

Process Hazard Analysis With RiskPoynt

Operationalize Bow Ties From HAZOP Studies

19 April 2023

Agenda

- Short Introduction to RiskPoynt
- High Level Overview of HAZOP & LOPA
- Industry Need
- How It Works

What Is RiskPoynt?

What Is RiskPoynt?

- Acquired by Prometheus Group in 2022
- CRV / Barrier management software
 - Cloud-deployed visualization tool, 100% SaaS
 - EHS solution that pairs well with ePAS, Scheduling, Operator Rounds
- Operating since 2011, Over 190 Oil and Gas Facilities with >100 more new sites being added with ongoing projects
 - Covering the hydrocarbon value chain from Upstream offshore platforms and FPSO facilities, through Midstream collection and processing facilities and transmission pipelines, to Downstream processing and LNG plants



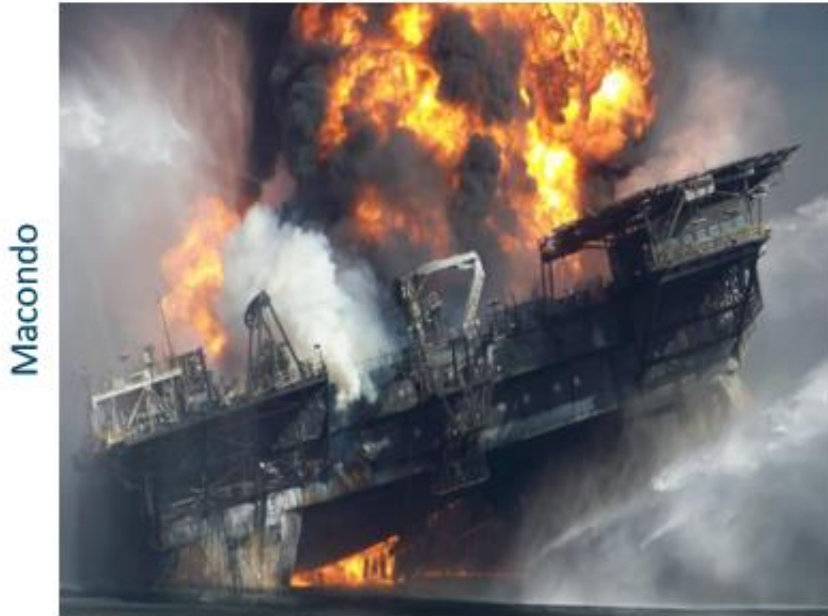
Why Have RiskPoynt?

Major Accident Hazard Prevention!

- Barrier management is about major accident hazard prevention
- Systems are designed to visualize integrity, allowing operators to Gain Control and Operate Safely
- Barrier management **reduces** the **likelihood** of major accidents occurring and improves communication on major accident hazards and cumulative risk

What Is a Major Accident Hazard (MAH)?

A source of danger that has the potential to cause a major incident, whether that involves multiple fatalities and/ or significant damage to plant, equipment, or the environment



Macondo



Piper Alpha



Ocean Ranger

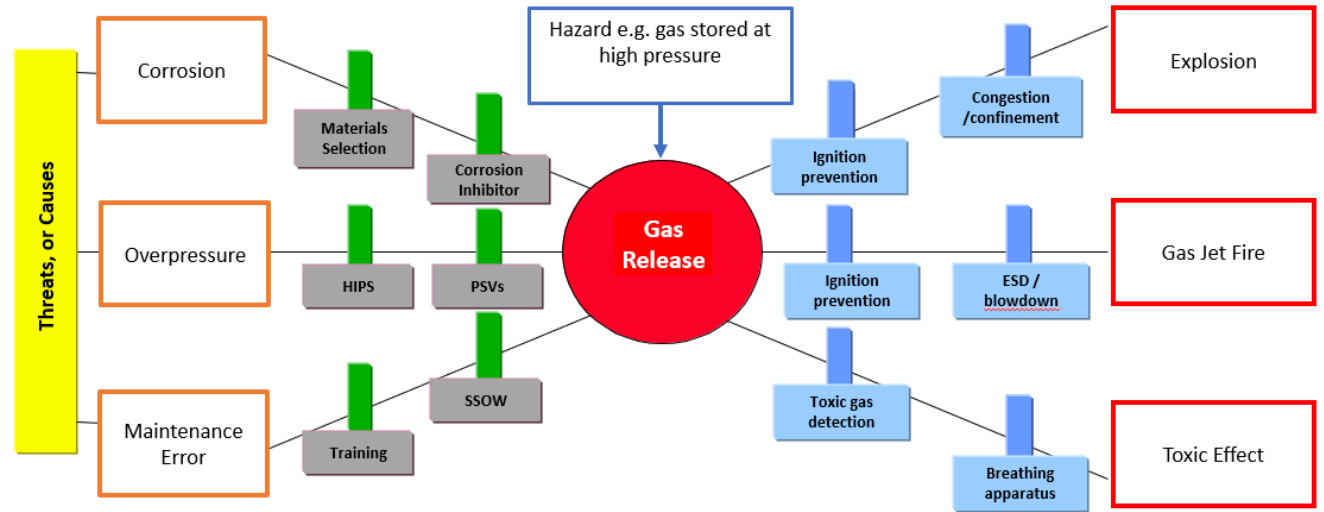
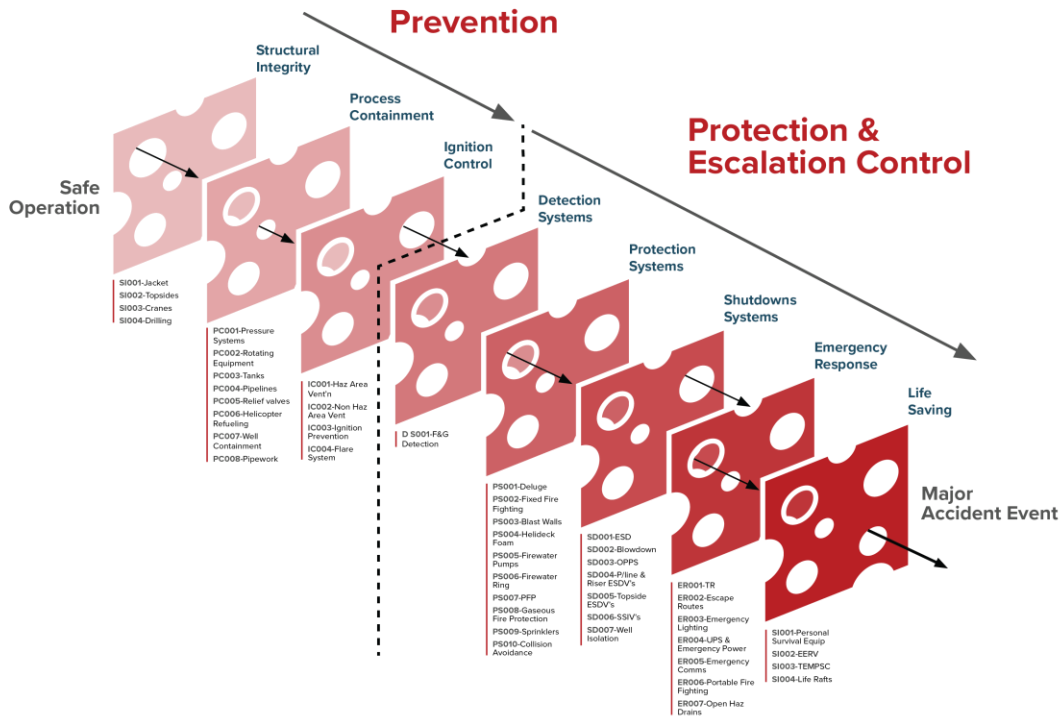
What Is a Barrier?

Barriers are functional groupings of safeguards which the system visualizes the 'Fit for Service' using **Red** / **Amber** / **Green** coded 'Swiss Cheese' barriers identifying the conditions and accumulative risk status within the operational hierarchy.

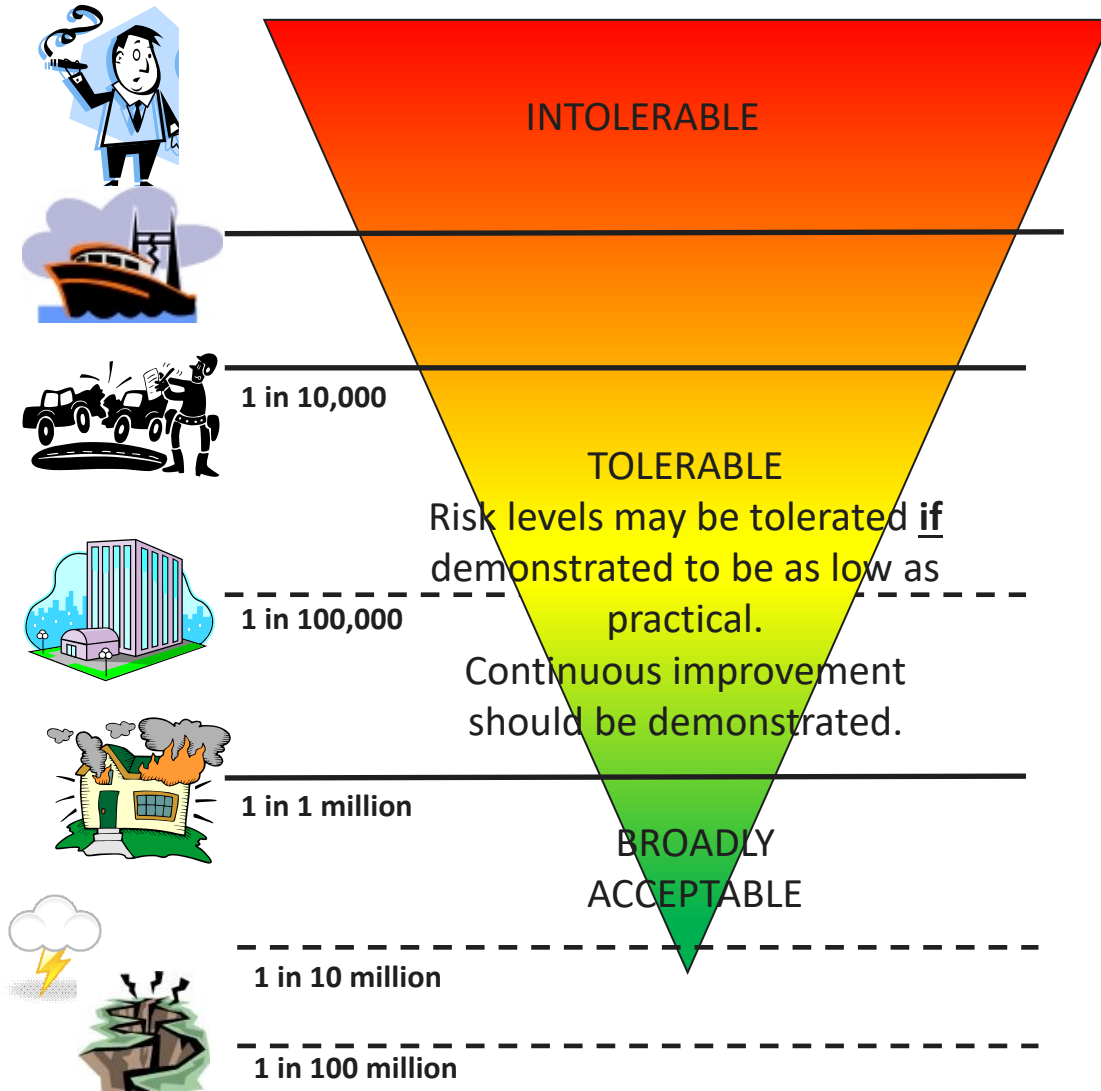
Barrier Management means the effective monitoring, evaluation and management of operational risk across the portfolio of complex integrated facilitates ensuring people, plant and process are 'fit for service.'

What Is a Barrier?

Barriers are organized by their function. Prevention barriers are to the left and escalation and protection are to the right. Barriers function independent of each other but a lineup of degraded barriers means an increase in MAH potential.



Likelihood x Severity = Risk



Max. tolerable risk for workers
 $10^{-3} / y$ (1 in 1,000/yr)

Max. tolerable risk for public
 $10^{-4} / y$ (1 in 10,000/yr)

Broadly acceptable risk below
 $10^{-6} / y$ (1 in 1,000,000/yr)

What Is Cumulative Risk?



Distributed Control Systems



Permit to Work



ERP System



Maintenance Mgmt. System



Learning Mgmt. System



Incident Mgmt. System



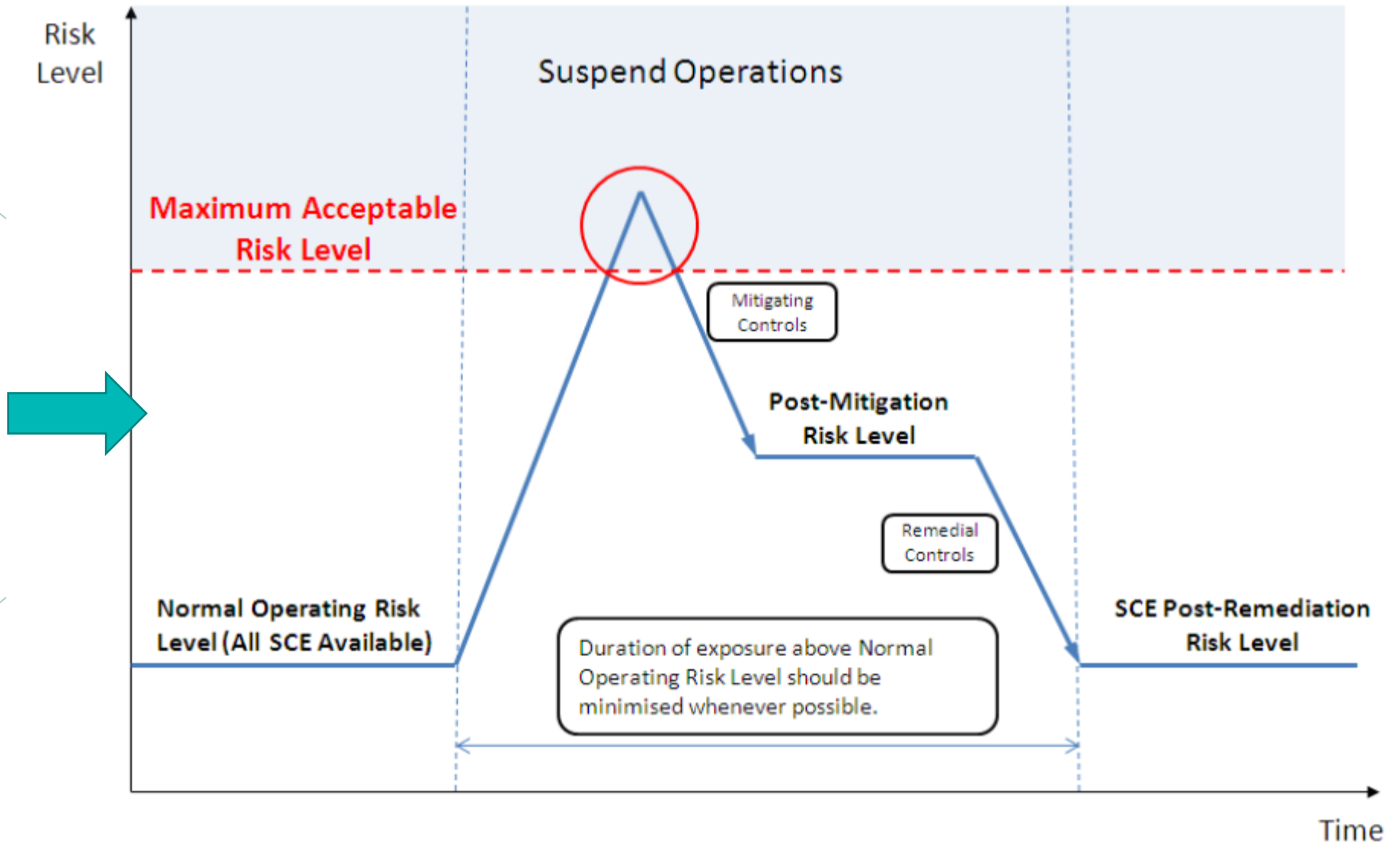
Risk Assessments



Management of Change



Audit & Inspection



What Is Cumulative Risk?

☰
🔥 RiskPoyn Barrier Model (CRV)

🔗 Bow Tie
🌀 Helix
🔄 Kiosk Mode
📊 KPI
100%
📍 Data Analysis
📄 Dashboard
📁 Manage Data
🔄 Refresh
📖 Help
🚪 Log Out

UK English

06/04/2023

Layout Drawings

- ▶ APM
- ▶ AUSTRALIA
- ▶ BRAZIL
- ▶ CANADA
- ▶ COLOMBIA
- ▶ MEXICO
- ▶ NETHERLANDS
- ▶ NEW ZEALAND
- ▶ NORTHERN ISLAND
- ▶ PAPUA NEW GUINEA
- ▶ PHILIPPINES
- ▶ RAILWAY
- ▶ ROMANIA
- ▶ TUNISIA
- ▶ UK
 - ▶ EPNORTH
 - ▶ EPSOUTH
 - ▶ GEN-BARRY
 - ▶ GEN-KINGSLYNN
 - ▶ NORTH SEA
 - ▶ S_EASINGTON
 - ▶ S_ROUGH
 - ▶ ALPHA 47-8A
 - ▶ BRAVO 47-3B
 - ▶ SR_FPSO
 - ▶ SR_REFINING
 - ▶ SR_TERMINAL
- ▶ UNITED STATES
- ▶ USA

SITE : ALPHA 47-8A; Date: Thu Apr 06 2023

	Structural Integrity	Process Containment	Ignition Control	Detection Systems	Protection Systems	Shutdown Systems	Emergency Response	Lifesaving Systems
Initial								
Barrier								
Mitigated								

CLOSE

MANAGE CHECKLIST

CONTROL ACTIONS

📄 SUMMARY
📊 REPORTS
🛡️ RISK RECORDS
🔄 RECOVERY ACTIONS
☰ SCE CONDITION
🔴 SIMOPS
📄 PERMITS
🔊 RELIABILITY
🔊 CONTROL ACTIONS
📄 DOCUMENTS

<p>SI002</p> <p>DF CR6-22-86017 Deferring Maintenance Work on Cat Cracker</p> <p>DF CR6-23-86020 Deferral test for Bowtie</p> <p>SI003</p> <p>HF CR6-16-00024 Effects on crane and mechanical handling operations due to more frequent offloads</p> <p>PS CR6-22-00067 Cat Cracker WO Deferment</p>	<p>PC001</p> <p>PS COG-15-00003 Failure of Process containment barrier on the 1st stage separator (Tag V-49001) causing over pressure of downstream separator.</p> <p>PS COG-16-00212 Emergency Shutdown valve not full closing</p> <p>PC004</p> <p>DF CR6-22-86016 Risk Assessment Created for Deferral of Work Order: WO-2904202014561636</p> <p>PC008</p> <p>DF CR6-16-86000 Continue to operate with AAA1 on 2" Dia. (2"-AA-805-A1) Fuel gas Supply Header with</p>	<p>DS001</p> <p>PS HIB-13-00143 ORA-040 To operate system without any existing, fixed, fire and gas detection and fire suppression system on the Mezzanine Deck</p>	<p>PS003</p> <p>PS BEA-13-00131 ORA-054 * Failed Foam Suppression System into the Condensate Tank</p> <p>PS004</p> <p>DF CR6-21-86012 Risk Assessment Created for Deferral of Work Order: WO-2904202014561679</p> <p>PS BEA-13-00129 ORA-050 Sustain a reliable Fuel Gas purge to the HP and LP-vent systems</p> <p>PS BEA-13-00130 ORA-053 To operate site without redundant fire water pump water pump</p>	<p>SD001</p> <p>PS COG-15-00002 Compressor backflow risk on gas compression train. The pressure relief valve is due for replacement - identified as undersized for the system</p> <p>PS CR6-20-00027 Emergency Shutdown valve not full closing !!</p> <p>PS CR6-16-00002 LALL-2021B-03 OVERRIDE TO PREVENT CLOSURE OF SDV-2021B-01 ON MBF-2021B SUCTION SCRUBBER</p>
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The Result

Companies that use Barrier Management:

- Lower likelihood of MAH events occurring
- Align to international standards (IOGP)
- Use facts to decide prioritization changes, targeting work on equipment that keeps the operator safe
- Broaden communication on operational risks so all personnel are aware of the condition of the facility
- Promote and foster a culture of safe operations and inclusion – everyone has a part to play in safety
- Measurable success in barrier condition over time
- **Safer operations improve production**

HAZOP and LOPA Functions

Defining The Process

Periodic Safety Reviews
 Safety Reviews,
 Process Hazard (HAZOP) Reviews

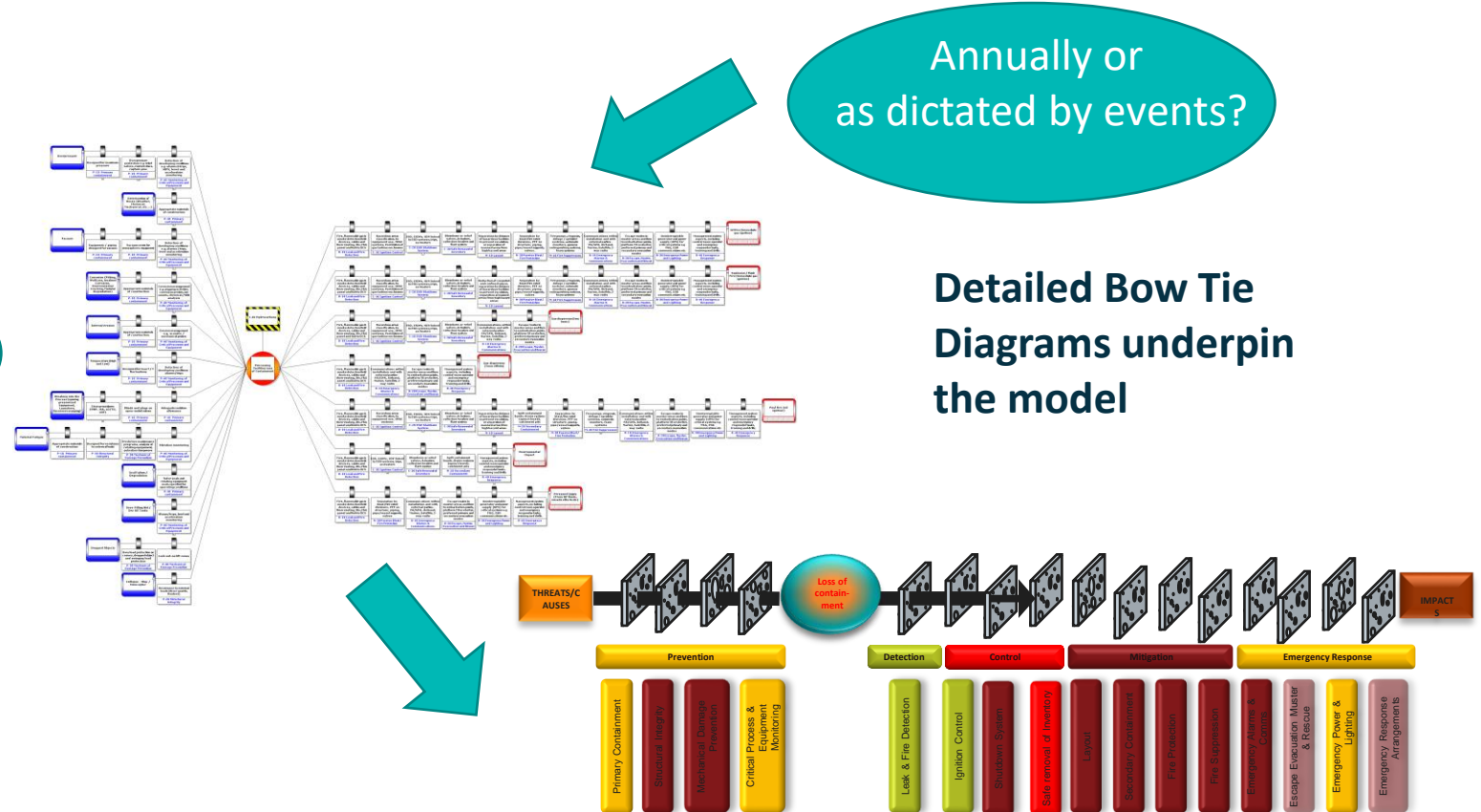
Barrier Assurance Activities

- WMS
- Tech. Authority
- ICP/IVB input

Daily / weekly / monthly

Operational Risk Assessment

- Mitigation measures
- Asset risk assessment teams
- - Tech. Authority review



Annually or as dictated by events?

Detailed Bow Tie Diagrams underpin the model

Cumulative risk profile presented on barrier model

- Justification of basis for continued safe operation
- Management review and approval

RiskPoynt HAZOP/ LOPA to Bowtie Integration

- Reduce time to implement RiskPoynt
 - Rapidly convert legacy HAZOP/LOPA studies into operational Bowties for CRV consumption
- Smart scanning of HAZOP studies
 - Uses fuzzy logic, identifies equipment, keywords, etc.
 - Automatically drafting Bowties
- Electronic scanning of P&ID's
 - Allowing markup of nodes and digitization of equipment data

P&ID Markup & Node Definition

AI/ML for auto P&ID scanning & equipment detection

Draw box around node to automatically select equipment/lines

Additional equipment can be selected on the dwg and added to the node

Selected equipment within node can be edited manually

Marked up P&ID and equipment list can be exported to PDF/Excel

Class	Type
Instrument	Process Control
Instrument	Process Control
Instrument	Safety System I
Instrument	Process Control
Instrument	Instrument
Instrument	Instrument
Valve	Gate Valve
Instrument	Instrument
Instrument	Instrument
Valve	Gate Valve
Valve	Gate Valve
Valve	Gate Valve
Other	Flange
Valve	Gate Va
Valve	Gate Va
Valve	Gate Va
Valve	Gate Va
Instrument	Special
Valve	Bleeder
Valve	Gate Valve

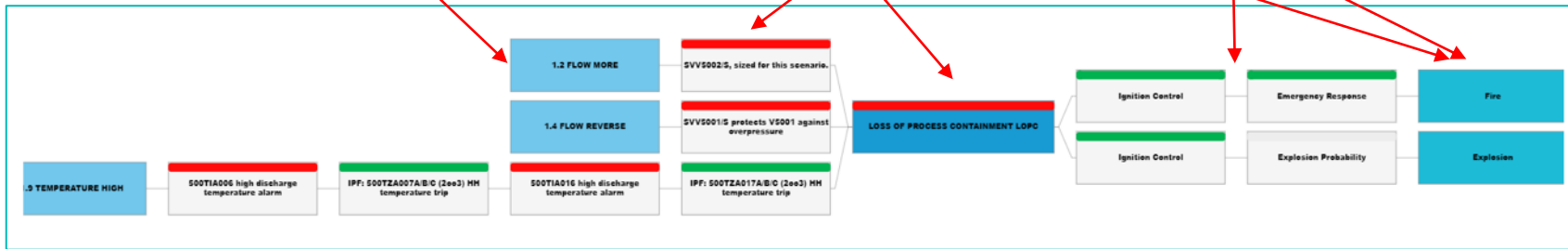
PAGE	REFERENCE DRAWING NUMBER	TYPE LABEL	GROUP	ATTRIBU	ATTRIBU	ATTRIBU	NOTES
1	DE-5270.00-42313-944-GCR-305	Instrument	Node1	RV			R12
1	DE-5270.00-42313-944-GCR-305	Instrument	Node1	LT			R13
1	DE-5270.00-42313-944-GCR-305	Instrument	Node1	ZT			R12
1	DE-5270.00-42313-944-GCR-305	Process Control System in Primary Location (Panel)	Node1	PI			R27
1	DE-5270.00-42313-944-GCR-305	Instrument	Node1	LG			R43
1	DE-5270.00-42313-944-GCR-305	Process Control System in Primary Location (Panel)	Node1	LI			R12
1	DE-5270.00-42313-944-GCR-305	Instrument	Node1	PT			R27
1	DE-5270.00-42313-944-GCR-305	Instrument	Node1	LT			R12
1	DE-5270.00-42313-944-GCR-305	Instrument	Node1	PI			R26
1	DE-5270.00-42313-944-GCR-305	Process Control System in Primary Location (Panel)	Node1	LALL			R12
1	DE-5270.00-42313-944-GCR-305	Instrument	Node1	TT			R24
1	DE-5270.00-42313-944-GCR-305	Process Control System in Primary Location (Panel)	Node1	TS			R24
1	DE-5270.00-42313-944-GCR-305	Process Control System in Primary Location (Panel)	Node1	PAUL			R27
1	DE-5270.00-42313-944-GCR-305	Process Control System in Primary Location (Panel)	Node1	LI			R13

Many Different HAZOP Formats

Deviation	Causes	Consequences	Consequence Categories			Safeguards	ALARP?
			CAT	S	Hazardous Material		
1.2. Flow More	1.2.1. Fail open control valve on blanketing line 500PICA200A or failure of 500PICA200, leading to opening of 500PICA200A while closing 500PICA200B. Cause: 1.1.2.1	1.2.1.1. Potential overpressure of V5002. LOPC, fire and explosion. LOPA Scenario: 1.3	P	SB	1 H2	1 SW5002/S, sized for this scenario. LOPA Scenario - IPL Item: 1.3.1	Y, as cost of other options is considered grossly disproportionate
		2 Emergency Response (valid for fire scenario, but not taken credit for as explosion is highest risk for fatality). LOPA Scenario - IPL Item: 1.3.2					
3 Ignition control. LOPA Scenario - IPL Item: 1.3.3							
4 Explosion probability. LOPA Scenario - IPL Item: 1.3.4							
		1.2.1.2. Less H2 flow to K5001A/B, refer to 1.1.2. Cause: 1.1.2					
1.4. Flow Reverse	1.4.1. 500PICA027 loop fails such that valve opens, so that fresh gas spill back line is open.	1.4.1.1. Pressure at the suction starts to build up against the shut check valve H50035. Potential overpressure of V5001. LOPC, fire and explosion. LOPA Scenario: 1.4	P	SB	1 H2	1 SW5001/S protects V5001 against overpressure and is sized for this scenario. LOPA Scenario - IPL Item: 1.4.1	Y, as cost of other options is considered grossly disproportionate
						2 Emergency Response (valid for fire scenario, but not taken credit for as explosion is highest risk for fatality). LOPA Scenario - IPL Item: 1.4.2	
						3 Ignition control. LOPA Scenario - IPL Item: 1.4.3	
						4 Explosion probability. LOPA Scenario - IPL Item: 1.4.4	

Mapping HAZOP to Bowtie

Deviation	Causes	Consequences	Consequence Categories		Safeguards	ALARP?	Safety Critical Elements		HAZOP Recommendations	
			CA	S			PEFS Tag nr.	HAZOP Recommendations	Responsibility	
	1.1.3. Failure of loop such that drain valve 500UZ871 opens (control valve of 500LISA001). Consequence: 1.3.1.1	1.1.3.1. Gas to flare. Loss of H2. Community impact.			1. Size of the on/off valve 500LISA001 is 20 mm to minimize the H2 flow. 2. 500GB0008 off-norm alarm to alert operator to check drain valve.	Y, as cost of other options is considered grossly disproportionate				
	1.1.4. Control valve 500PICA200A to V5002 blanketing fails closed. Cause: 14.6.1	1.1.4.1. Reduced suction pressure P5001A/B (still liquid height in feed vessel V5002). Feed pump P5001A/B will run slightly off his pump curve. Economic impact. No hazardous consequence.								
1.2. Flow More	1.2.1. Fail open control valve on blanketing line 500PICA200A or failure of 500PICA200, leading to opening of 500PICA200A while closing 500PICA200B. Consequence: 1.3.2.1	1.2.1.1. Potential overpressure of V5002. LOPC fire and explosion. LOPA Scenario: 1.3	SB	1. H2	1. SVV5002/S, sized for this scenario. LOPA Scenario - IPL item: 1.3.1 2. Emergency Response (valid for fire scenario, but not taken credit for as explosion is highest risk for fatality). LOPA Scenario - IPL item: 1.3.2 3. Ignition control. LOPA Scenario - IPL item: 1.3.3 4. Explosion probability. LOPA Scenario - IPL item: 1.3.4	Y, as cost of other options is considered grossly disproportionate	Threat Barrier			LOSS OF CONTROL
		1.2.1.2. Less H2 flow to K5001A/B, refer to 1.1.2 Cause: 1.1.2								
1.3. Flow Misdirected	1.3.1. Manual bypass around 500UZ871 inadvertently opened	1.3.1.1. Refer to 1.1.3 Cause: 1.1.3								



HAZOP / LOPA

Bowtie

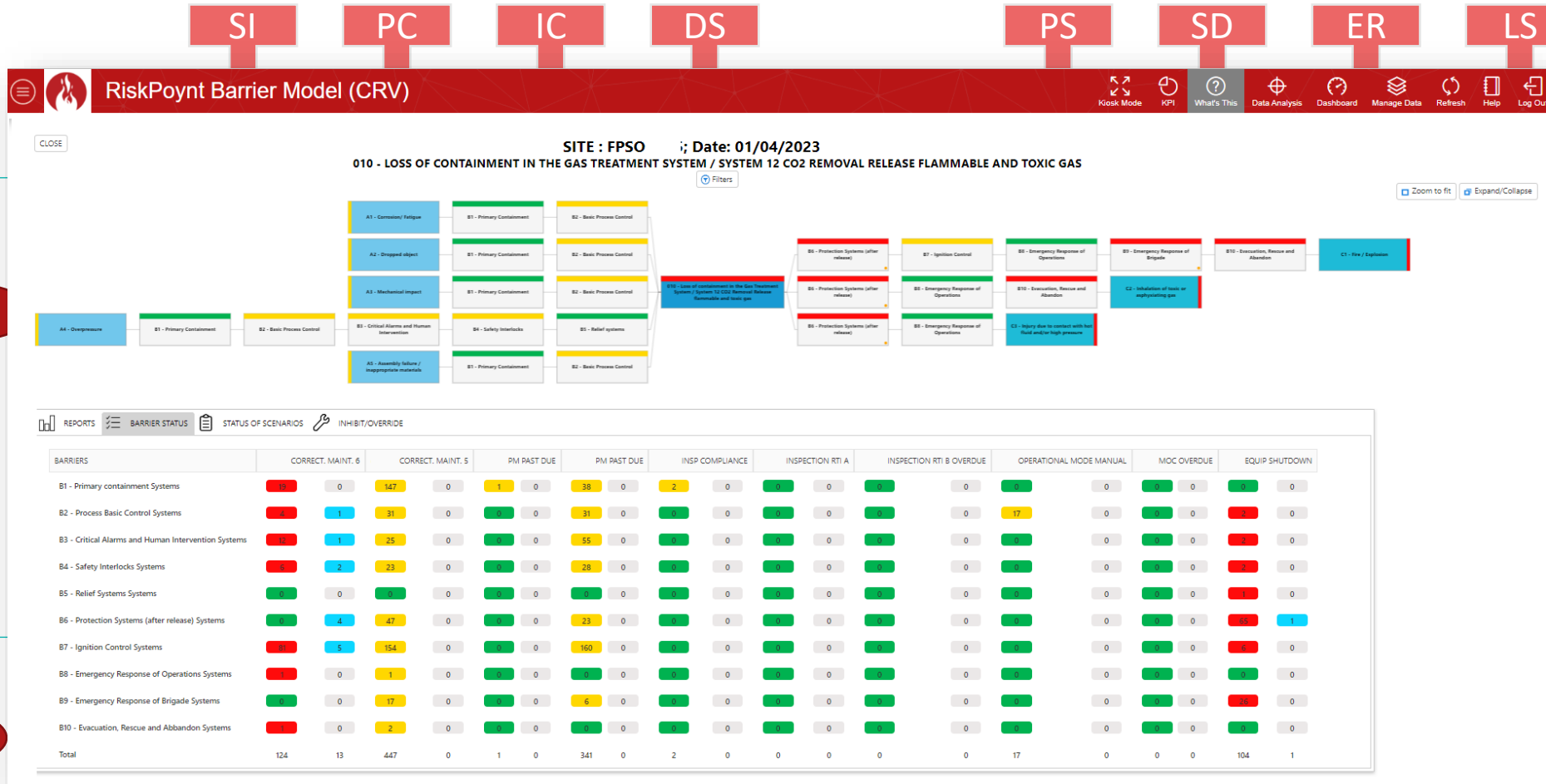
Outcome - Operational Bow Tie

1.2.1 Fail open control valve on blanketing line 500PICA200A or failure of 500PICA200, leading to opening of 500PICA200A while closing 500PICA200B.

IEF 1.00E-1

1.4.1 500PICA027 loop fails such that valve opens, so that fresh gas spill back line is open.

IEF 1.00E-1



1.2.1.1 Fire

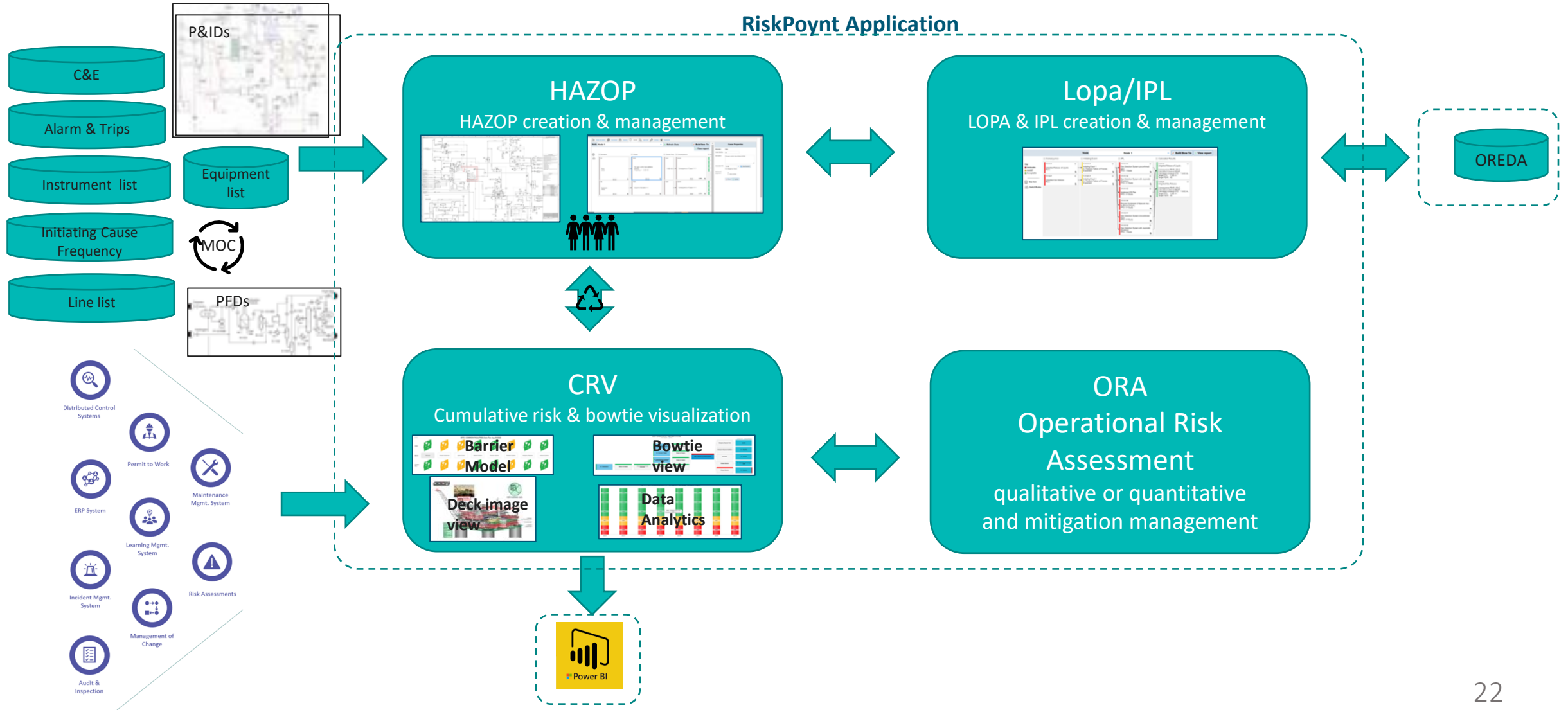
1.2.1.1 Explosion

1.4.1.1 Fire

1.4.1.1 Explosion

HAZOP/LOPA With RiskPoynt

High Level Overview



RiskPoynt Offering

- HAZOP, LOPA, and Bowtie integrated within one application
- 'Drag & Drop' user interface for HAZOP & LOPA creation
- Instant generation of Bowtie from HAZOP
- Real-time operational status of Bowtie, based on existing RiskPoynt Cumulative Risk principles
- Configurable bowtie degradation ruleset, based on simple 'pass-through' RAG or complex Initiating event frequency / Probability of Failure on Demand (PFD) calculations
- Traceability of impact of MOC / ERP etc. from Bowtie back to HAZOP

Benefits to Operators

- During the HAZOP workshop, causes, consequences, etc. are codified to allow automatic creation of Bowtie
- Creating LOPA from HAZOP when safeguards are out of tolerance
- Creating Bowties from HAZOPs is no longer a time-consuming manual review process
- Integrated solution means any changes to equipment are managed through the entire process
- Cumulative risk to the operator can be visualized at specific 'top event' / Major Accident Hazard level e.g. *Loss of Containment (Gas Compression)*
- Executive dashboard of 'Major Accident Hazard' status traceable back to Safety Case
- Relationship between MAH and Equipment status- which degraded equipment is impacting the MAH and why?

How It Works

Codification During Scribing

RiskPoynt Barrier Model (CRV)

Study Description Documents Sessions HAZOP Approvals Settings Equipment

Node Hazop Study Node 001 Refresh Data View report View Bow Tie Build Bow Tie

Deviation	Cause	Cause Freq	Consequence	Score	Safeguard
1.1 Flow No/Less	1.1.1 @C-15004 Debutaniser OVRHD to FWH Vlv @on/off valve @C-15004 Debutaniser OVRHD to FWH Vlv control loop failure Frequency = 1.00E-03	1.1.1 1.00E-03	1.1.1.1 Consequence of Cause 1.1.1 Nitrogen Fire #Loss of Process Containment and #Jet Fire LOPA Exists LOPA	P3-C E1-C A4-C	1.1.1.1.1 @on/off valve which #Jet Fire #Protection System test text@on/off valve which #Jet Fire #Protection System test text 1.1.1.1.2 Safeguard for Consequence 1.1.1.1.1 #Drop Object #Detection Systems and make this more text. @C-15004 Debutaniser OVRHD to FWH Vlv# 1.1.1.1.3 @on/off valve which #Jet Fire #Protection System test text@on/off valve which #Jet Fire #Protection System test text 1.1.1.2.1 @on/off valve which #Jet Fire #Protection System test text 1.1.1.2.2 @on/off valve which #Jet Fire #Protection System test text @on/off valve #Drop Object #Protection System
1.2 Flow No/Less	1.2.1 @C-15004 Debutaniser OVRHD to FWH Vlv @on/off valve @C-15004 Debutaniser OVRHD to FWH Vlv control loop failure Frequency = 1.00E-03	1.2.1 1.00E-03	1.2.1.1 Consequence of Cause 1.1.1 Nitrogen Fire #Loss of Process Containment and #Jet Fire LOPA Exists LOPA 1.2.1.2 Consequence of Cause 1.1.1 Nitrogen Fire #Loss of Process Containment and #Jet Fire	P3-B P3-B	1.2.1.1.1 Safeguard for Consequence 1.1.1.1.1 #Drop Object #Detection Systems and make this more text. @C-15004 Debutaniser OVRHD to FWH Vlv# 1.2.1.1.2 @on/off valve which #Jet Fire #Protection System test text 1.2.1.2.1 @on/off valve which #Jet Fire #Protection System test text

Properties

Parameter	Value
Consequence Identity	1.1.1
Description	Consequence of Cause 1.1.1 Nitrogen Fire #Loss of Process Containment and #Jet Fire

TOP EVENTS

- Loss of Process Containment a
- Loss of Process Containment
- Risk to human life

CONSEQUENCES

- Fire
- Explosion
- Jet Fire
- Gas Cloud

SUBSTANCES

- Nitrogen - Fire
- Gasoline - Unignited release
- Gasoline - Spill to water
- Crude - Unignited release
- Sour water - Unignited release
- LPG - Self heating
- H2S - Ignited release

Action Due Date:
Responsible:
ALARP?:
LOPA Requirements: People Environment Asset Reputation
Referenced Equipment:
Close Update

Creation LOPA From HAZOP Consequence

RiskPoynt Barrier Model (CRV)

Study Description Documents Sessions HAZOP Approvals Settings Equipment

Node Hazop Study Node 001 Refresh Data View report View Bow Tie Build Bow Tie

Consequence

1.1.1.1.1
Consequence of Cause 1.1.1 Nitrogen Fire #Loss of Process Containment and #Jet Fire # P3-C

1.1.1.1.2
Consequence of Cause 1.1.1 Nitrogen Fire #Loss of Process Containment and #Jet Fire # A4-C

1.1.1.2.1
Consequence of Cause 1.1.1 Nitrogen Fire #Loss of Process Containment and #Jet Fire P3-B

1.1.1.2.2

Initiating Event

1.1.1.1.1.1
Initiating Event 1 Cause for Deviation 1.1

1.1.1.1.2.1
Initiating Event 1 Cause for Deviation 1.1

1.1.1.2.1.1
Initiating Event 1 @C-15004 Debutaniser OVRHD to FWH Vlv @on/off valve @C-15004 Debutaniser OVRHD to FWH Vlv control loop failure

1.1.1.2.2.1

IE PFD

1.1.1.1.1.1
1.00E-02

1.1.1.1.2.1
1.00E-02

1.1.1.2.1.1
1.00E-03

1.1.1.2.2.1

IPL

1.1.1.1.1.1
Safeguard for Consequence 1.1.1.1.1 #Drop Object #Detection Systems and make this more text @C-15004 Debutaniser OVRHD to FWH PFD: 1.0000E-02

1.1.1.1.1.2
@on/off valve which #Jet Fire #Protection System test text PFD: 1.0000E-04

1.1.1.1.1.3
description this is the new barrier PFD: 1.0000E-03

1.1.1.1.2.1
Safeguard for Consequence 1.1.1.1.1 #Drop Object #Detection Systems and make this more text @C-15004 Debutaniser OVRHD to FWH PFD: 1.0000E-02

1.1.1.1.2.2
@on/off valve which #Jet Fire #Protection System test text PFD: 1.0000E-04

1.1.1.2.1.1
@on/off valve which #Jet Fire #Protection System test text PFD: 1.0000E-04

1.1.1.2.1.2
Safeguard for Consequence 1.1.1.1.1 #Drop Object #Detection Systems and make this more text @C-15004 Debutaniser OVRHD to FWH PFD: 1.0000E-02

1.1.1.2.2.1

EF PFD

1.00E-02

1.00E-04

1.00E-03

1.00E-02

1.00E-04

1.00E-04

1.00E-02

CM PFD

1.00E-02

1.00E-04

1.00E-04

1.00E-02

1.00E-04

1.00E-02

Calculated Results

1.1.1.1.1
Consequence PEAR : P3-C, Calculated Achieved PEAR : P3-A, Calculated Achieved PFD : 1.0000E-11, Target PFD : 1.0000E-01

1.1.1.1.2
Consequence PEAR : A4-C, Calculated Achieved PEAR : A4-A, Calculated Achieved PFD : 1.0000E-08, Target PFD : 1.0000E-01

1.1.1.2.1
Consequence PEAR : P3-B, Calculated Achieved PEAR : P3-A, Calculated Achieved PFD : 1.0000E-09, Target PFD : 1.0000E-01

1.1.1.2.2

Properties

Parameter	Value
Identity	1.1.1.1.1
Description	Consequence of Cause 1.1.1 Nitrogen Fire #Loss of Process Containment and #Jet Fire #
Consequence Ranking	P3-C
Target Ranking	4D
Target PFD	1.0000E-01
Achieved Ranking	P3-A
Achieved PFD	1.0000E-11
Target ALARP?	<input checked="" type="checkbox"/>
Required Risk Reduction PFD	
Required Risk Reduction Factor	0
Overall Risk Reduction Factor	0
Workings	$F = \sum (IEFs \times P_e \times PFD_1 \times PFD_2 \times PFD_n) \times P_c \times PFD_{RHS}$ <p>IEF = Initiating Event Frequency PFD_n = Probability of Failure on Demand for Valid Barriers (n being the total number of valid barriers for each IE) P_e = Enabling Factor P_c = Conditional Modifier(s) Σ = The Sum of (IEF x PFDs) as required</p>
Condition Modifier	1.00E+00
IE, IPL, EF	1.0000E-11
Right Hand Side	1.0000E+00

Close

Creation Bow Ties From HAZOP

RiskPoynt Barrier Model (CRV)

Study Description Documents Sessions HAZOP Approvals Settings Equipment

Node Hazop Study Node 001 Refresh Data View report View Bow Tie Build Bow Tie

Consequence Initiating Event IE PFD IPL IPL PFD Calculated Results

Properties

Param	Value
Deviation	1.1.1.1.1
Description	Consequence of Cause 1.1.1 Nitrogen Fire #Loss of Process Containment and #Jet Fire #
Consequence Ranking	P3-C
Target Ranking	4D
Target PFD	1.0000E-01
Achieved Ranking	P3-A
Achieved PFD	1.0000E-11
Target ALARP?	<input checked="" type="checkbox"/>
Required Risk Reduction PFD	
Required Risk Reduction Factor	0
Overall Risk Reduction Factor	0
Workings	$F = \sum(IEFs \times P_{e1} \times PFD_1 \times PFD_2 \times PFD_3 \times PFD_{n15})$ <p>IEF = Initiating Event Frequency PFD_n = Probability of Failure on Demand for Valid Barriers (n being the total number of valid barriers for each IE) PFD_r = Probability of Failure on Demand for Valid Barriers on the right hand side of the bowtie P_e = Enabling Factor P_c = Conditional Modifier(s) Σ = The Sum of (IEF x PFDs) as required</p>
Condition Modifier	1.00E+00
IE, IPL, EF	1.0000E-11
Right Hand Side	1.0000E+00

Hazop to RiskPoynt Bowtie

HAZOP Table:

Deviation	Cause	Cause Freq	Consequence	Score	Safeguard
Flow No/Leak	SDV-30000 malfunctions closed while running multiple plants (4301) Frequency = 1.00E-01	1.00E-01	Potential to fail lines and equipment downstream of compressor. Potential explosion. Potential personnel injury (I). LOPA: blocked compressor outlet addressed in other nodes.	PE-A	Each compressor has PSHH Discharge PSV sized for blocked outlet
Flow No/Leak	SDV-30000 malfunctions closed while running single plant (4301) Frequency = 1.00E-01	1.00E-01	Potential to fail lines and equipment downstream of compressor. Potential explosion. Potential personnel injury (I). LOPA: blocked compressor outlet addressed in other nodes.	PE-A	Each compressor has PSHH Discharge PSV sized for blocked outlet RHS Barrier
Flow No/Leak	Block valve on inlet or outlet of AC-302 Plant #1 Amine Air Cooler left closed (4301) Frequency = 1.00E-02	1.00E-02	Potential to fail lines and equipment downstream of compressor. Potential loss of containment. Potential fire. Potential explosion. Potential personnel injury (I). LOPA: blocked compressor outlet addressed in other nodes.	PE-A	Each compressor has PSHH Discharge PSV sized for blocked outlet RHS Barrier
Pressure High	External fire near F-300, AC-302, and T-301		Potential to fail lines and equipment downstream of compressor. Potential explosion. Potential personnel injury (I). LOPA: blocked compressor outlet addressed in other nodes.	PE-A	PSV 30201, set at 1440 psig on AC-302 RHS Barrier

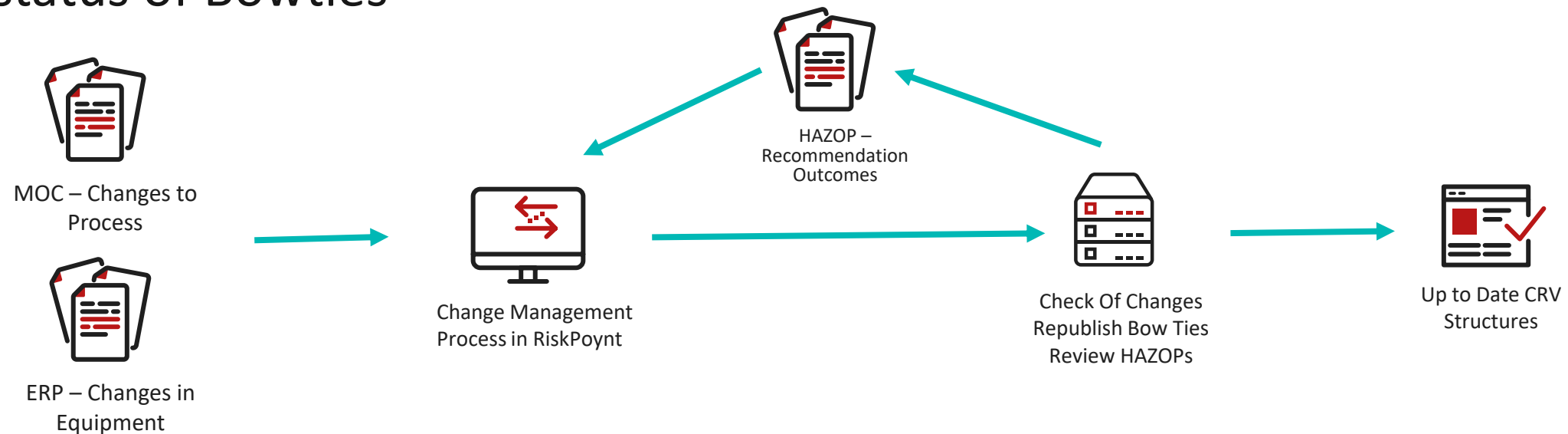
Bowtie Diagram:

- Central Event: Node 1 Loss of Process Containment
- Barriers:
 - PSV 30201, set at 1440 psig on AC-302
 - Discharge PSV sized for blocked outlet
 - Each compressor has PSHH
 - RHS Barrier
- Consequences:
 - Fire, Explosion, Personnel Injury
 - Personnel Injury

Demonstration

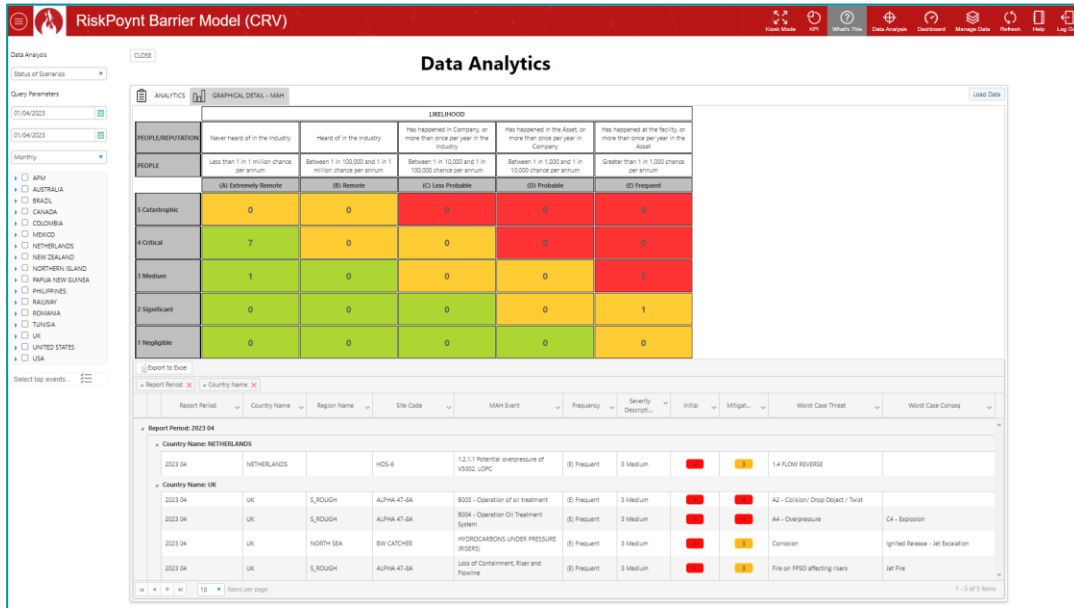
Manage Change in the Process End to End

- Impacts from MOCs, etc. can instantly be seen on Bowtie and Hazop
- Obsolete Hazops can be identified where MOC/ERP modification to plant or operating envelope has occurred
- RiskPoynt already has full register of operational impacts; work orders, MOCs, Risk Assessment, etc., so these can be used to show operational status of Bowties

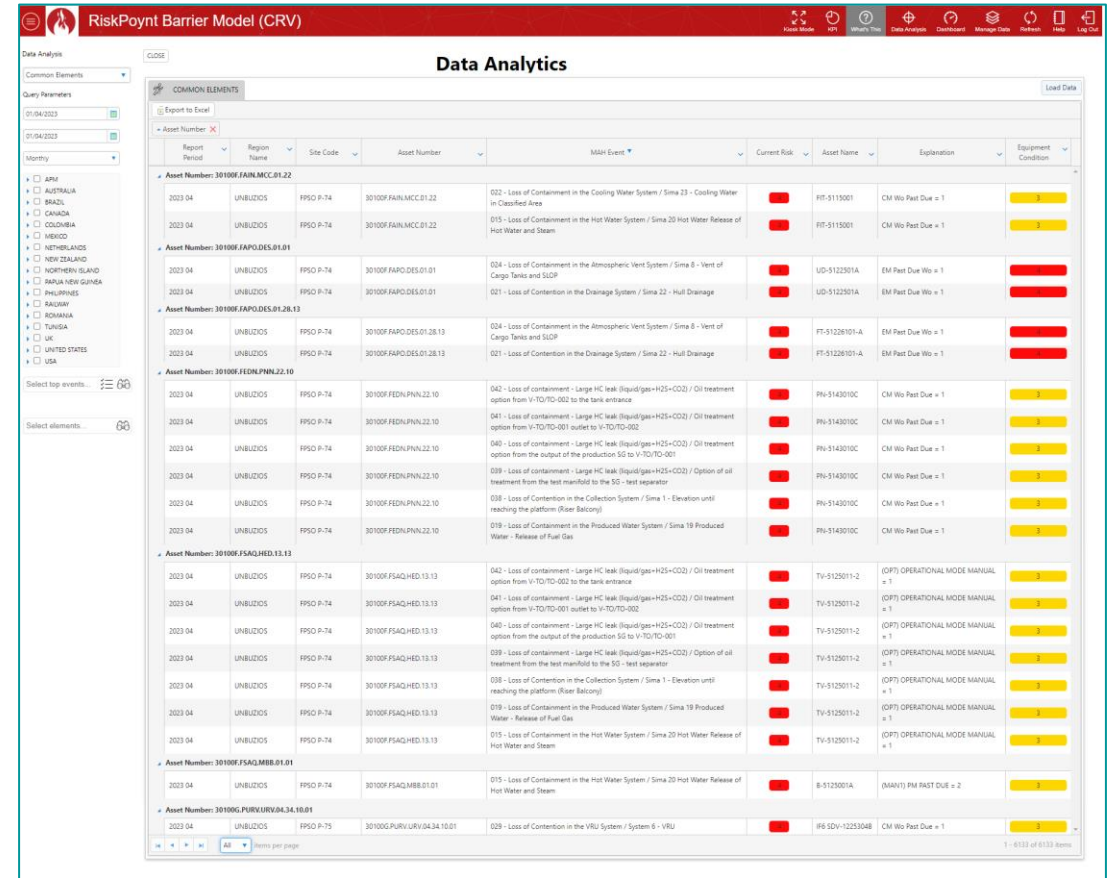


Benefits to Operators

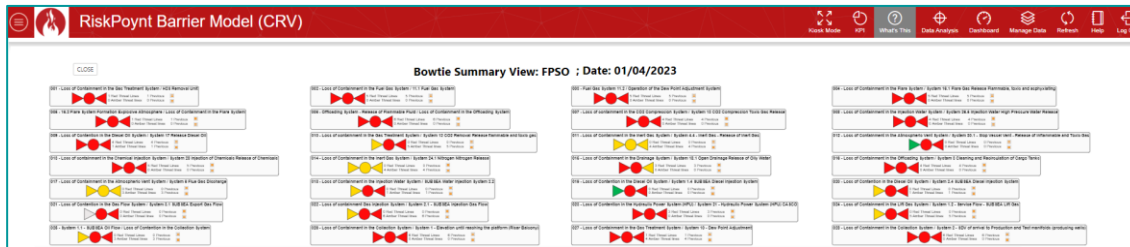
- Executive Dashboard



- Relationship between MAH and Equipment status



- Cumulative Risk Visualize by Specific Top Event



Questions?

PROMETHEUS
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CONFERENCE

Michael Mostert