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Google earth

Technology Benefits & Summary

Technology benefits

- Independent from system operation status
- High sensitivity
- Physical detection (no calculation)
- Pin point location of leakages
- 24/7 monitoring system
- Event Log and report generation
- Modular and expandable
- Tested by many third party companies
- Intrinsically Safe

Questions ?

Thank You

MODELING DRY GAS AND WET GAS PIPELINE CORROSION INTEGRITY USING NACE ICDA STANDARDS

Jiteen Tilekar *
Amitabh Chaturvedi
Honeywell Process Solutions

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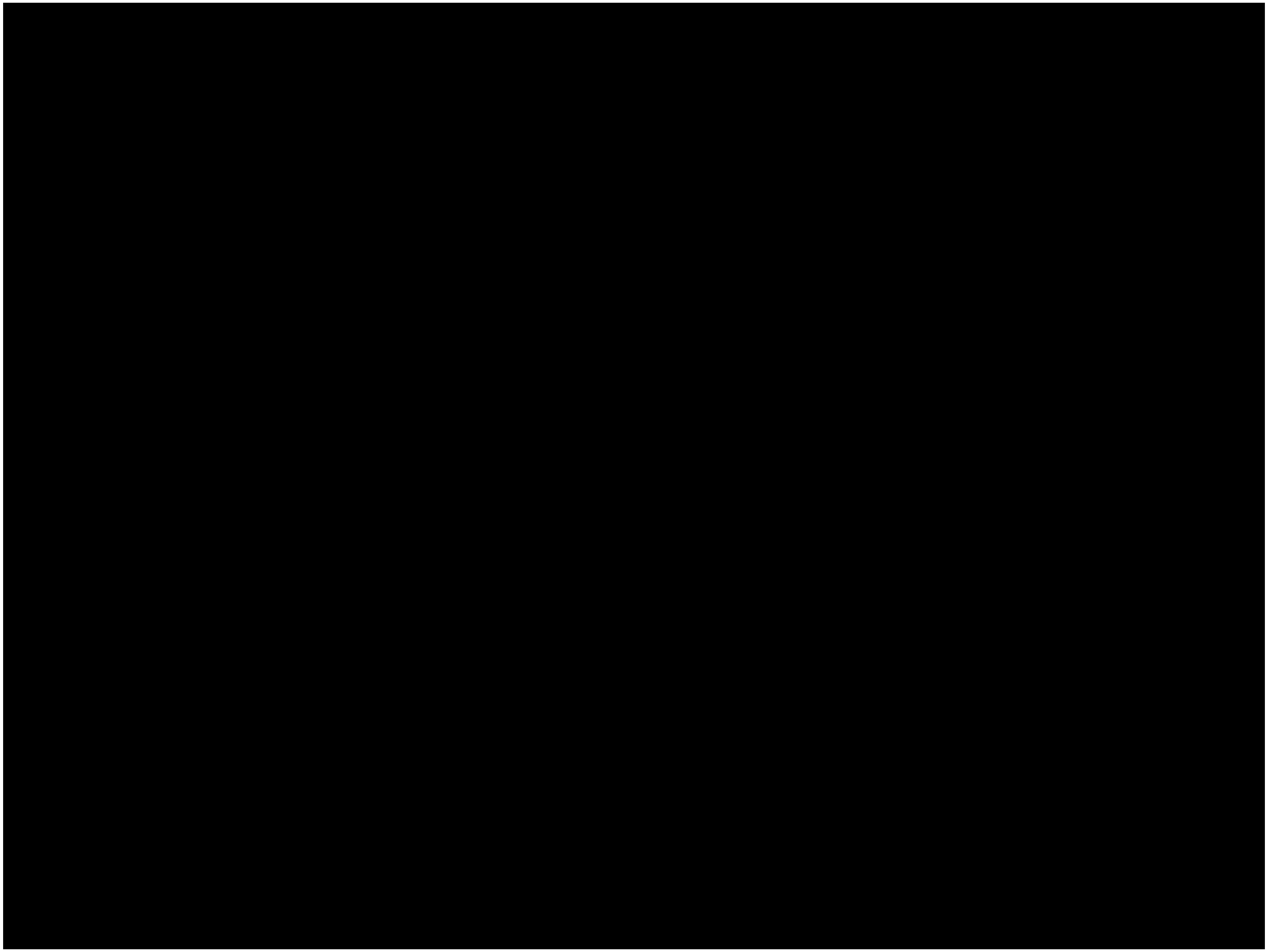
Presentation Outline

- Asset Integrity using Pipeline Protection
- Dry Gas ICDA (DG-ICDA) - NACE SP0206 – 2006
  - Natural Gas Transmission Pipeline Systems
- Wet Gas ICDA (WG-ICDA) - NACE SP0110 – 2010
  - Natural Gas Production Pipeline Systems
- Problems for Upstream Industry
- Solution
- Benefits
- Summary

Corrosion!



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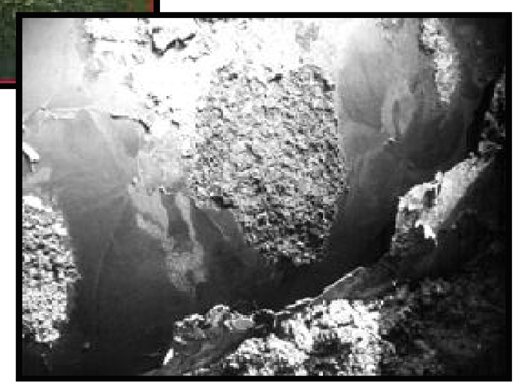
Asset Integrity – Why should you care?

Opportunity	Value
Failure prevention/risk reduction	$10 to $35 million (CDU overhead)
	$60 million each (sour water system)
Reduce lost production	~$100,000 per day
Steel/alloy upgrade	$1 to $10 million
Prioritize inspections	$1M+ to postpone smart-pig runs / 20% reduction in inspection costs
Reduce Unplanned Shutdown Costs	>$240,000 per day
Reduce Capital Materials Costs	~$17million per plant
Optimize Inhibitor Dosage	20-60% Savings on $250K to $2M contracts

Note: Data referred are from survey done by NACE International

Internal Corrosion of Pipelines

- Internal and external corrosion results in up to 50 percent of all pipeline leaks (upstream and midstream)
- Over 20 percent of pipeline leaks result from corrosion
- Internal corrosion accounts for between 70 and 90 percent of corrosion failures
- Direct assessment (DA) has been developed for the purpose of performing integrity verifications for pipelines that are not able to accept inline-inspection (ILI) tools



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What causes Internal Corrosion in Pipelines?

- Water accumulation at low spots and high inclinations
- Phase separation in case of multiphase pipelines leading to water wet sections in pipelines
- Top of the line corrosion in case of condensing water
- Accumulation of solids in case of multiphase and liquids pipeline leading to under-deposit corrosion
- Flow regime changes leading to water separation, solids deposition
- Presence of water (electrolyte) is a necessary but not sufficient condition for corrosion to occur
- Presence of acid gases such as CO_2 and H_2S and other corrodents causes corrosion

Need for ICDA

- Some pipelines are not able to accept inline-inspection (ILI) tools
- In some cases performing ILI may be cost prohibitive or may require disruption of critical services
- ICDA has been developed for the purpose of performing integrity verifications on such pipelines
- Initially driven by a need to meet pending changes to U.S. transmission pipeline regulations in the face of major failures
- Using the latest developments in technology, flow modeling and corrosion prediction, ICDA can be used to enhance integrity verification
- Properly performed ICDA leads to substantial cost savings from reduced inspection of entire pipelines and failure-free operations

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Dry Gas ICDA (DG-ICDA) – NACE SP0206

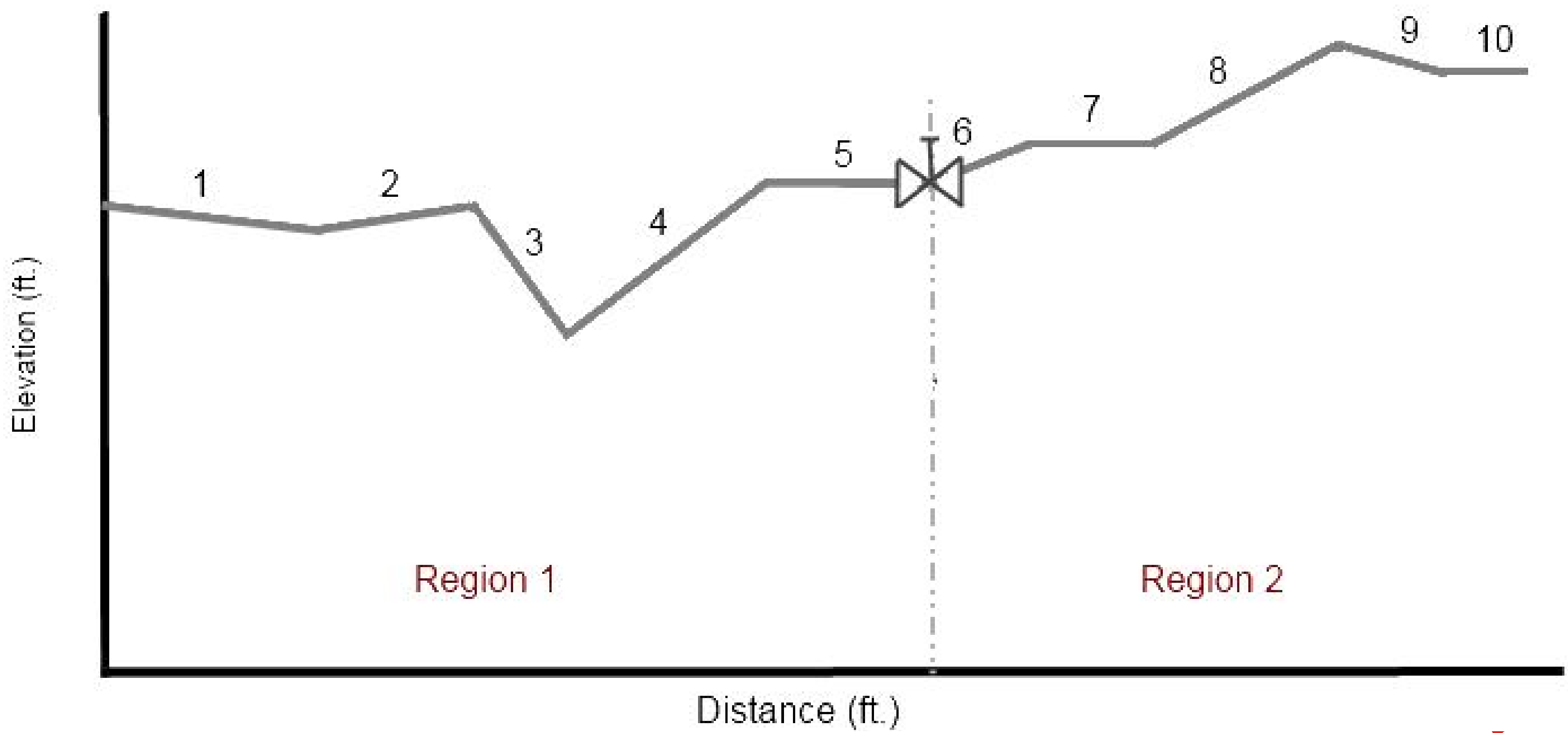
- Pre-Assessment
  - The pre-assessment step determines whether DG-ICDA is feasible for the pipeline being evaluated, and identifies DG-ICDA regions.
- Indirect Inspection
  - DG-ICDA indirect inspection uses flow modeling results to predict the locations most likely to have suffered internal corrosion within each DG-ICDA region.
  - The indirect inspection step relies on the ability to identify locations most likely to accumulate water and is applicable to pipelines in which stratified flow is the primary liquid transport mechanism.

Dry Gas ICDA (DG-ICDA) – Continued..

- Detailed Examination
  - Determines whether internal corrosion exists at the locations selected in the indirect inspection step.
  - Uses the findings of indirect inspection to assess the overall condition of the DG-ICDA region.
- Post-Assessment
  - Assess the effectiveness of DG-ICDA. The effectiveness of the DG-ICDA process is determined by the correlation between detected corrosion and the DG-ICDA predicted locations.
  - Determine the reassessment intervals to maintain pipeline integrity.

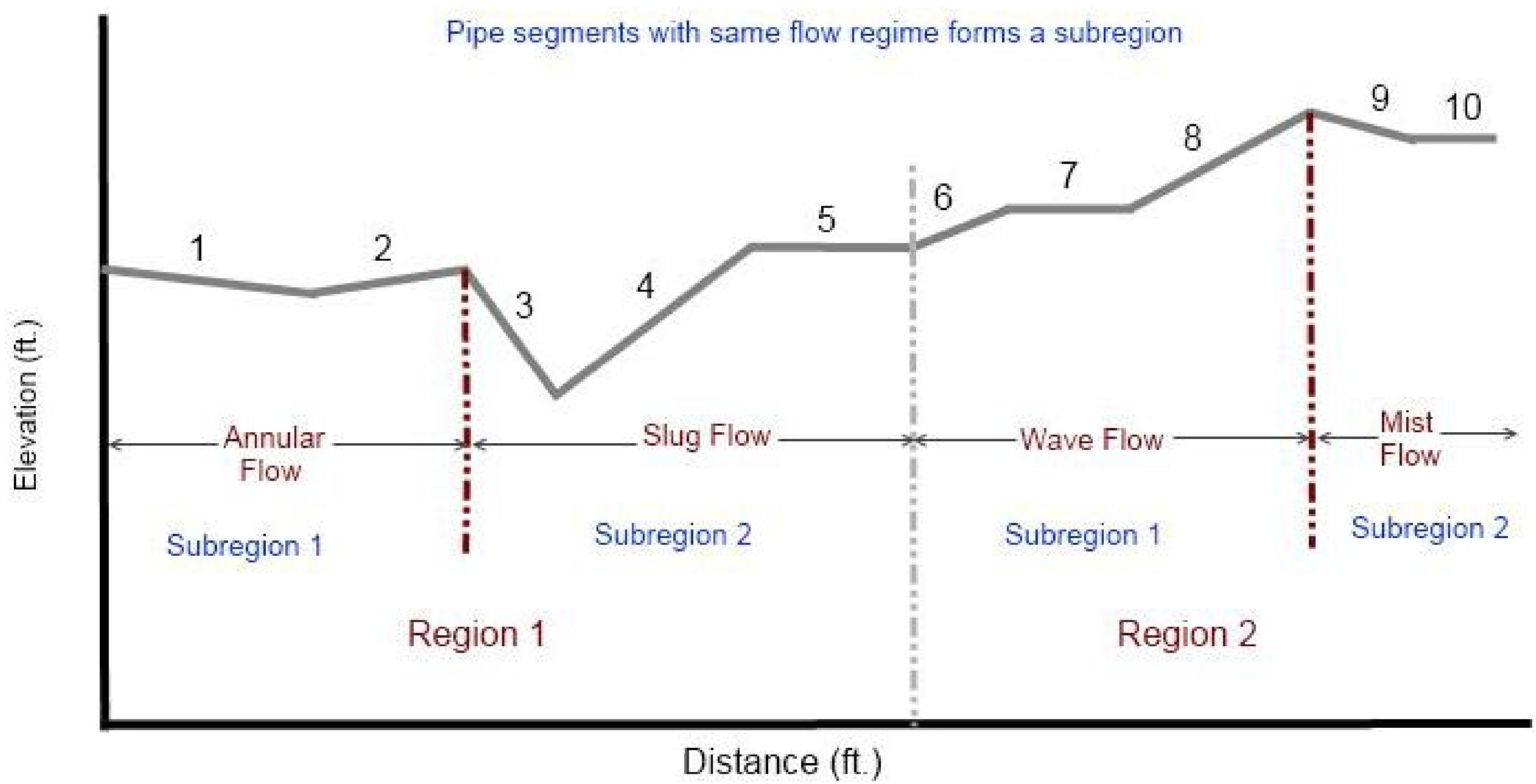
WG-ICDA: Preassessment

- Aims to identify WG-ICDA regions from pipeline
- Regions are simply a groups of pipe segments
- WG-ICDA region: a portion of pipeline between each point of input or withdrawal of process fluids



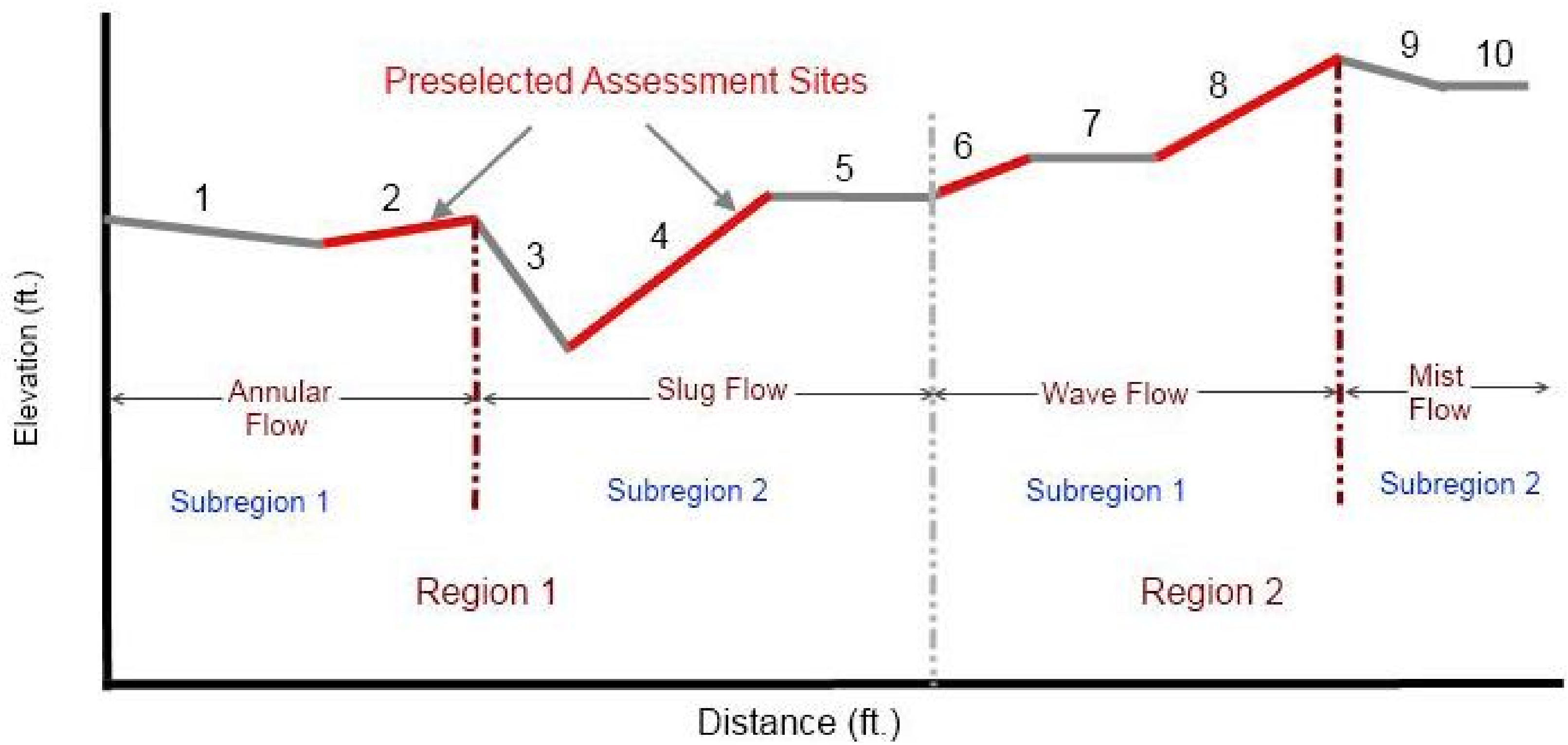
WG-ICDA: Indirect Inspection

- Objective 1:
  - Identify subregions within each WG-ICDA region
  - Subregion formation is a function of flow regimes obtained through multiphase flow modeling.



Indirect Inspection – Contd..

- Objective 2:
  - Identify Preselected Assessment Sites based on liquid holdup and wall loss percentage values.
  - Segments with values greater than those of subregion are identified as Preselected Assessment Sites.



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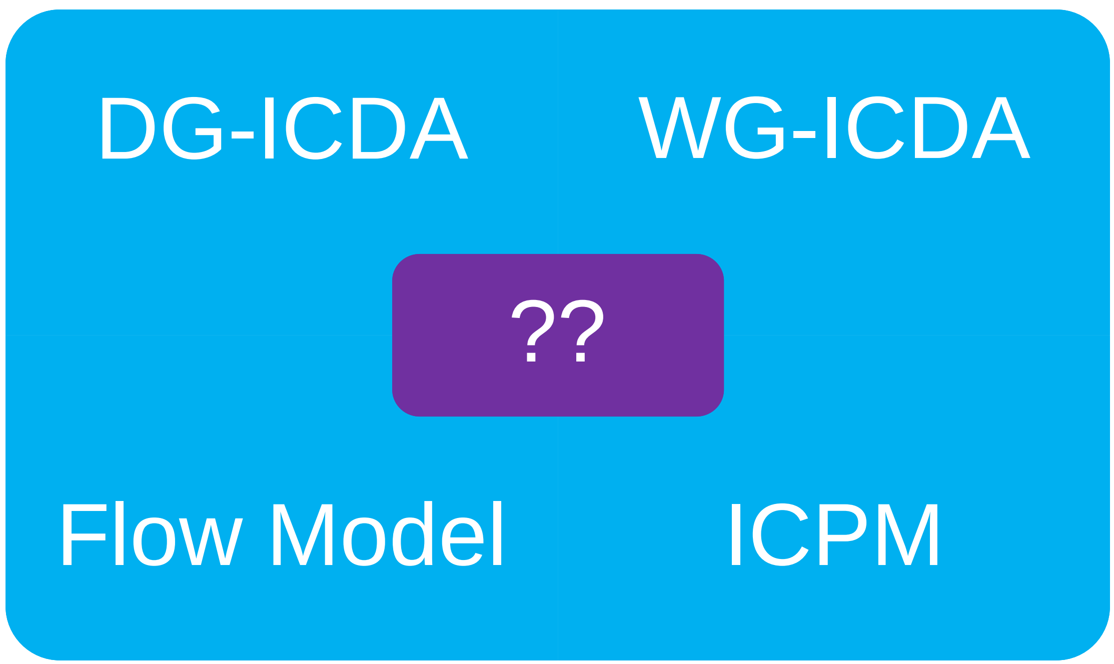
Wet Gas ICDA (WG-ICDA) – Continued..

- Detailed Examination
  - Allows the detailed examination of assessment sites prioritized to have the highest corrosion severity along with less severe locations.
  - The pipe examination must have sufficient detail to determine the existence, extent, and severity of corrosion.
- Post-Assessment
  - Analyzes data collected from the previous three steps to assess the effectiveness of the WG-ICDA process in order to prioritize and activate mitigation, establish corrosion control and maintenance strategies, and determine reassessment intervals to maintain pipeline integrity.

Problem!

- Indirect Inspection is *time consuming* and has a great impact on the *cost of pipeline integrity*
- Lack of an integrated framework to perform DG-ICDA, WG-ICDA and to predict corrosion rate for critical sites
- Needs considerable human intervention



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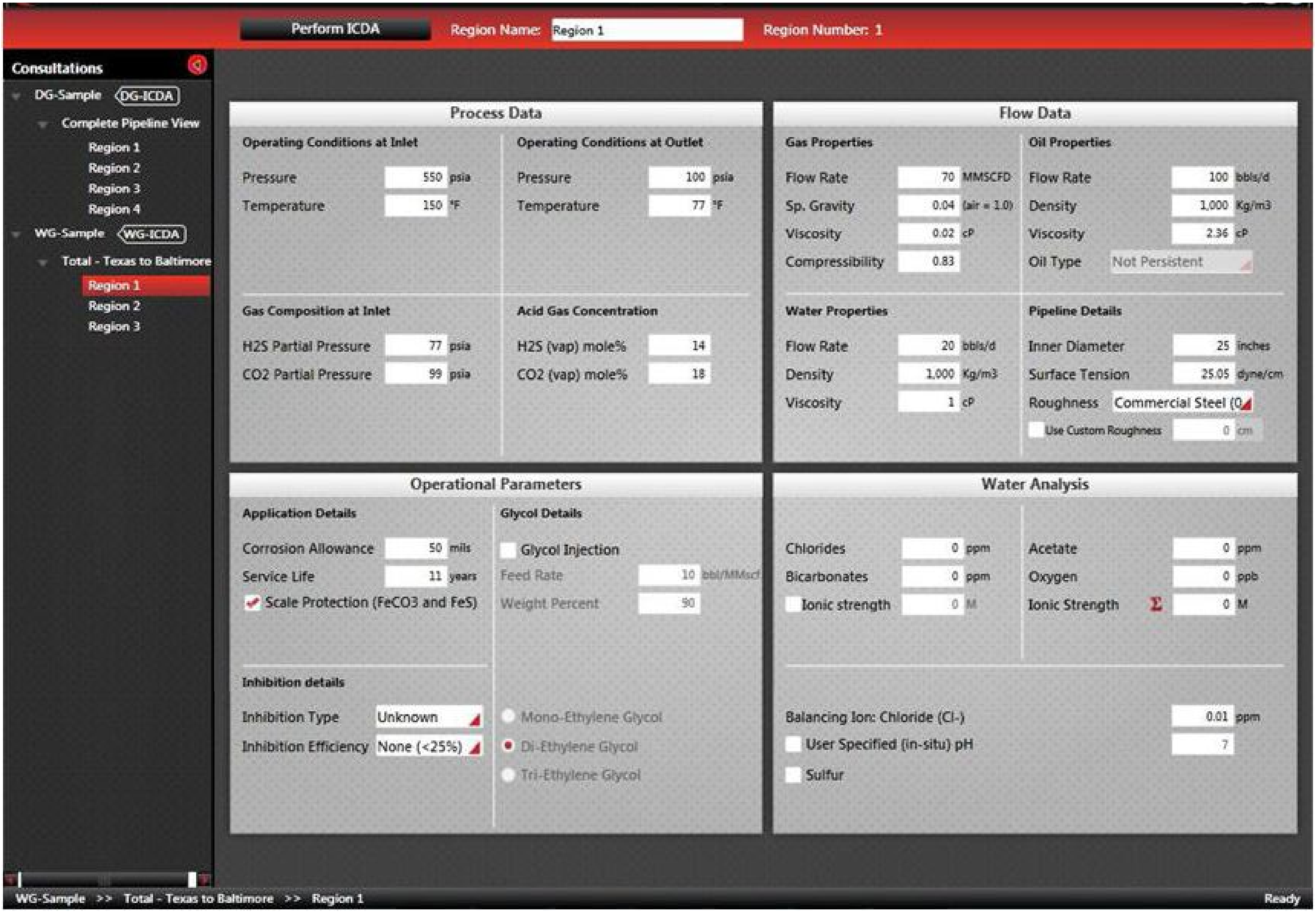
Solution



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Features of ICDA Model

- Primary focus to automate the Indirect Inspection step of ICDA
- DG-ICDA and WG-ICDA functionalities are compliant with NACE Standard Practices SP0206 and SP0110 respectively
- State-of-the-art framework integrated with ICDA models, advanced Internal Corrosion Predictive Model (ICPM) and flow modeler with a precise water phase behavior and in-situ pH computation modules.
- Internal corrosion predictive model (ICPM) used in is based on Honeywell's most popular corrosion assessment program for carbon steels – PREDICT™
- A comprehensive and simple to understand visual interface to study critical zones for water accumulation in a pipeline system
- Preselected assessment sites are shown in Summary Table format helps SMEs to easily identify Final Assessment sites
- A well organized report for Final Assessment Sites can be easily generated

Features – Contd..

- User can now choose the most suitable balance type and balancing ions as well
- Ability to enter water analyses at inlet
- Ability to accurately model momentum transfer effects to compute flow regimes, superficial velocities, void fractions, pressure drops and shear stresses etc.
- Improved wall wetting predictions
- Ability to accurately determine scaling effects due to formation of $FeCO_3$ and FeS scales as a function of temperature and pH
- An effective cost analysis tool with wide coverage of different cost components

Intuitive DG-ICDA Results

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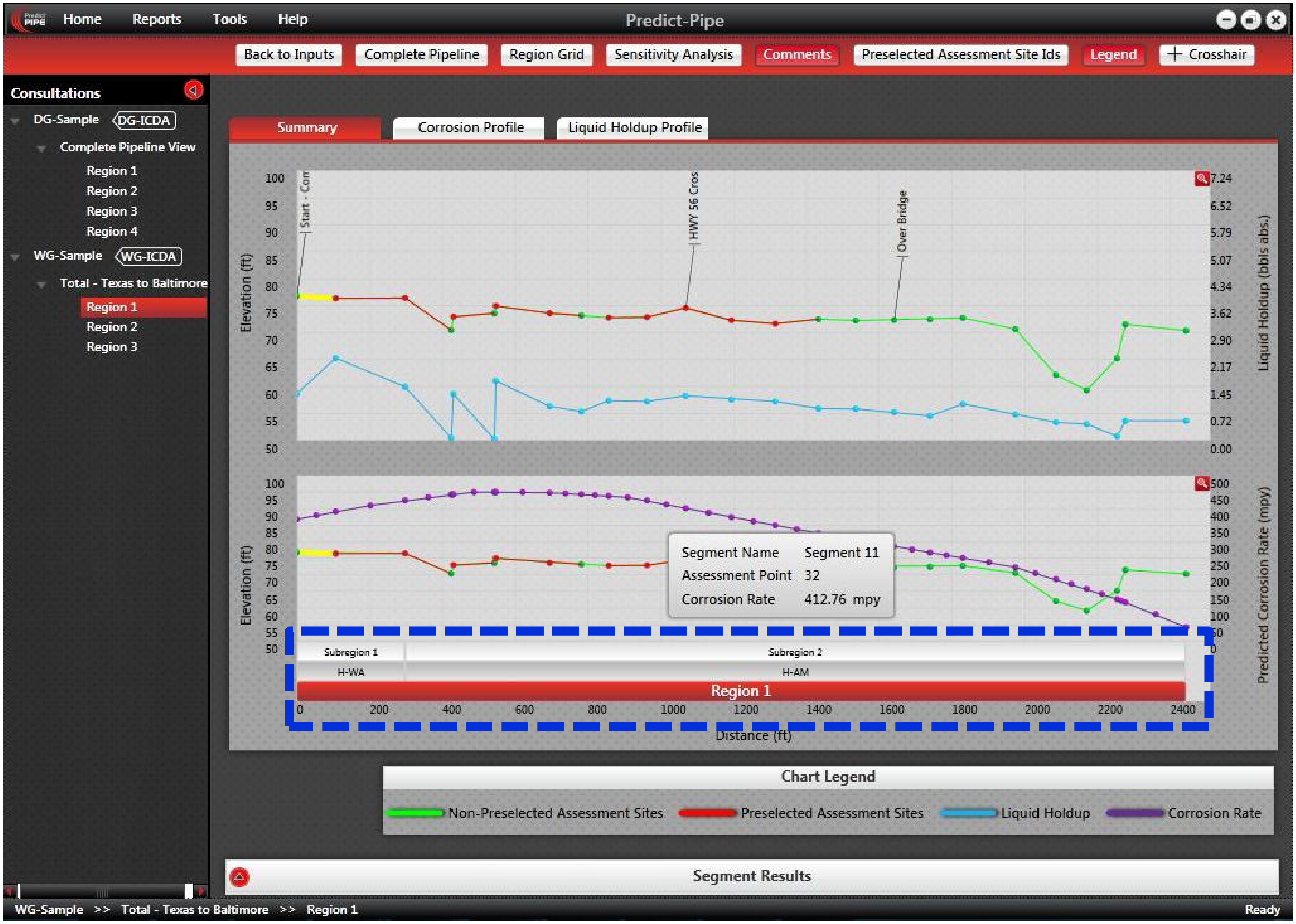
WG-ICDA

- Designed to comply with the NACE SP0110 WG-ICDA standard
- Primary goal is to simplify and automate Indirect Inspection by identifying Preselected Assessment Sites
- Subject Matter Experts (SMEs) can select final assessment sites based on results
- Program can generate detailed report comprising Preselected sites and Final Assessment Sites for SMEs / stakeholders responsible for pipeline integrity.

ICDA Results



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Final Assessment Sites Report

Segment Details

Region #	Length of Region	Co-Ordinates	Description	Subregion #	Flow Regime	Segment #	Distance	Elevation	Pressure	Corrosion Rate	Superficial Liquid Velocity	Superficial Gas Velocity	Liquid Holdup	Wall Loss	Preselected Assessment Sites	Comments
	ft						ft	ft	psia	mpy	ft/s	ft/s	bbls abs.	%		
1	42.82			1	H-WA	1	0	76.83	550	367.8	0.002	7.552	1.27	80.9	No	Start - Compressor Stn
						2	106.8	76.43	530.3	391.5	0.002	7.8	2.24	86.14	Yes	
												Average:	1.74	86.74		
						3	297.1	76.5	495.3	425.1	0.002	8.291	1.45	93.51	Yes	
						4	424.2	70.45	471.9	442.3	0.002	8.66	0.07	97.3	No	
						5	430.3	72.98	470.7	443	0.002	8.678	1.26	97.46	Yes	
						6	542.6	73.64	450	449.5	0.002	9.037	0.04	98.89	No	
						7	546.6	75	449.3	449.6	0.002	9.051	1.62	98.9	Yes	
						8	694.4	73.63	422.1	447.5	0.003	9.579	0.93	98.44	Yes	
						9	781.8	73.22	406	443.3	0.003	9.925	0.78	97.53	No	
						10	856.6	72.81	392.2	438.1	0.003	10.24	1.08	96.39	Yes	
						11	961.9	72.9	372.8	424.7	0.003	10.73	1.06	93.43	Yes	
						12	1068	74.63	353.2	401	0.003	11.28	1.22	88.23	Yes	HWY 56 Crossing

ver Bridge

Final Assessment Site Selection

Region #	Subregion #	Segment #	Distance	Elevation	Flow Regime	Corrosion Rate	Liquid Holdup	Wall Loss	Preselected Assessment Sites	SME Comments	Comments
			ft	ft		mpy	bbls abs.	%			
1	1	1	0	76.83	H-WA	367.8	1.27	80.9	No		Start - Compressor Stn 1A
1	1	2	106.8	76.43	H-WA	391.5	2.24	86.14	Yes		
1	2	4	424.2	70.45	H-AM	442.3	0.07	97.3	No		
1	2	7	546.6	75	H-AM	449.6	1.62	98.9	Yes		
1	2	15	1433	72.51	H-AM	325.6	0.88	71.63	No		

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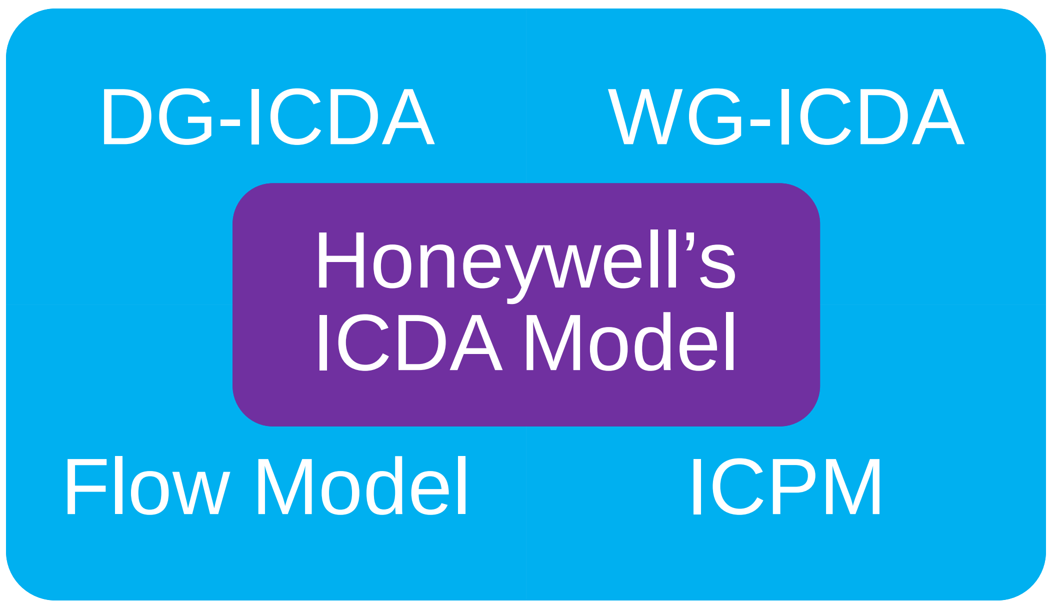
Summary

- ICDA Models help in reducing corrosion and thereby better pipeline integrity
- Use of ICDA guidelines/model helps in detecting corrosion problems in advance to avoid unexpected failures
- More savings in costs and time with better pipeline integrity



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Visit us: www.honeywellprocess.com

Thank you!

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Darchem Thermal Protection

Passive Fire Protection of Critical Safety Equipment and Instrumentation

Robert Pitman - Darchem Engineering Ltd

Passive Fire Protection

- Passive Fire Protection (PFP) is defined as a coating, jacketing, or other enclosure type system that, in the event of a fire, will provide thermal protection to restrict the rate at which heat is transmitted to the object or area being protected. PFP systems are used to:
  - Prevent fire escalation due to continuing release of hydrocarbon inventory.
  - Protect critical safety systems
  - Minimize damage to structural elements, especially those that support refuge or escape of personnel; or surround critical production equipment
  - Allow safe evacuation of personnel

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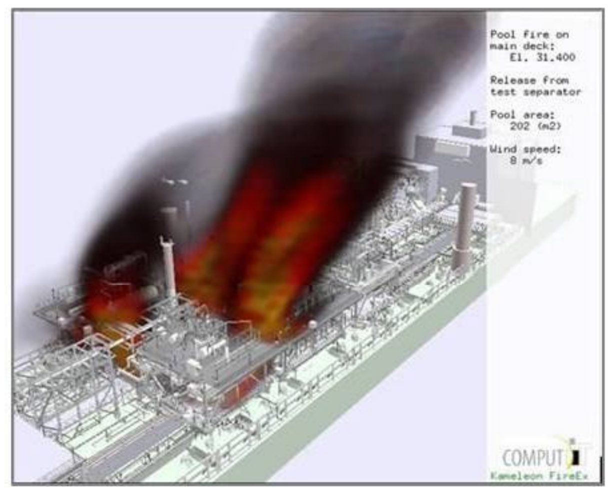
Fire types

Hydrocarbon Pool Fire

- Flame burning above a horizontal pool of vaporizing fuel
- Up to 1,100°C as defined by international recognised standards as UL1709 or BS 476.
- Fire spec commonly designated as H30 (30 minutes) or H60 (60 minutes) for example.

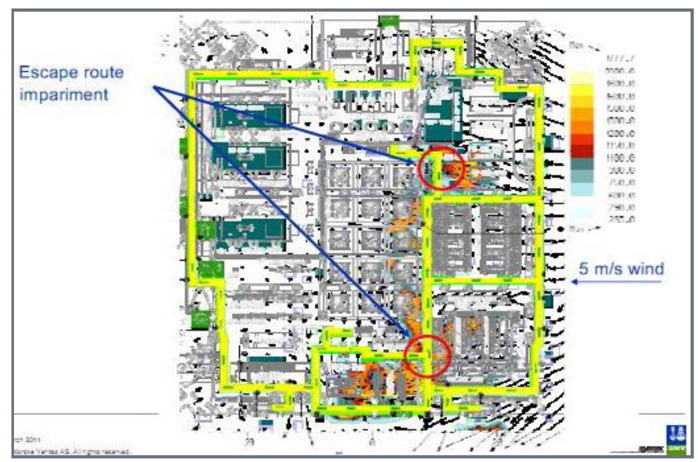
Hydrocarbon Jet Fire

- Directional flame resulting from combustion of a pressurised fuel
- Up to 1,200°C as defined by international recognised standards ISO 22899-1
- Fire spec commonly designated as J30 (30 minutes) or J60 (60 minutes) for example



Determining PFP scope & specifications (API RP 2218)

- Approaches for determining fireproofing needs include:
  - Assessment of the consequences of fires scenarios – costs, loss of life, environmental impact
  - Assessment of the frequency & risks of fires
  - Application of experience-based design rules (corporate or insurance guidelines) – CFD modeling etc.
- Requirements also determined by
  - Operator policy
  - FEED and Consultant analysis
  - Government policies



Determining PFP scope & specifications (API RP 2218)

- Recommended practice proposes an evaluation process that includes developing *fire scenarios* from which a *needs analysis* evolves:
  - hazard evaluation
  - development of fire scenarios including potential release rates and determining the dimensions of fire-scenario envelopes
  - determining fireproofing needs based on the probability of an incident considering a number of technical, economic, environmental and personnel factors
  - choosing the level of protection (based on appropriate standard test procedures) which should be provided by fireproofing material for specific equipment based on the needs analysis.

PFP time period considerations

- Following analysis and selection of requirements, the fire protection period can be specified for considerations such as:
  - Allow time for depressurisation of the system – reduce pressures below critical levels or until critical heat load from fire is over
  - To allow for activation of Safety Systems and remote Emergency Shutdown procedures; and cover other Emergency resource response times

Equipment	Examle UL1709 Pool fire considerations
Emergency valves and actuators	• 30 minutes – to allow time for valve motor operator to fully open and close. • Actuators will lose functionality within minutes of fire engulfment – limiting temps determined by internal cabling & instrumentation • Actuator limiting temps range from 70 to 150° C. • Valve limiting temps range from 200 to 400° C
Pipework, flanges and bolted connections	• Loss of tightness of unprotected bolted connections leading to potential leaks. • 30 to 60 minutes protection against limiting temps of 200 to 400° C
Critical Control systems, Electrical Power, and Instrument cables	• 15 to 30 minutes protection – especially for systems used to control emergency systems (shut-down, isolation, depressurisation, etc.) • Operating limits around 150° C.
LPG vessels	• 90 minutes protection.

Selection of PFP type and materials

- Each type of fireproofing system uses a different combination of materials with various physical and chemical properties. These properties should be taken into consideration so that the system selected will be appropriate for its intended application:
  - Weight and volume limitations
  - The fire resistance rating (time period) selected
  - The material's strength and durability.
  - Whether the material is to be shop or field applied
  - The corrosiveness of the atmosphere and of fireproofing materials to the substrate
  - Equipment operating temperature limitations in non-fire conditions
  - Expected or warranted lifetime of the fireproofing system.

Selection of PFP type and materials

- Continued:
  - Inspection requirements to manage corrosion under fireproofing
  - Accessibility for inspection and maintenance
  - Risk associated with fireproofing impairment during maintenance
  - Regulatory requirements
  - Life Cycle Cost (including purchase, maintenance and inspection)

- Options for process equipment and instrumentation include:
  - Flexible jackets
  - Stainless steel fireboxes
  - Mold or cast PFP coatings
  - Epoxy or composite enclosures

Passive Fire Protection enclosures – Flexible jackets

Description	Advantages	Disadvantages
Insulation fibre materials encased in weatherproof vinyl cloths. Jacket panels fastened together by either SS316 lacing, Belts and Buckles, or Velcro.	• Flexibility to protect all equipment types • From H15 to J180 fire periods • Withstand high process temperatures • Good accessibility or removal for inspection and maintenance • Low maintenance • Low cost • Durable and weatherproof	• Susceptible to water or moisture ingress - which can open up gaps in panels if not properly fitted • Rely on plant operator diligence for removal and refitting to ensure integrity is retained

Flexible PFP jacket on valve and actuator

Flexible PFP jacket on cable tray

Flexible PFP jacket on piping

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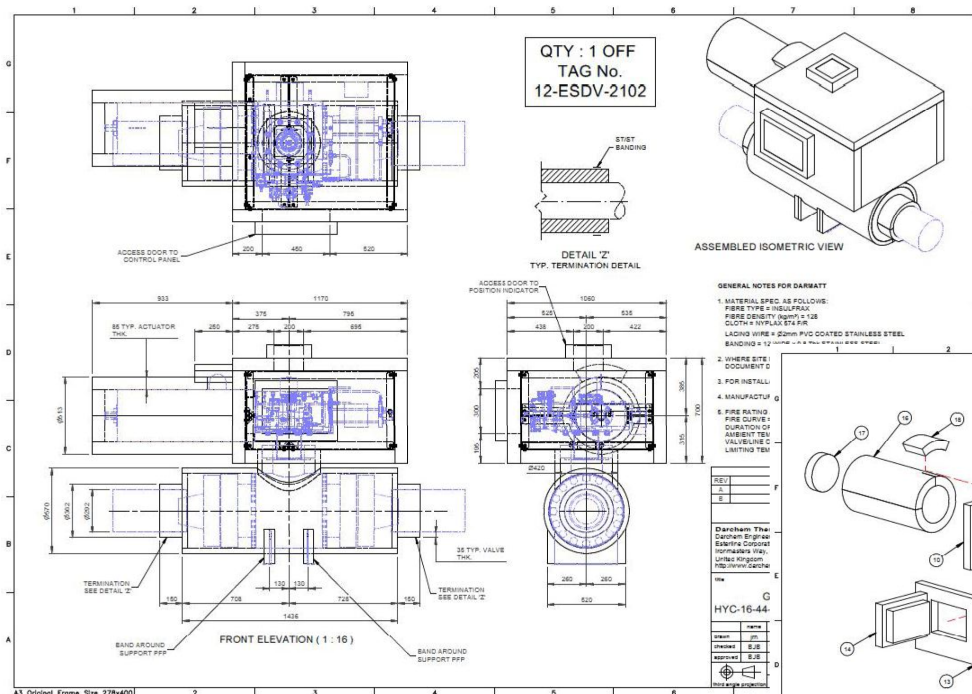
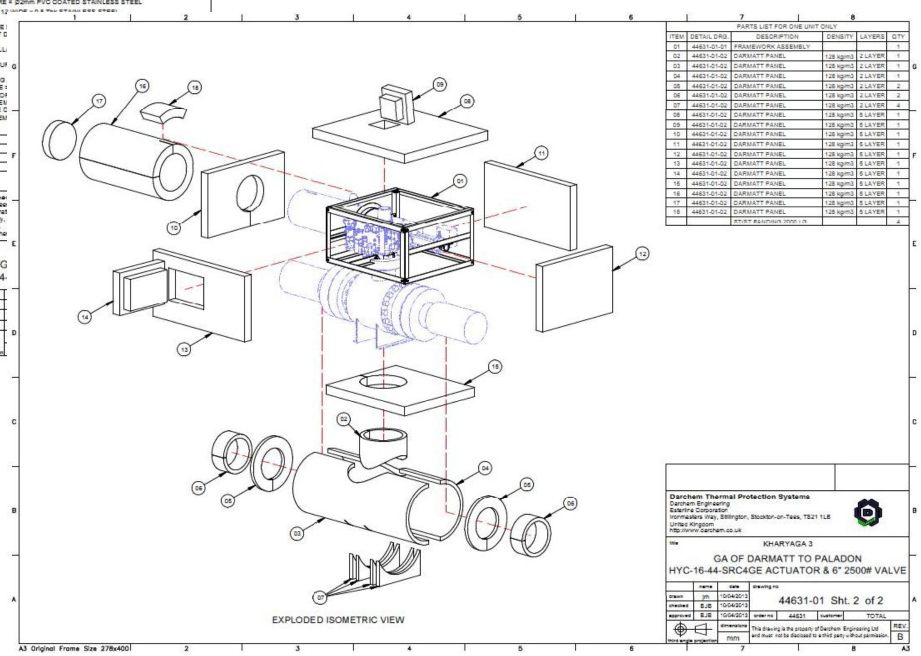
Flexible PFP jackets – no requirement is too complex

Jetfire PFP jackets installed on an
FPSO turret riser sections

Flexible PFP jackets – an engineered solution





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Flexible PFP jackets – operator considerations

Access hatches for maintenance & inspection

Ventilation grills for cooling and gas release

PFP enclosures – Stainless steel ‘fireboxes’

Description	Advantages	Disadvantages
Insulation fibre materials encased in SS316 outer skins.	• Can be designed to protect most types of equipment, subject to space constraints at site • H15 to J120 protection • No maintenance • Good accessibility • Durable and weatherproof	• Weight considerations • Large space envelopes • Cost of materials

SS enclosure for actuator and controls

SS enclosure for offshore safety valve

SS enclosure for riser anchor flange & pipe

PFP – Epoxy Intumescent / composite coatings

Description	Advantages	Disadvantages
Epoxy intumescent coating applied directly to the equipment, i.e. actuator or valve.	• Aesthetic appeal of ‘integral solution’ • H15 to J30 protection • No maintenance • Good accessibility • Durable and weatherproof	• Limitations for use with high process temperatures • Modifications or repairs at site? • Limitations to H30 or J30 scenarios • Long lead times for applying PFP at suppliers location • Checking for CUI? • Withstand hose streams during fire?


Epoxy intumescent coating on actuator

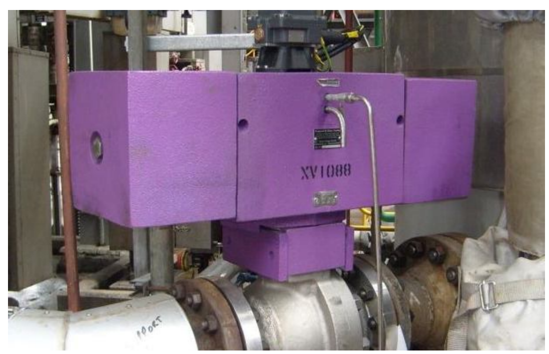

Phenolic coating PFP on vessel


Epoxy coating for cabinet

PFP – Epoxy Intumescent / composite enclosures

Description	Advantages	Disadvantages
Enclosures made out of epoxy intumescent, phenolic or ceramic insulation layers, with protective outer gelcoat and ablative coating.	• Can be designed to protect most types of equipment, subject to space constraints at site • H15 to J30 protection • No maintenance • Good accessibility • Durable and weatherproof	• Limitations for use with high process temperatures • Equipment clashes – space envelope • Modifications/repairs at site? • Limitations to J30 & confirmation of final temps during fire?

Epoxy PFP box on flange

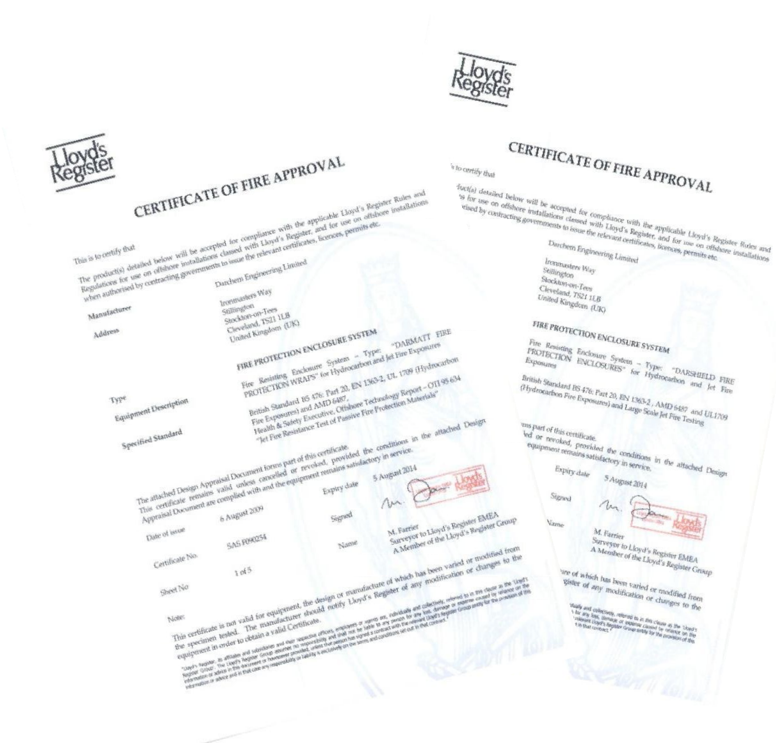


Epoxy PFP box on actuator

Epoxy PFP box for electrical controls

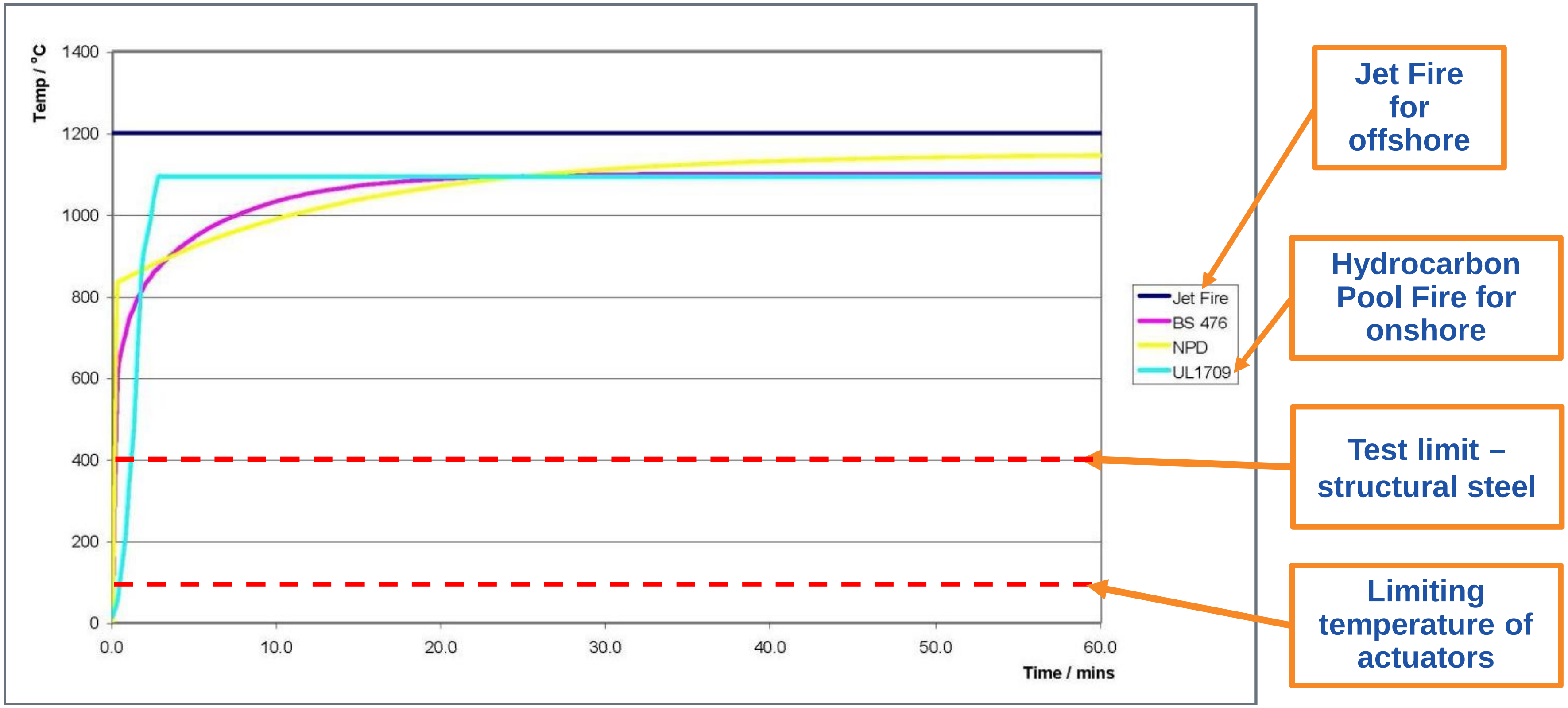
Importance of PFP Systems Testing and Certification

Certification from internationally renowned agencies is a must!



Testing and Certification - standards

PFP testing and certification must comply with Industry Standard Fire Curves



A PFP System can pass a fire test at 400 deg C, but equipment being protected will often have a limiting (failure) temperature between 75 to 100 deg C

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Installed PFP – fit for purpose?

- One size does not fit all
- Has PFP supplier taken into account of?:
  - Fire specification
  - Ambient conditions at site
  - Process temperatures
  - Limiting temperatures of equipment
  - Weights and volumes
  - Accessibility requirements
- Thermal calculations and designs should be approved by certification agencies
- Demonstrate fire performance in the real world

XXXXXX - XXXXXX : BIFFI ALGAS 0,9C-0400-335-CL

Calculations Using JetFire Firecurve

Duration of Run	60 minutes
Mass of Protection Shield Contents	478.5kg
Insulation Type	Darmatt from 128kg/cu m
Darmatt consists of	5 layers of 25mm thickness
Inside Area of Darmatt	5.75 sq m
Minimum Periphery of Shield Section	2.632m
Actuator Stem Included?	Yes
Metallic Cross-Sectional Area of Stem	0.00542 sq m
Length of Stem to Outer Surface of Shield	0.32m
Temperature of Exposed Stem at 60mins	1200 deg C
Ambient Temperature	45 deg C
Time Constant Used in Calculations	0.305 second

Duration of fire protection required

Specification of Darmatt being used

Starting temperature (before fire) of protected equipment

Time (mins)	Temperature Distribution Through System (deg C)											
3.0	1200	918	569	215	65	46	45	45	45	45	45	45
6.0	1200	1004	768	496	230	82	49	45	45	45	45	45
9.0	1200	1042	855	640	406	194	80	50	46	45	45	45
12.0	1200	1064	906	726	525	319	151	71	50	46	45	45
15.0	1200	1079	941	784	608	420	242	115	62	48	46	45
18.0	1200	1091	966	826	669	499	326	178	89	56	47	45
21.0	1200	1099	986	858	716	561	399	245	129	71	51	45
24.0	1200	1106	1001	884	753	611	459	308	179	95	58	46
27.0	1200	1112	1014	905	784	652	510	365	230	128	67	46
30.0	1200	1117	1025	922	810	686	553	415	280	164	79	48
33.0	1200	1121	1034	938	832	716	590	458	325	200	92	50
36.0	1200	1125	1042	951	850	741	622	496	364	233	105	53
39.0	1200	1128	1049	962	867	763	649	528	398	263	117	56
42.0	1200	1131	1055	972	881	781	673	555	427	286	129	61
45.0	1200	1133	1060	980	893	797	693	578	452	310	139	66
48.0	1200	1136	1065	988	904	811	710	598	472	328	149	71
51.0	1200	1137	1069	994	913	823	724	614	489	343	158	77
54.0	1200	1139	1073	1000	920	833	736	628	504	356	166	84
57.0	1200	1140	1076	1005	927	842	746	639	516	367	173	91
60.0	1200	1142	1078	1009	933	849	755	649	526	377	180	98

These calculations have been carried out in accordance with the Business Operating Procedure reference 7.04

Outside temperature of fire protection (1200°C) for 60 minutes

Final temperature of equipment inside fire protection (after required protection period)

.... Date:........................

.... Date:........................

Approved:........................ Date:........................

Revision: A

Thermal calculations should be run for all equipment

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Demonstrate performance in the real world

- All design features used in the real world should be tested and certified
  - Enclosure corners and edge features
  - Fixing methods and joints
  - Access panels and ventilation grills

ISO 22899-1 Jet Fire test – before, during and after – Lloyds Register witnessed

Summary

- Major fire events may be rare – but they are potentially catastrophic



- A properly analysed and implemented PFP policy - used in conjunction with other risk reducing measures will greatly enhance personnel safety and plant integrity

THANK YOU FOR YOUR TIME

-

ANY QUESTIONS?

Passive Fire Protection for Critical Systems

Presented by Andrew Bragg and Ray Browne
of
Thermal Designs UK LTD

Passive Fire Protection Specialists

In partnership with Trouvay and Cauvin

Topics For Our Presentation

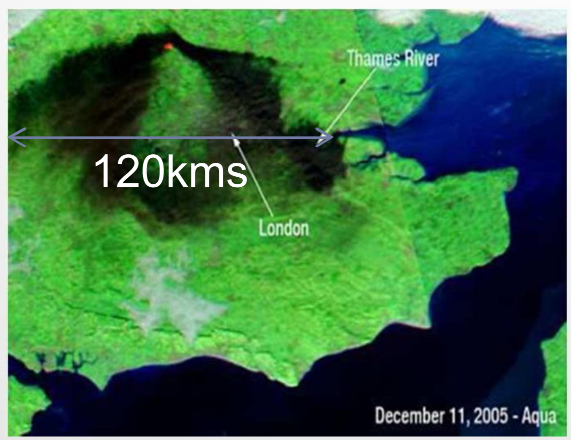
- **Typical fires in the petrochemical industry.**
- **What are the costs associated with a major fire e.g.(*Buncefield UK*)?**
- **What is passive fire protection and its history.**
- **What can be done to prevent fires?**
- **What standards should be used to specify passive fire protection?**
- **How fire protection is tested.**
- **The different types of fire protection.**
- **Life cost for passive fire protection.**
- **Safety issues relating to passive fire protection.**
- **Why does the end-user not get value for money?**
- **Thermal Designs UK Ltd, fire protection specialists.**

What does a Hydrocarbon fire look like?

Pipeline fire

Tank fire

Tank Fire via Satellite



What effect does it have on equipment?

Typical loss due to fire

Table 1 Summary of the overall cost of the Buncefield incident, by main category

Sector	*Cost (£ million)*
Site operators (compensation claims)	£625
Aviation	£245
Competent Authority and Government response	£15
Emergency response	£7
Environmental impact (drinking water)	£2
Total	£894

Source: Buncefield UK GOV report

- **£894 million , (₹9,046cr)**
- **UK government calculated that to protect the whole UK from this type of accident would cost £23 million (₹232cr INR) or 2.57% of the losses from this one incident.**

How does Passive Fire Protection relate to the petrochemical industry?

Loss Prevention

Preventative measures are always being reviewed; explosion proof items which prevent the ignition sources reaching potentially explosive dust or gas; seal technologies that prevent the release of these potentially explosive clouds; working procedures (hot work and zero energy) that prevent accident during maintenance.

However evidence has shown time and time again that wherever human intervention is possible then accidents do happen! And it’s the mitigation of these effects (loss prevention) which passive fire protection can and does prevent.

Loss of Lives

Loss of Inventory

Continuity of service

Litigation

Environmental Catastrophes

History of Passive Fire Protection

Definition

The term “Passive Fire Protection” generally relates to such items as fire-resisting partitions and barriers. These help control the spread of a fire, buy time for a building’s occupants to escape, help fire fighters tackle the blaze and also limit the damage wherever possible.

History

Passive fire protection actually dates back to Roman times (2000 years ago). The designs of Roman villas incorporated passive fire principles that we still use today:

- **Concrete barriers (made from volcanic ash).**
- **Duplicate escape routes.**
- **Fire gaps.**
- **Use of non combustible materials to prevent fire spread.**

Generally, since that time however improvements in technology have only happened because of disasters. Something goes wrong and we evaluate the possible ways of prevention or mitigation.

What can be done to prevent a fire ?

In fact I'd like to quote AK Sharma (director of the Delhi Fire Service) DFS

Control of fires is done in three ways:

1. Procedural protection.
2. Educational protection.
3. Physical protection.

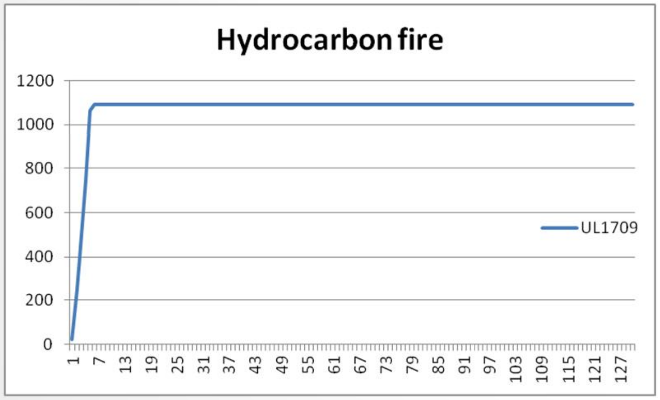
Procedural – disaster plans, non smoking policies, work permits, fire emergency plans, safety manuals, conducting plant survey, safety survey, safe start up & shut down procedure, regular and preventive maintenance

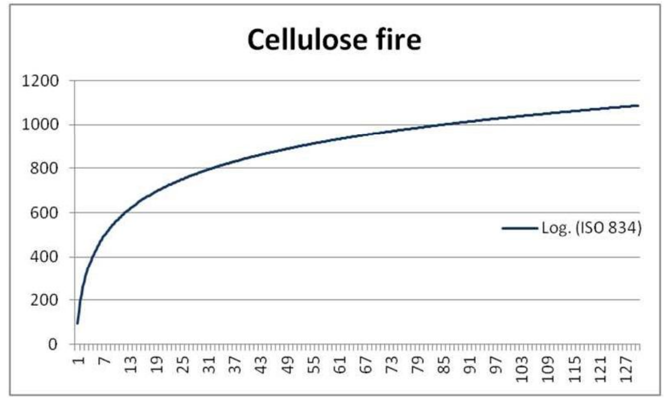
Educational protection - periodic training programme on safety, fire safety and hazardous properties of materials, mock fire drill, safety manuals, health & safety news bulletins, leaflets, safety motivation schemes, educating the public living nearby about the activities in the industry

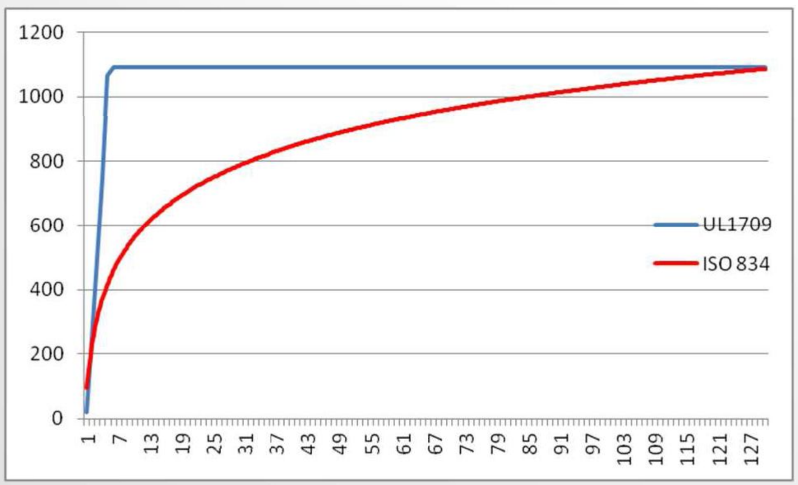
Physical Protection - strict & rigorous approach in following the relevant standards , codes & practices, built in safety devices and safety system, venting through tall stacks,
field monitors for different toxic gases, burning waste gases in a flare system, provision of wind cones, fire proofing of steel structures, PPE, passive protection system, active protection system, automatic protection system.

In actuality it is almost impossible to prevent the start of a fire where people are involved.

What are the types of fire



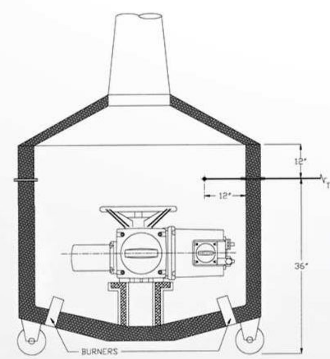




Of all the fire tests available UL 1709 is the most demanding, with the fastest temperature rise coupled with one of the highest heat fluxes. This is why UL1709 has been adopted by the petrochemical industry.

UL1709 Fire Test

- UL1709 has been adopted by the petrochemical Industry as the de-facto standard for safety critical equipment a it is the most demanding .
- UL1709 states that the temperature in the test should reach 2000°F (1093°C) within five minutes and be maintained at this level throughout the test.
- Crucially during this period the equipment must maintain structural integrity and operate for the period of time specified by the engineer or end user – typically this is 30 minuets
- Not all tests are carried out the same way by other companies: Thermal Designs' test exposes the whole surface of the equipment to the fire but other manufacturers do not by typically laying the equipment on the floor of the furnace.



- All Thermal Designs products are successfully tested to UL1709 for at least 30 minuets.

Different Types of Fire Protection

Insulating bags or blankets:
These use insulation to prevent the migration of heat from reaching the critical item.

Traditional fire box :
This uses both the insulation from the wall structure as well as the air gap to prevent the migration of heat from reaching the critical item.

Intumescent coating :
This does nothing until a chemical reaction is started by the addition of heat from the fire. This then uses an endothermic reaction to cool the surface which then chars to reflect 80-90% of the heat away from the critical equipment.

Insulating bags or blankets:

- Are not “people proof.”
- Are difficult to fit.
- Absorb moisture and spills.
- Insulate and down rate electrical motors.
- Incur logistics and installation costs.
- Need to be removed and refitted during maintenance (usually by the manufacturer) which has an additional cost.
- Promotes corrosion which can go undetected.
- Have a limited life.
- Contravenes BSEN60079-4:2008.
- Can cover flame paths on explosion proof actuators invalidating the guarantee.
- Blast resistance?
- Only appropriate on equipment which is already installed – but still have the above drawbacks.