



THE MORE YOU SWEAT IN PEACE

THE LESS YOU BLEED IN WAR

- CHIANG KAI SHEK

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Pipeline integrity measures at design & construction stage

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Common Operators' Problems

1. Unknown status and fullness of operation data and history.
2. Lack of integral central information system (Database, Experts and Geographical system).
3. Absence of Risk Management System based on business safety and environment requirements.
4. Missing Integral Monitoring system of the pipeline network.
5. Insufficient systematic procedures and regulations for surveying and gathering of existing information.
6. Insufficient crisis mitigation plans.
7. Inaccurate estimation of HSE impact.

PIMS takeaway

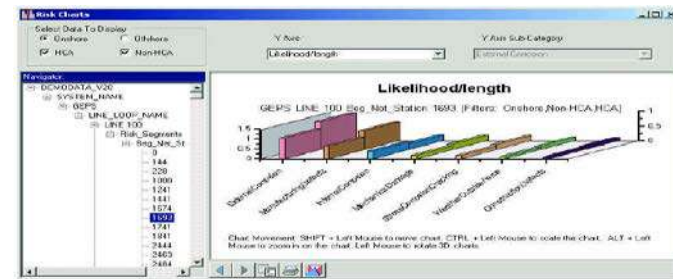
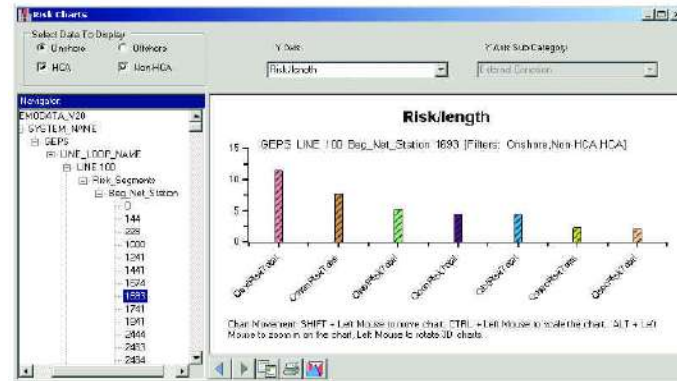
- Efficient storage, control and access to accurate information.
- Safer operation and long-term efficiency. Managing pipeline location, equipment and facilities. Better data distribution for decision makers.
- Reduced operation cost and improved company performance.
- Pipeline risk assessment Integrity management planning.

Process of the Pipeline Integrity Management

- 1. Determine the major threats and risks to the integrity of their pipelines.**
- 2. Develop plans to address the identified threats.**
- 3. Conduct appropriate inspections to determine the condition of the pipeline.**
- 4. Assess the results of the inspections.**
- 5. Update the risk assessments and management plans.**

Risk Assessment & Management Plans functionality

- Determine risk ranking based on threats and consequences to ensure compliance with regulations
- Identify areas of potential risk to prioritize mitigation measures
- Manage and refine risk equations to optimize performance
- Perform “what if?” scenarios to assess the impact of alternate inspection and maintenance strategies
- Allow informed decisions regarding maintenance and capital expenditure schedules and budgets
- Create a risk time-line for future trend analysis and performance measurement
- Exchange platform that is moving towards open source applications.



Scenario Analyst Manager

Name: Fault Injection
 Description: Risk Equation: FLEI_Demo
 Group: HSA

Name	Description	Type	Expression	EvaluateOnly	DisplayOnce	Visible	GroupItem	Weight
ExternalCost		EVALUATE	2*Mag1Pr	1		<input type="checkbox"/>		1
InternalCost		EVALUATE	3*Mag1.5*2	2		<input type="checkbox"/>		1
StructuralCost		EVALUATE	1*Mag1Pr*4	3		<input type="checkbox"/>		1
Manufacturing		EVALUATE	15*Mag1Pr	4		<input type="checkbox"/>		1
Manufacturing		EVALUATE	15*Mag1Pr	5		<input type="checkbox"/>		1
WeldingMag		EVALUATE	2*Mag1Pr*6	6		<input type="checkbox"/>		1
Offshore		EVALUATE	2*Mag1Pr*7	7		<input type="checkbox"/>		1
Probabilistic		EVALUATE	Exp[1*Mag1Pr]	8		<input type="checkbox"/>		1
Life Cycle		EVALUATE	3*Mag1Pr*9	9		<input type="checkbox"/>		1
Environmental		EVALUATE	3*Mag1Pr*10	10		<input type="checkbox"/>		1
Financial		EVALUATE	3*Mag1Pr*11	11		<input type="checkbox"/>		1
Consequence		EVALUATE	Exp[1*Mag1Pr]	12		<input type="checkbox"/>		1
Risk		EVALUATE	4*Exp[1*Mag1Pr]	13		<input type="checkbox"/>		1
NonHCCost	Cost	EVALUATE	0	131	100	<input type="checkbox"/>		1
NonPCCost	Cost	EVALUATE	0	132	100	<input type="checkbox"/>		1
NonHCCost	Cost	EVALUATE	0	133	100	<input type="checkbox"/>		1
NonPCCost	Cost	EVALUATE	0	134	100	<input type="checkbox"/>		1
NonHCCost	Cost	EVALUATE	0	135	100	<input type="checkbox"/>		1
IncreasedPot	Cost	EVALUATE	0	136	100	<input type="checkbox"/>		1
MitigationCost	Cost	EVALUATE	Exp[1*Mag1Pr]	137	100	<input type="checkbox"/>		1

Determining major threats (time dependent & independent)

Terrain

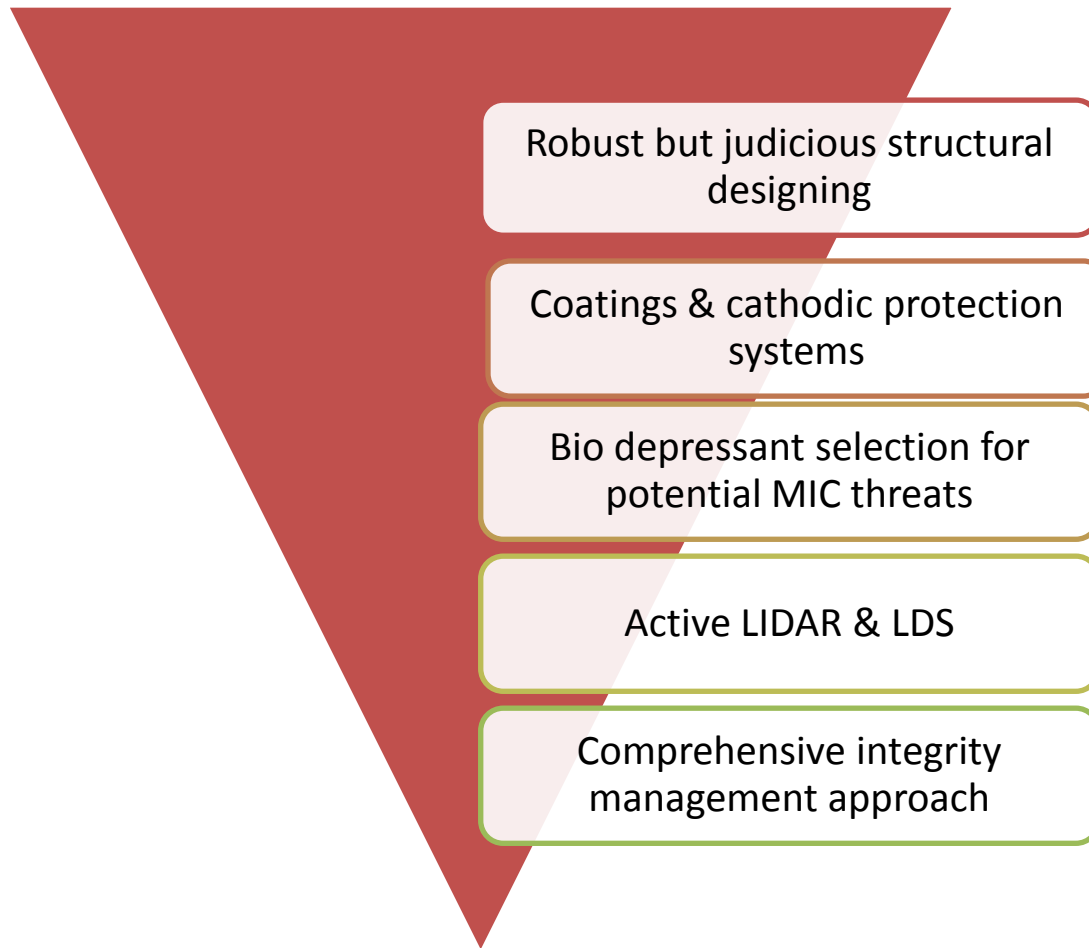
Soil
morphology

Product
chemistry

Third party
damage

Wear & tear

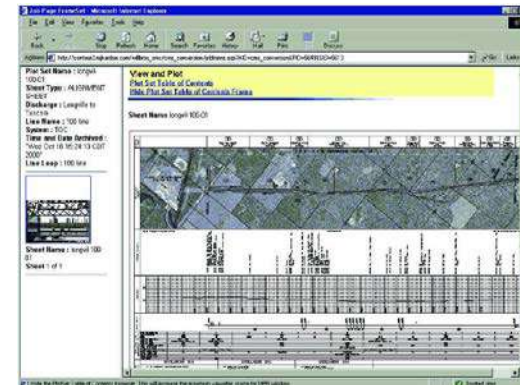
Planning threat mitigation



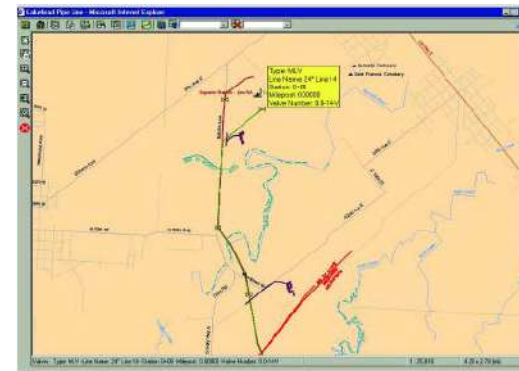
Where?



Reviewing and reporting within a GIS environment



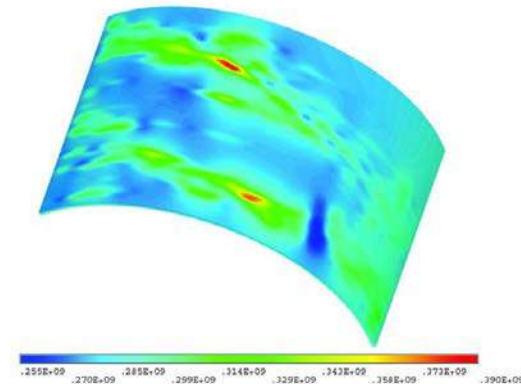
Create accurate alignment sheets for review and analysis.



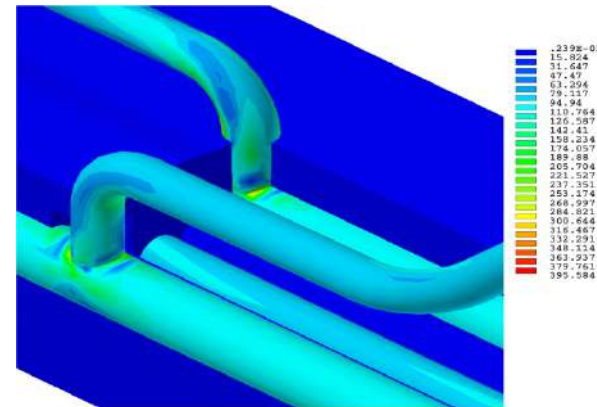
Functionality of **Structural Analysis**

(3D nonlinear structural analysis and evaluation of remaining life of pipeline segments):

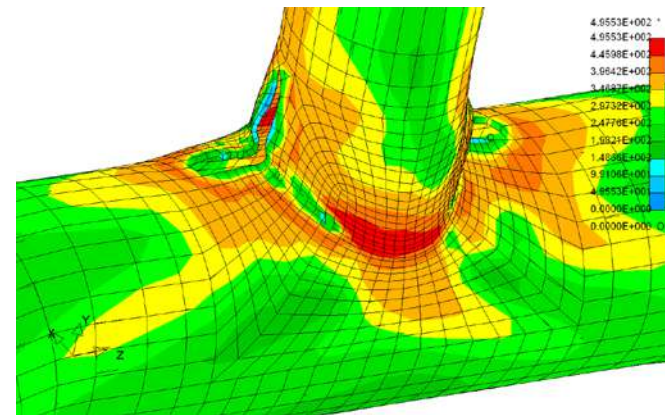
- 1) Nonlinear stress state analysis of defected (dead leg caverns, erosive thinning of pipe walls, weld seam defects, dents, excavated segments, included cold-bent segments, shifted from design position)
- 2) High accuracy calculation of burst pressure and maximum safe pressure (considering regulation safety factor) for each defected or critical segment)



3) Current monitoring of critical pipeline segments strength using computation structural simulators.

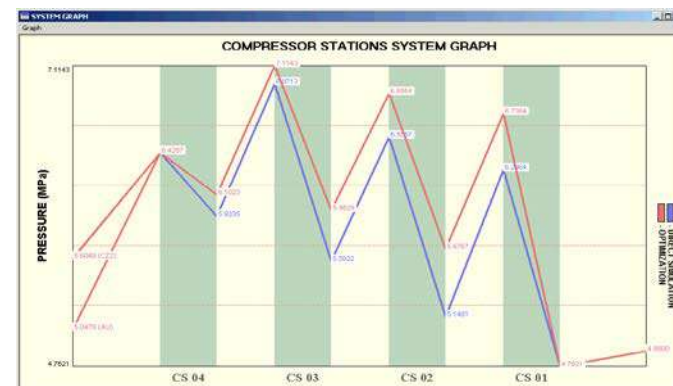
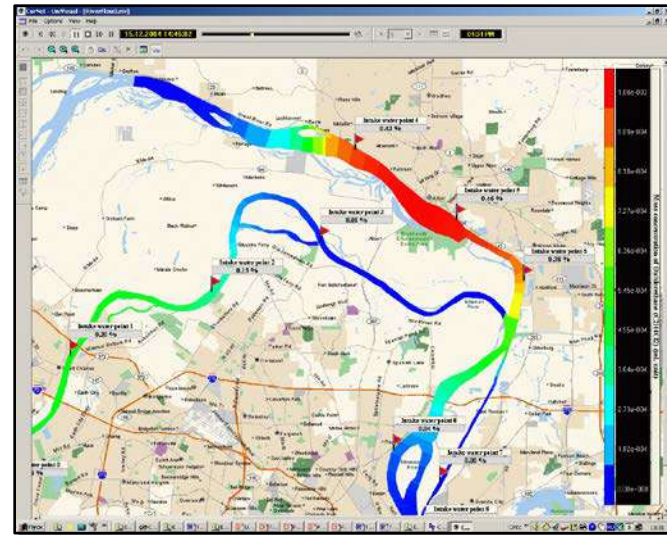


4) Forecasting estimation of nonlinear stress state behavior of defective segments and reduction of their safety factors due to increase of defects; calculation of remaining life, etc.



Risk assessment & management plans must cover

- Short-term and long-term forecasting safety of pipeline network operation based on direct high accuracy simulation methods of pipeline operation and risk assessment methods;
- Scientifically justified optimal ranking of pipeline network segments in terms of their repair and replacement according to data of integrated numerical structural analysis of pipelines and possible consequences caused by these pipeline ruptures (taking into account fire risk, debris and toxic effect on personnel & residents).



SUMMARY

- Think of integrity management as a cradle to grave process.
- Accept inspection as a long term profit centre goal rather than a short term cost centre necessity.
- Judiciously make room for inspection regimes during concept, design & construction phases.
- Have the right people & the right processes would follow.
- Above all the intent matters.

Questions?

Thank you