PROMETHEUS GROUP | 17TH ANNUAL USER CONFERENCE NORTH AMERICA

PETROBRAS

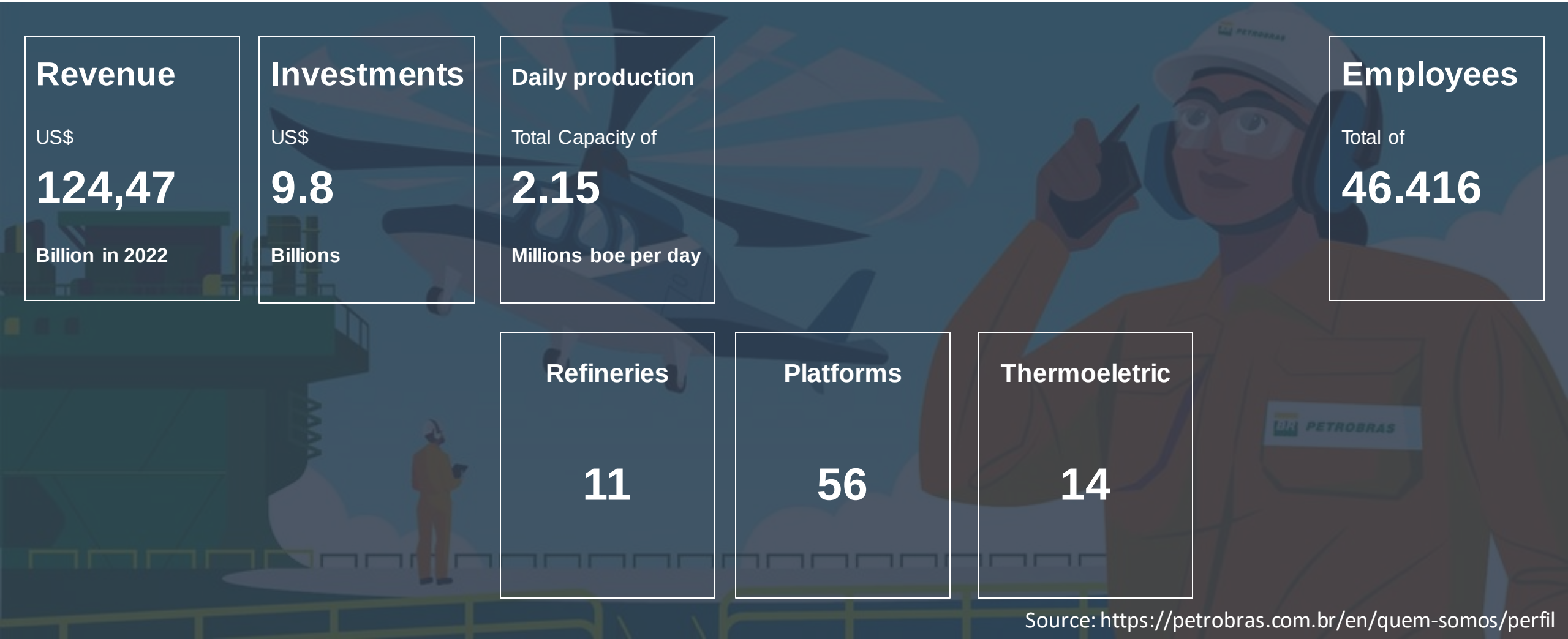
Dynamic Process Safety Barriers Management at Petrobras

Fábio Rossi
Rafael Armada

April 2024

Dynamic Process Safety Barriers Management at Petrobras

Petrobras at a glance (2022)



Revenue

US$

124,47

Billion in 2022

Investments

US$

9.8

Billions

Daily production

Total Capacity of

2.15

Millions boe per day

Employees

Total of

46.416

Refineries

11

Platforms

56

Thermoeletric

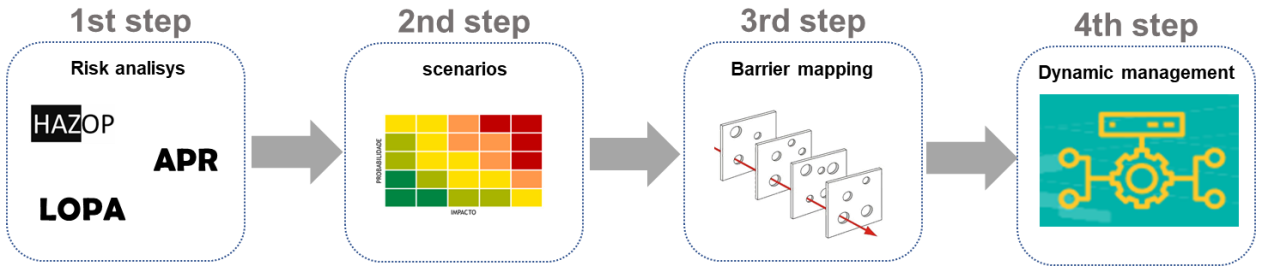
14

Source: https://petrobras.com.br/en/quem-somos/perfil

Dynamic Process Safety Barriers Management at Petrobras

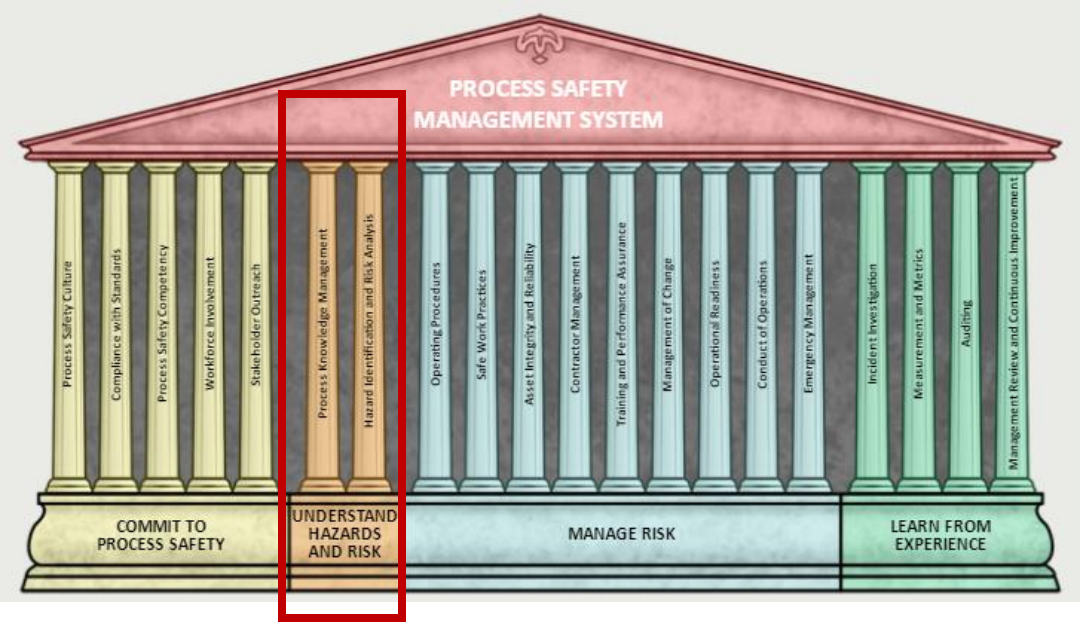
The Project purpose is to enhances **understanding of specific scenarios** and provides **clear indication that the safeguards** (risk-control measures) are in place and performing properly.

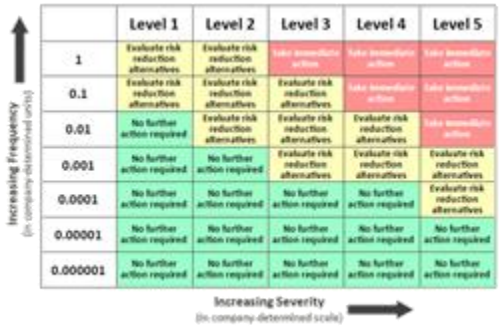
Summarizes and **communicates the health** (effectiveness) **and importance** (criticality) **of these safeguards** to support the **decision-making.**



Dynamic Process Safety Barriers Management at Petrobras

Understand Hazards and Risks





Preliminar Risk Analysis

PETROBRAS	APR	Associated MOC:
		Analysis Leader:
Unit:	Title:	Date:
System:	Reference Drawings:	
Subsystem:		
Node:		

Hazardous Event	Causes	Possible effects	Detection (D) / Safeguards (S)	R	Freq.	Severity Category				Risk Category				Observation / Recomendation	N°
						SP	P	E	I	SP	P	E	I		
Large Release of Toxic Gases	Reactor Temperature Control Failure	Toxic Gas Cloud with Multiple Fatalities	Failure in reactor water flow control (FV) Failure in reactor cooling control Operational failure to temperature alarm (TAH) Failure in cooling outlet valve (improper closure) Toxic gas detection system		B	V	V	IV	II	NT	NT	NT	M		

Hazard and Operability Study

PETROBRAS	HAZOP	Associated MOC:
		Analysis Leader:
Unit:	Title:	Date:
System:	Reference Drawing:	
Subsystem:		
Node (session):		

Deviation	Causes	Consequences	Detection (D) / Safeguards (S)	R	Freq.	Severity category				Risk Category				Observation / Recomendation
						SP	P	E	I	SP	P	E	I	
Temperture high	Loss of control in water flow for the reaction (Failure in the FV) or Opening of the FV due to temperature control failure (TC)	Loss of reaction control resulting in increased pressure, rupture disk opening, and formation of a toxic gas cloud with consequent fatalities	(S) Toxic Gas Detection System (S) Water Flow Control (FV) (S) Operational Response to Alarm (TAH) (D) Toxic Gas Detector	S	B	V	V	IV	II	V	V	IV	II	

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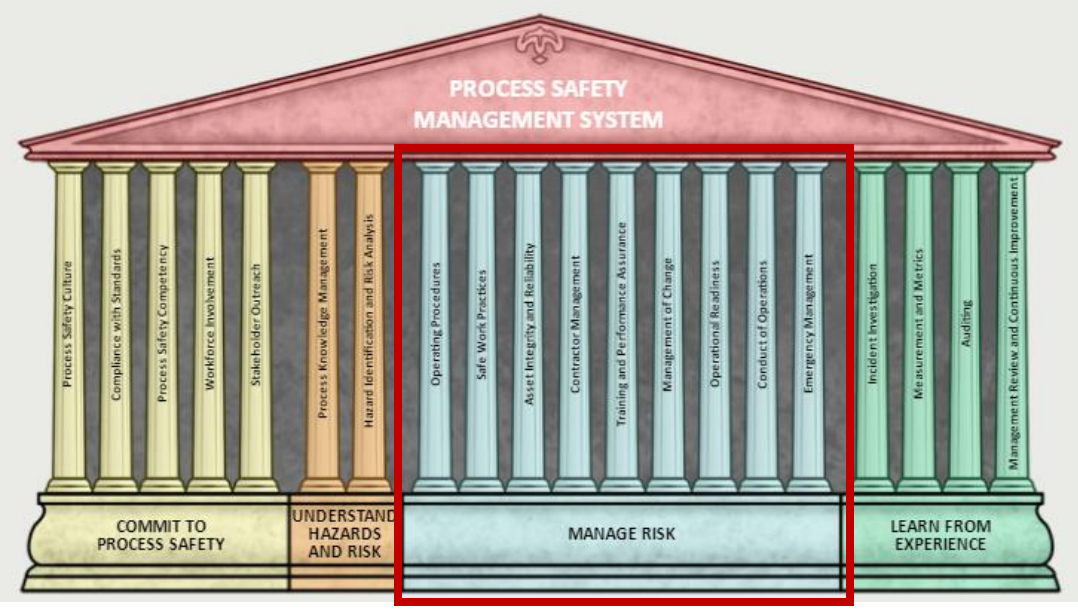
Manage Risk



- Inspection
- Maintenance
- Operation
- Process
- Automation
- Emergency response

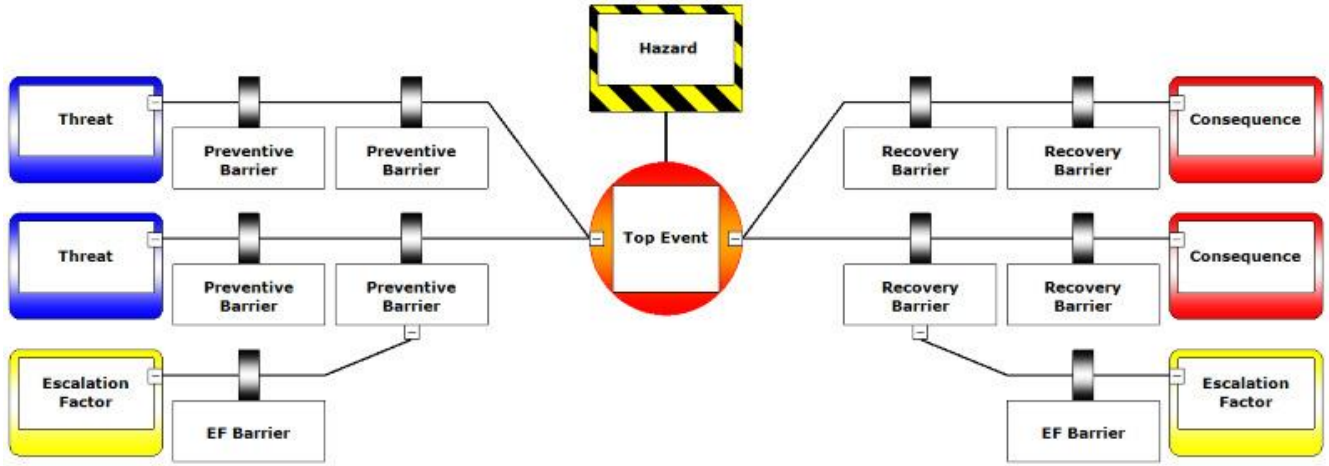
KPIs

Dynamic Process Safety Barriers Management at Petrobras

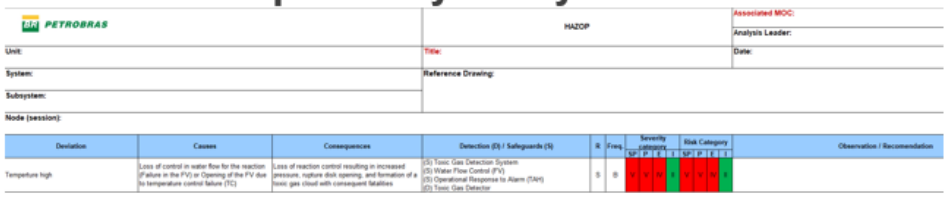
Bowtie

Visual tool for assessing and managing the risks, causes, and controls of potential major accidents. It is capable of showing all the barriers and deployed degradation controls.

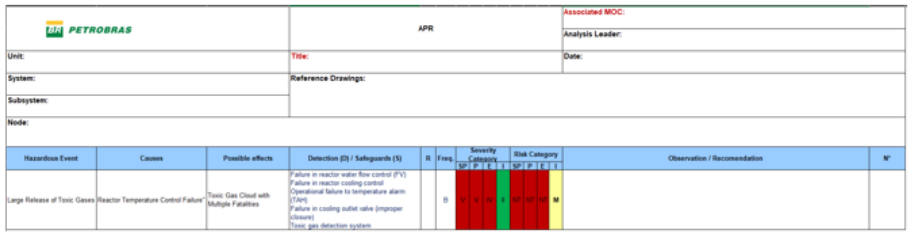
CCPS AiChe – Bow Ties in Risk Management, 2018 A Concept Book for Process Safety



Hazard and Operability Study



Preliminar Risk Analysis



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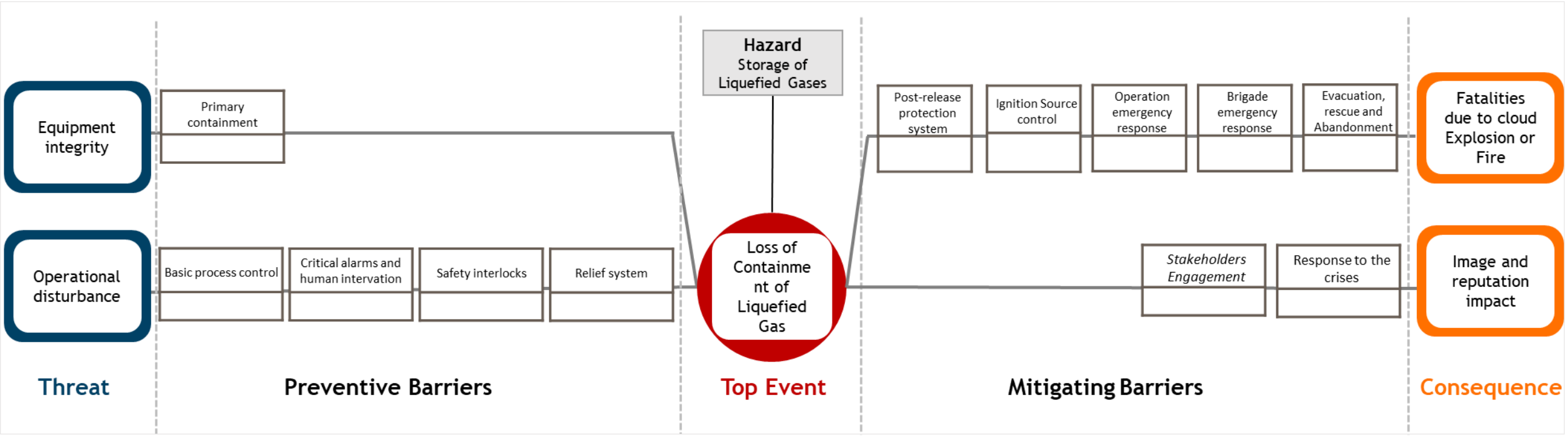
Bowtie



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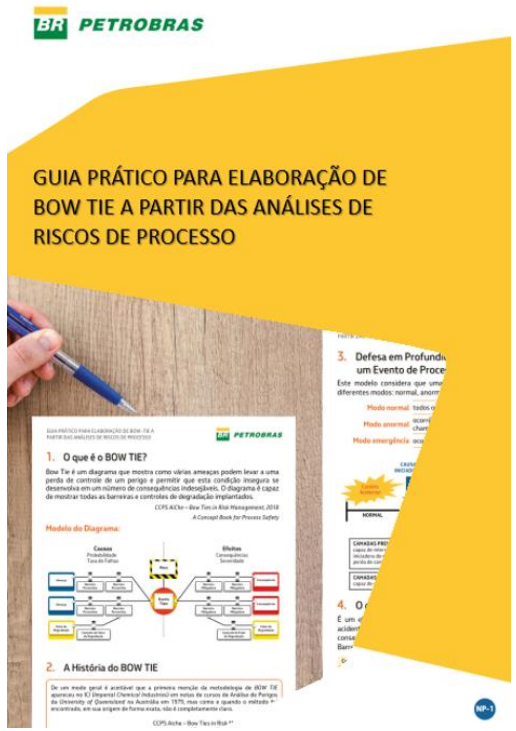
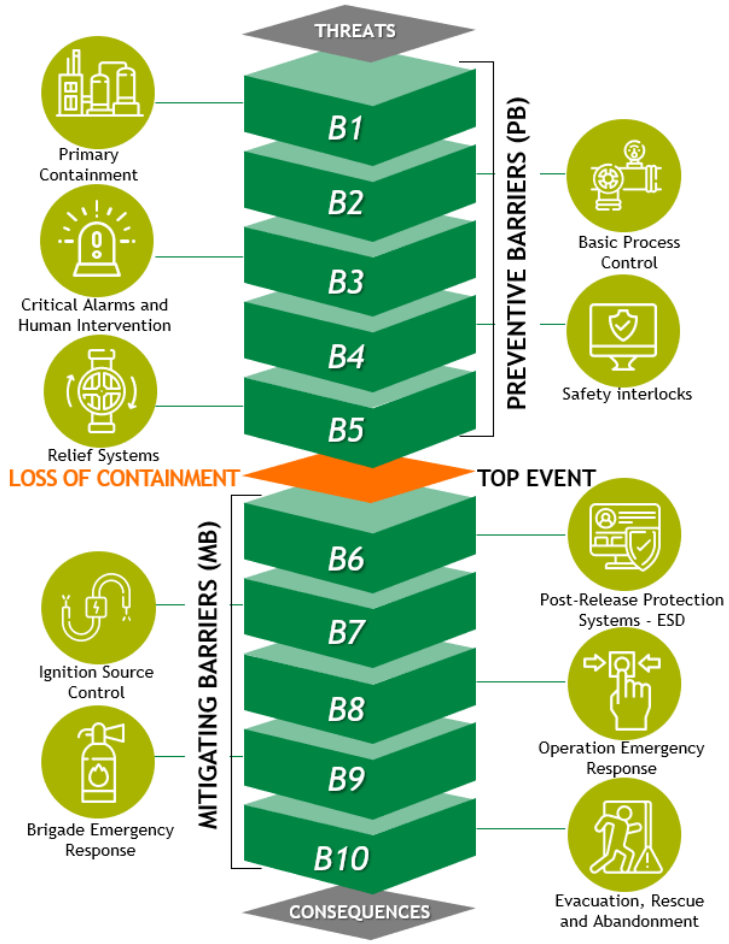
Bowtie





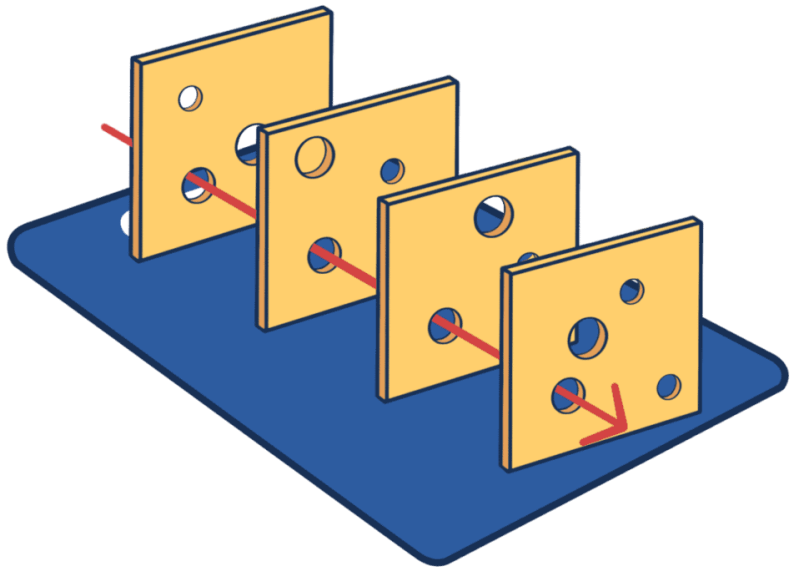
Dynamic Process Safety Barriers Management at Petrobras

Dynamic

	Level 1	Level 2	Level 3	Level 4	Level 5
1	Evaluate risk reduction alternatives	Evaluate risk reduction alternatives	Take immediate action	Take immediate action	Take immediate action
0.1	Evaluate risk reduction alternatives	Evaluate risk reduction alternatives	Evaluate risk reduction alternatives	Take immediate action	Take immediate action
0.01	No further action required	Evaluate risk reduction alternatives	Evaluate risk reduction alternatives	Evaluate risk reduction alternatives	Take immediate action
0.001	No further action required	No further action required	Evaluate risk reduction alternatives	Evaluate risk reduction alternatives	Evaluate risk reduction alternatives
0.0001	No further action required	No further action required	No further action required	No further action required	Evaluate risk reduction alternatives
0.00001	No further action required	No further action required	No further action required	No further action required	No further action required
0.000001	No further action required	No further action required	No further action required	No further action required	No further action required

Increasing Frequency (in company-determined units)

Increasing Severity (in company-determined scale)



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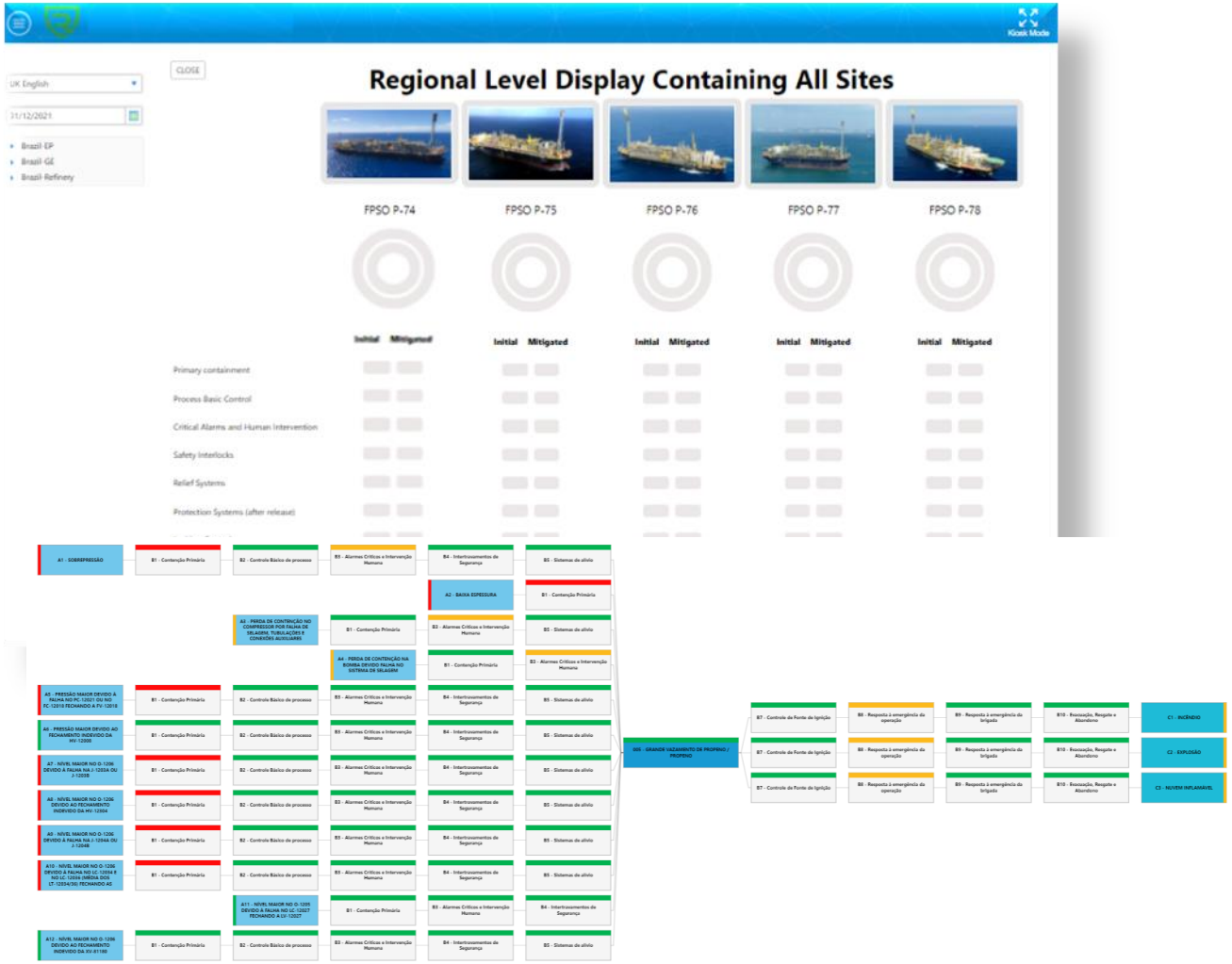
RiskPoynt

RiskPoynt
A Prometheus Group Company



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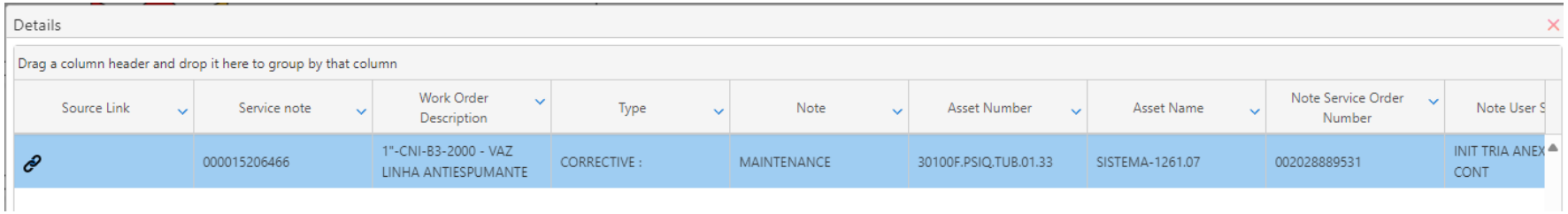
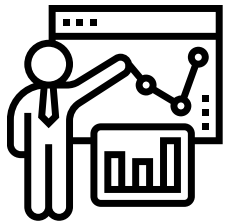
RiskPoynt



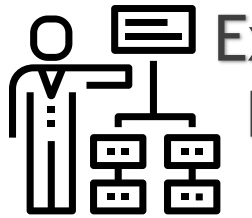
Dynamic Process Safety Barriers Management at Petrobras

Introduction



Expected Benefits

- Dynamic analysis of Process Safety Barrier integrity;
- Preventive identification of threats;
- Discipline integration – Operation, Maintenance, inspection, process and safety;
- Dynamic integrity assessment of Safety critical elements.



Expected Results

- Standard procedure;
- Data automation (quick response);
- Data reliability;
- Common language for risk communication;
- Effective management and control systems.

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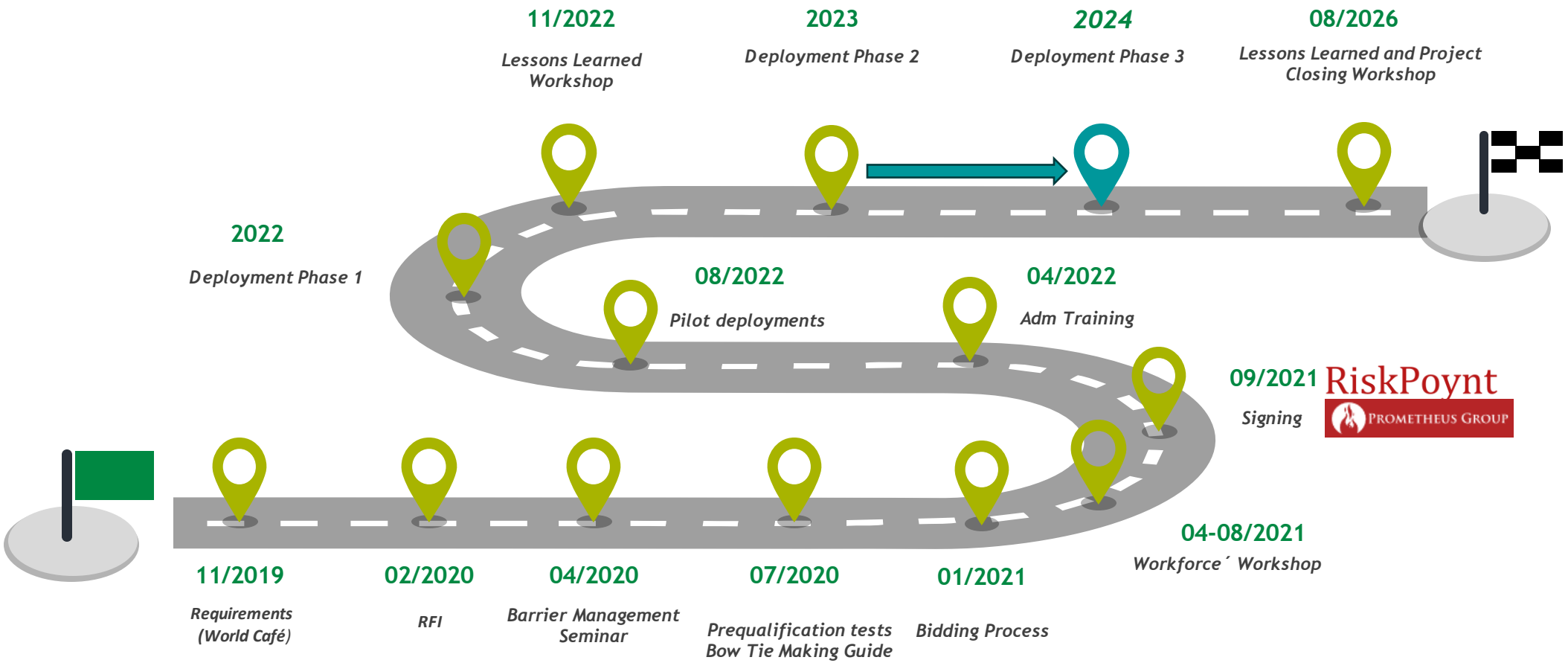
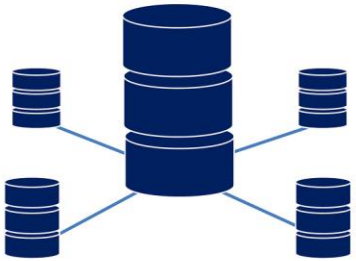
Roadmap



Dynamic Process Safety Barriers Management at Petrobras

Develop Software Communication with Databases

- Established remote connection between Petrobras' cloud and RiskPoynt's cloud;
- Integrate information from 30 different data sources;
- Translate 100 degradation criteria into queries for data acquisition
- 300.000 monitored equipment.

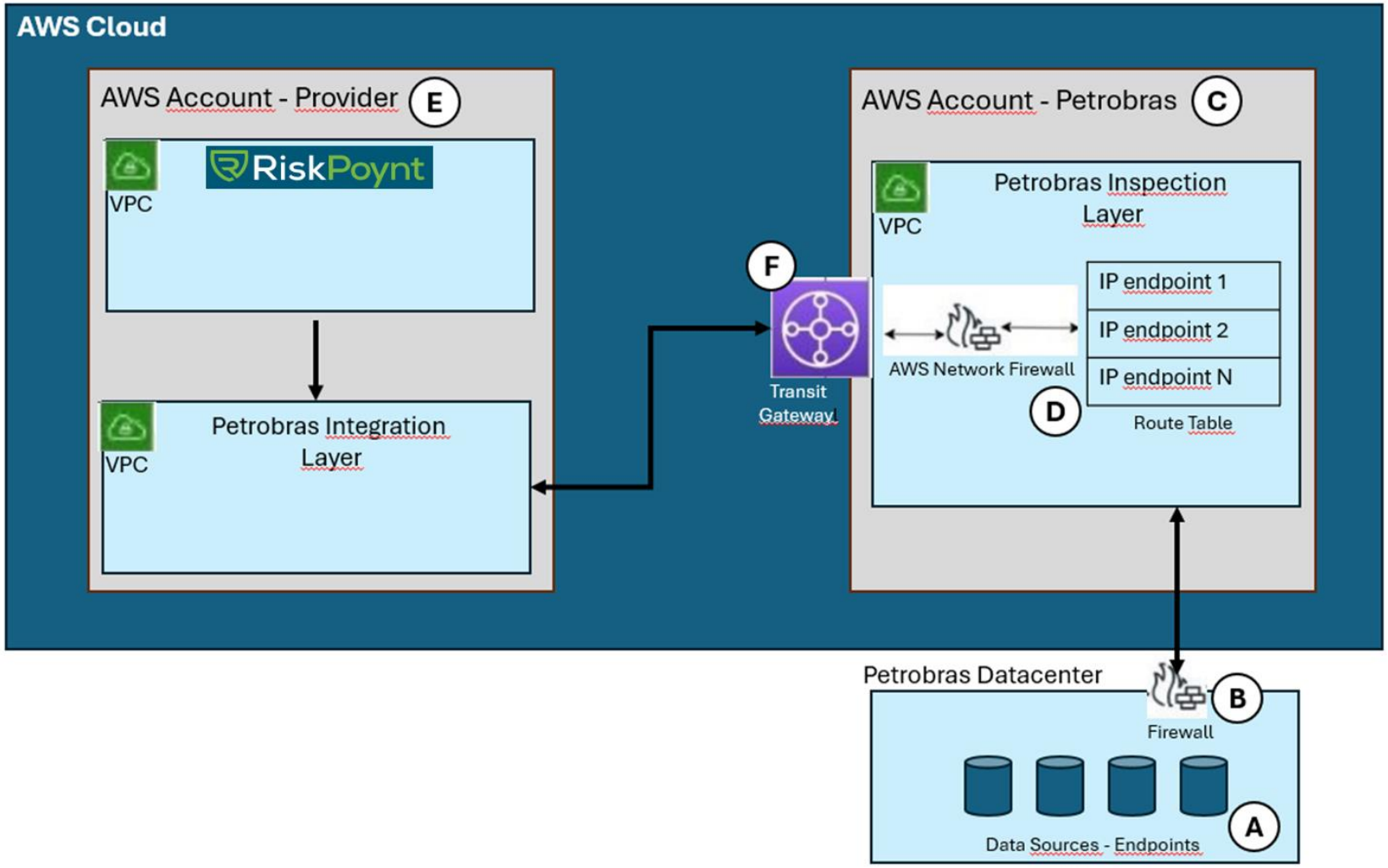


- **Maintenance Mgmt. System.**
- **ERP System.**
- **Management of Change.**
- **Alarms Mgmt.**

- Audit & Inspection.
- Risk Assessments.
- Permit to work.
- Licenses and compliance System.

- Learning Mgmt. System.
- Incident Mgmt. System.
- Distributed Control System.
- …

Cyber Security: Data Communication



A - Petrobras Data Sources
B – Petrobras network firewalls
C- Petrobras AWS Account
D – Access granted endpoints table
E – RP AWS Account
F – Transit Gateway – AWS security component

Integrations big numbers: one day at RP application operation

30 SYSTEMS CONSULTED

100 TABLES QUERIED

1,000 COLUMNS EXTRACTED

30,000 MAINTENANCE ORDERS/MAINTENANCE PLANS

4,000 RECORDS OF MONITORED ALARMS

300,000 PIECES OF EQUIPMENT MONITORED

DAILY LOAD PROCESSING OF **1H:30**

100 INTEGRATION JOBS

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Take Away

- Improve risk communication and stakeholder engagement;
- Optimizing resources allocation to strengthen controls;
- Adaptation to changing circumstances and evolving risks;
- PSM Critical Analysis across the company;
- Risk-based decision-making tool.

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Challenges

Ensure High availability and minimal failures

Keep track of life cycle of data sources integrated to RP

Review degradation criteria meeting business needs

Review and optimize data integration architecture

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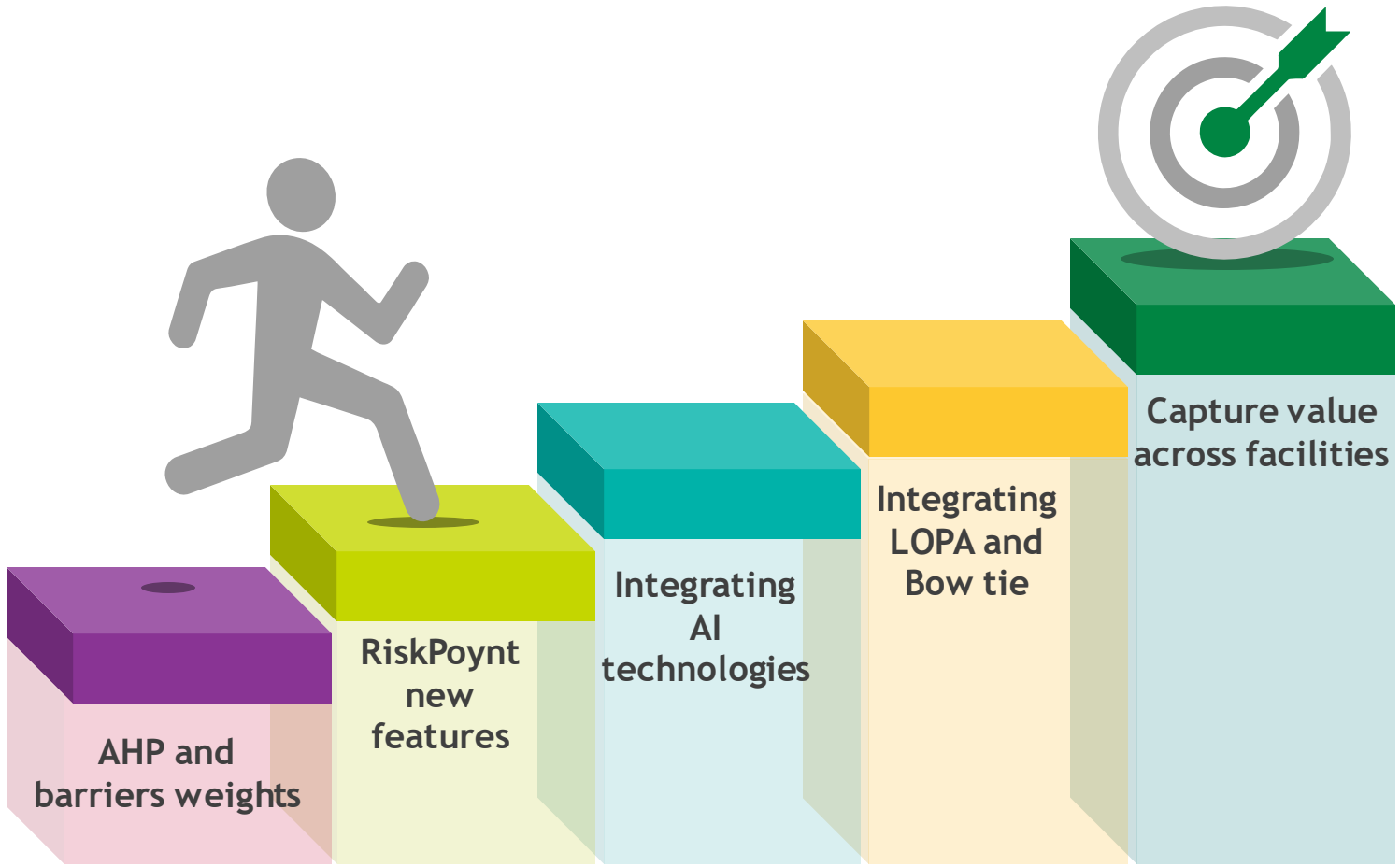
Way Forward



PETROBRAS

Contacts:

Fábio Rossi (Corporate Process Safety manager)

flrossi@petrobras.com.br

Rafael Armada (IT Manager)

rarmada@petrobras.com.br