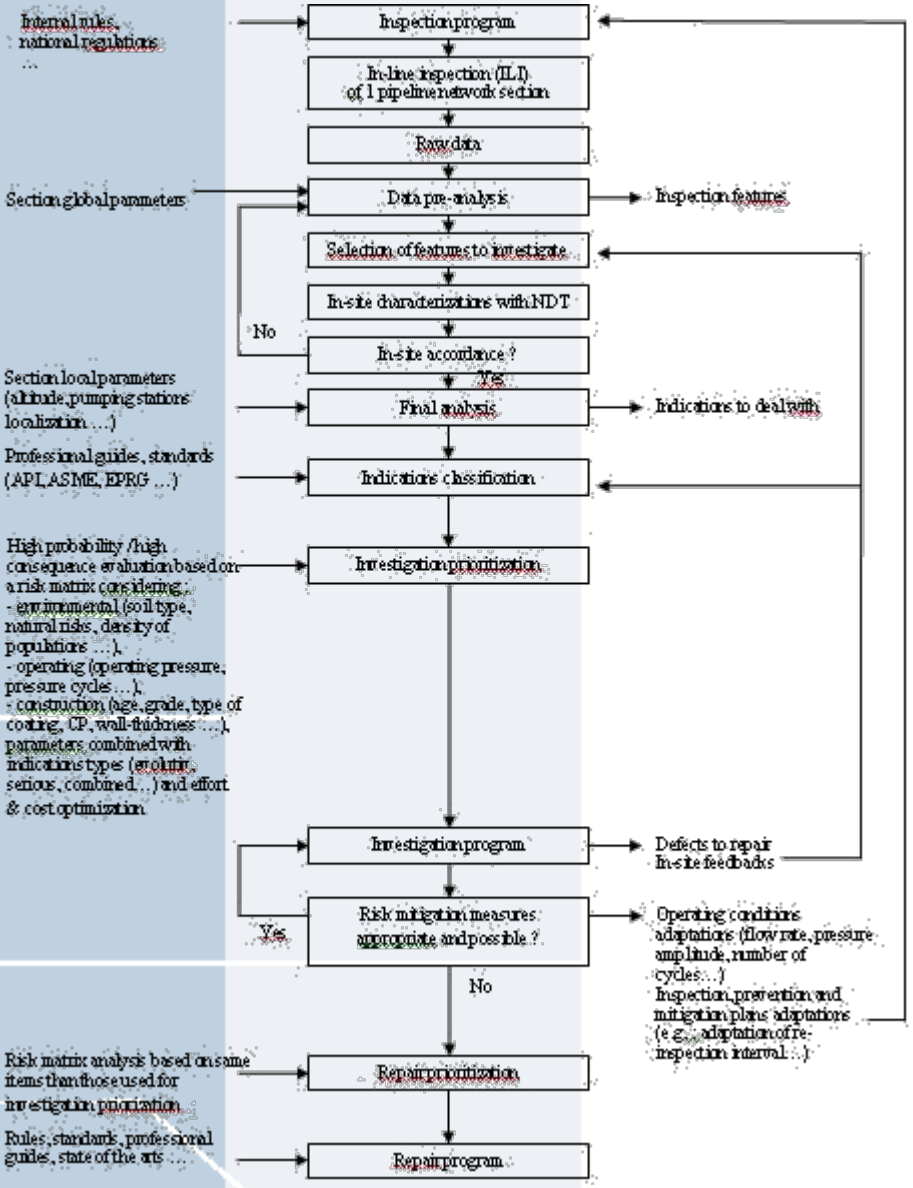
INTRODUCTION

Following an important increase of the in-line inspection tools performances, pipeline operators have today to deal with a large amount of features (geometric, metal loss, cracks features …).

But how to succeed in dealing with all of these features with an effectiv optimization of technical and economical aspects, with the permanent concern of goods and human safety and environment preservation ?

The main purpose of this presentation is to suggest guidelines and has not the pretention to give a unique way simply because each pipeline operator deals with its own strains and specificities …

ILI DATA EXPLANATION ITERATIVE PROCESSUS



ITERATIVE STEPS OF AN IN-LINE INSPECTION ANALYSIS.ppt

ILI DATA EXPLANATION ITERATIVE PROCESSUS

Internal rules,
national regulations
…

Inspection program

In-line inspection (ILI)
of 1 pipeline network section

Raw data

Section global parameters

Data pre-analysis

Inspection features

Selection of features to investigate

In-site characterizations with NDT

No

In-site accordance ?

Yes

Section local parameters
(altitude, pumping stations
localization …)

Final analysis

Indications to deal with

Professional guides, standards
(API, ASME, EPRG …)

Indications classification

High probability / high
consequence evaluation based on
a risk matrix considering :
- environmental (soil type,
natural risks, density of
populations …),
- operating (operating pressure,
pressure cycles…),
- construction (age, grade, type of
coating, CP, wall-thickness …),
parameters combined with
indications types (evolutiv,
serious, combined…) and effort
& cost optimization

Investigation prioritization

Investigation program

Defects to repair
In-site feedbacks

Risk mitigation measures
appropriate and possible ?

Yes

Operating conditions
adaptations (flow rate,
pressure amplitude, number of
cycles…)
Inspection, prevention and
mitigation plans adaptations
(e.g. : adaptation of re-
inspection interval…)

No

Risk matrix analysis based on same
items than those used for
investigation priorization

Repair prioritization

Rules, standards, professional
guides, state of the arts …

Repair program

IN-SITE CHARACTERIZATIONS

In-site NDT and measurements :

- **MPI,**

- **TOFDT,**

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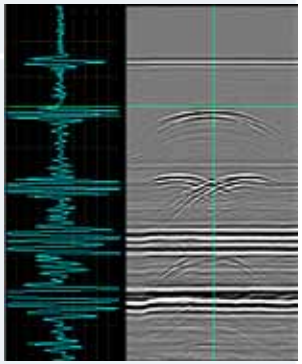
- **Phased Array …**



IN-SITE CHARACTERIZATIONS AND DATA PRE-ANALYSIS COMPARISON LOOP

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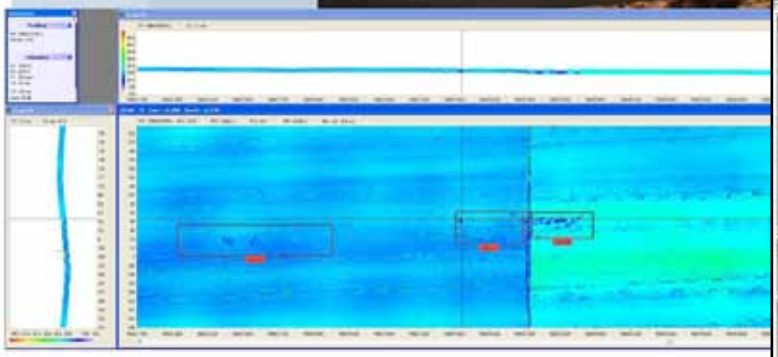
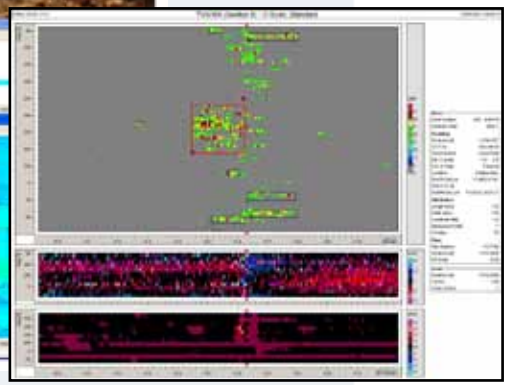
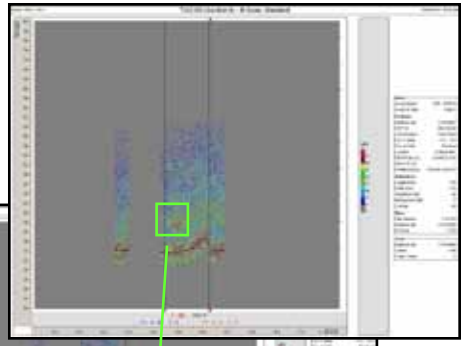






Priority	Area No.	Pipe No.	Distance [m]	Feat. Type	Comment	Rad. Pos	Len [m]							
3	007 - 002464	936	9352.024	Crack-Like		ext								
1	014 - 040917	2029	20071.397	Crack-Like	at GW	ext								
x	017 - 066283	2573	25403.222	Mill Anomaly		ext								
3	017 - 064375	2573	25409.479	Crack-Like		ext								
x	020 - 014818	3035	29632.656	Crack-Like	at GW	ext								
2	020 - 023124	3035	29633.234	Crack-Like		ext								
x	020 - 023125	3035	29633.690	Crack-Like		ext								
2	020 - 023126	3035	29634.384	Crack-Like		ext	400	42	245	1.8	1.0-2.0		In Base Mat.	6.5
x	020 - 014912	3035	29634.988	Crack-Like		ext	147	32	224	1.5	1.0-2.0		In Base Mat.	6.5
x	020 - 015156	3035	29640.520	Mill Anomaly		ext	28	19	310	1.3	1.0-2.0	27	In Base Mat.	6.5
x	020 - 015181	3035	29641.402	Mill Anomaly	at GW	ext	165	72	153	0.8	<1.0	69	In Base Mat.	6.5

PROFESSIONAL GUIDES, STANDARDS & LABORATORY TESTINGS

General standards as API 579 ”Fitness For Service”, professionnal guides

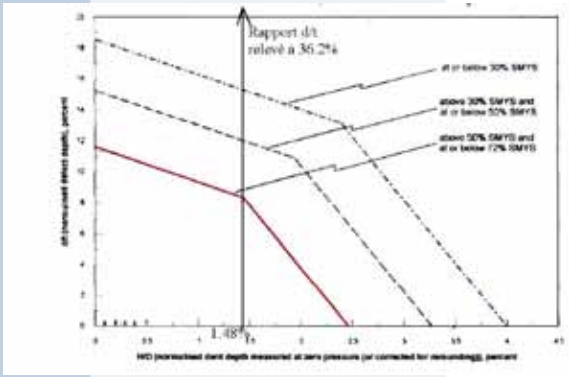
or specific standards for :

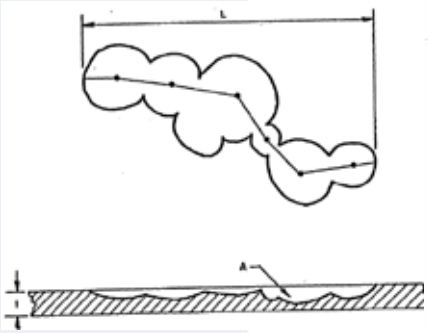
- **Cracks with models :**
  - **Corlas,**
  - **PAFFC,**
  - **CANMET …**

- **Metal loss ERF calculations with :**
  - **RSTRENG Effective Area or 0.85 dL,**
  - **ASME B31G,**
  - **DNV RP-F101,**
  - **BS7910,**
  - **SHELL 92 …**

- **Dents calculations with :**
  - **ASME B31-4 and B31-8,**
  - **EPRG (especially for combined dents),**
  - **API 1160 …**

and also laboraty testings (rupture pressure, fatigue testings ...) for particular defects …





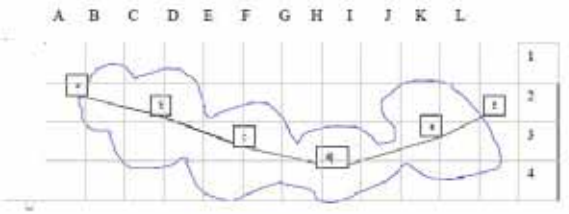
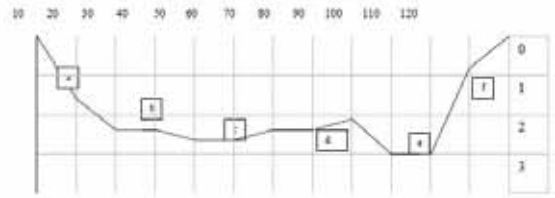


Schéma d'une corrosion et du quadrillage

	A	B	C	D	E	F	G	H	I	K	L	M
1	0	0.8	0.5	0.8	0	0	0	0	0	0	0	0
2	0	1.8	2.5	2.5	1.0	1.2	0	0	0.8	2.5	2.2	0
3	0	1.0	2.5	2.4	2.6	2.7	2.3	2.4	2.1	2.8	2.5	0.8
4	0	0	0.4	0.5	1.8	1.8	1.9	2.5	1.9	0.7	0.5	0.5

Tableau de relevé des manques d'épaisseur



Profil avec report des points les plus profonds

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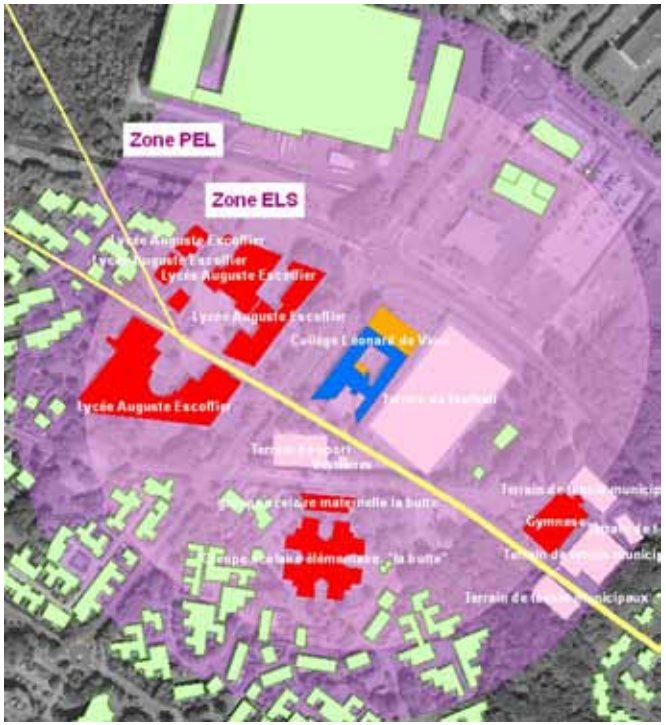
ENVIRONMENTAL PARAMETERS

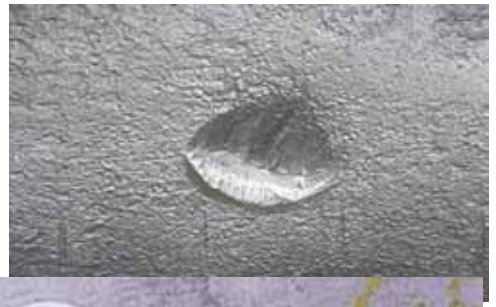


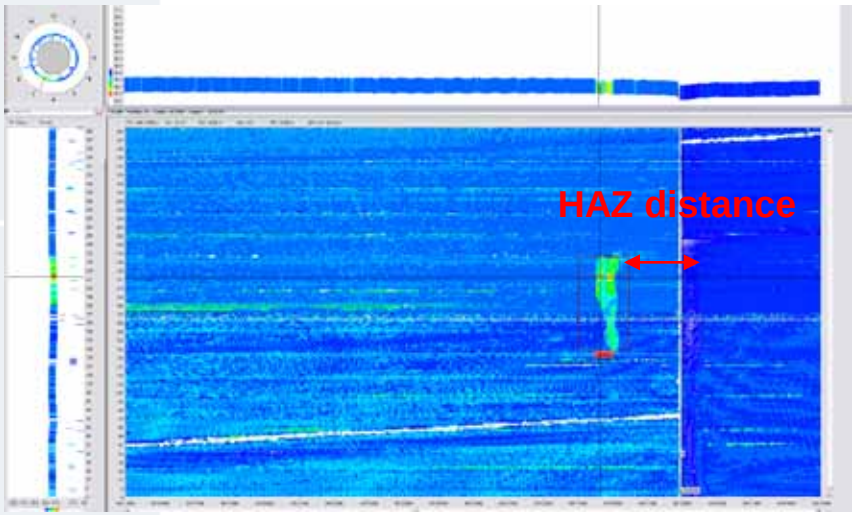
- natural risks (sysmic areas, erosion …),
- high-density of population areas,
- road/rail/water ways crossings,
- soil types and characteritics (sand, rocks …),
- buried depth …

INDICATION/DEFECT TYPES

Elements to take into account :

- design defects (lack of thickness …),
- defects with cinetics (cracks, …),
- combined defects,
- defects on welds or in HAZ
- …

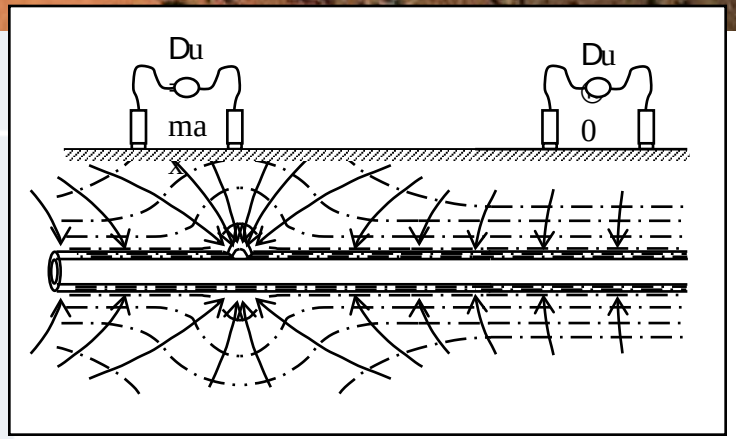




DATA GATHERING

All available data are usefull like :

- survey informations,
- incident and operation historic,
- CP monitoring,
- metallographic prints,
- CIPS, DCVG …



MITIGATION MEASURES

Mitigation measures may consist in :

- operating conditions adaptations (flow rate, pressure amplitude, number of cycles …),
- inspection and/or survey plans adaptations (e.g. : adaptation of re-inspection interval in order to estimate a corrosion evolution speed …)
- technical adaptations (e.g. : anodic field implementation…)
- …

Thank you for your attention

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