



EPSC

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Visualize and Manage Process Safety Risk in Operations

Practical Case Studies

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Introductions



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Visualize and Manage Process Safety Risk in Operations: Practical Case Studies

OUTLINE

CHALLENGE	Are our facilities getting any safer? Where should we focus? Lessons from 2020 survey of Process Safety professionals
OPPORTUNITY	Industry 4.0 and Digital Twins Connecting process safety to the frontline
CASE STUDIES	Practical application of Barrier Health Models to surface systemic risks Delivering real-time risk view of all activity & critical equipment status for a major Middle East refinery
DEVELOPMENT	Evolving the model to focusing on major hazard risk – dynamic risk pathways A maturity model – setting out your path forward

Q&A - throughout

GOOD INTENTIONS

Companies take safety seriously...

88%

Say safety is part of corporate value structures

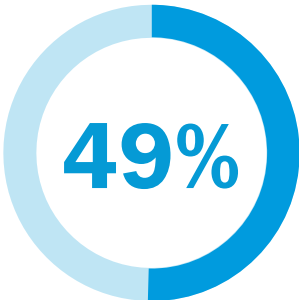
78%

Continuously monitor safety performance

60%

Are striving to reduce operational and Major Accident Hazard (MAH) risk exposure

... but risk insights are lacking.



Are unaware of their vulnerability to major hazard risk



Can proactively manage process safety

GOOD INTENTIONS

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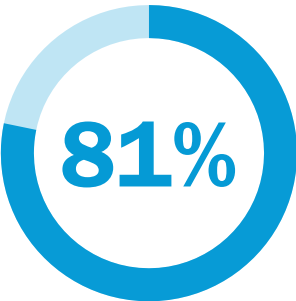
78%

Continuously monitor safety performance

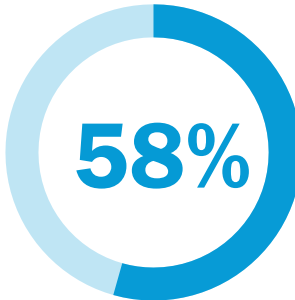
60%

Are striving to reduce operational and Major Accident Hazard (MAH) risk exposure

... but gaps exist between intent and reality.



Say there are gaps between process safety intent and reality

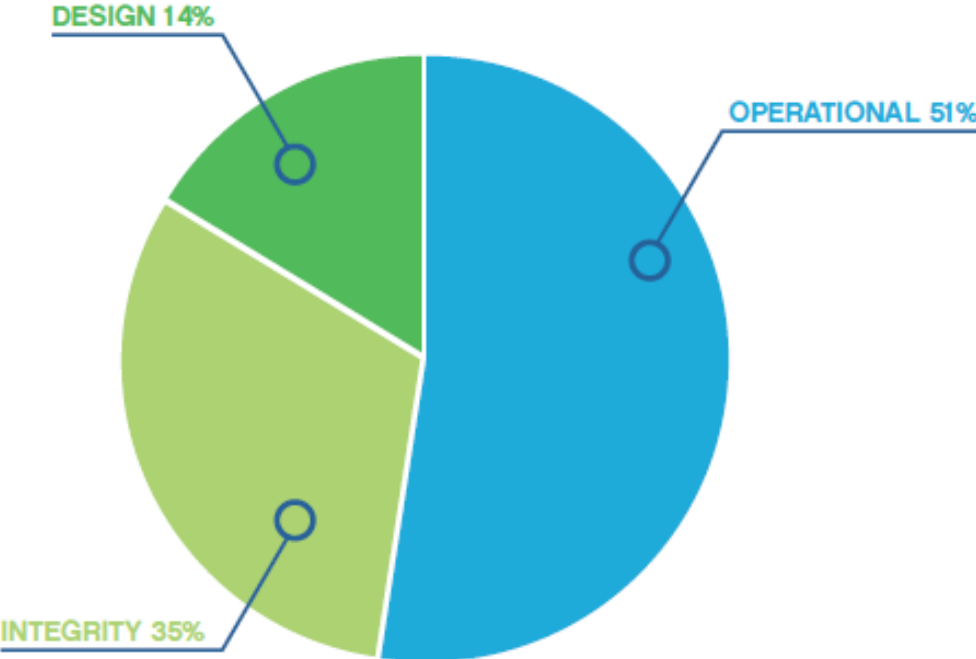


Say risk changes during periodic process safety review periods

EPSC Process Safety Fundamentals (2020)

FIGURE 1. EPSC BENCHMARK RESULTS OF 2019 INCIDENT ROOT CAUSES (ON CA 1000 CLASSIFIED PROCESS SAFETY CASES)

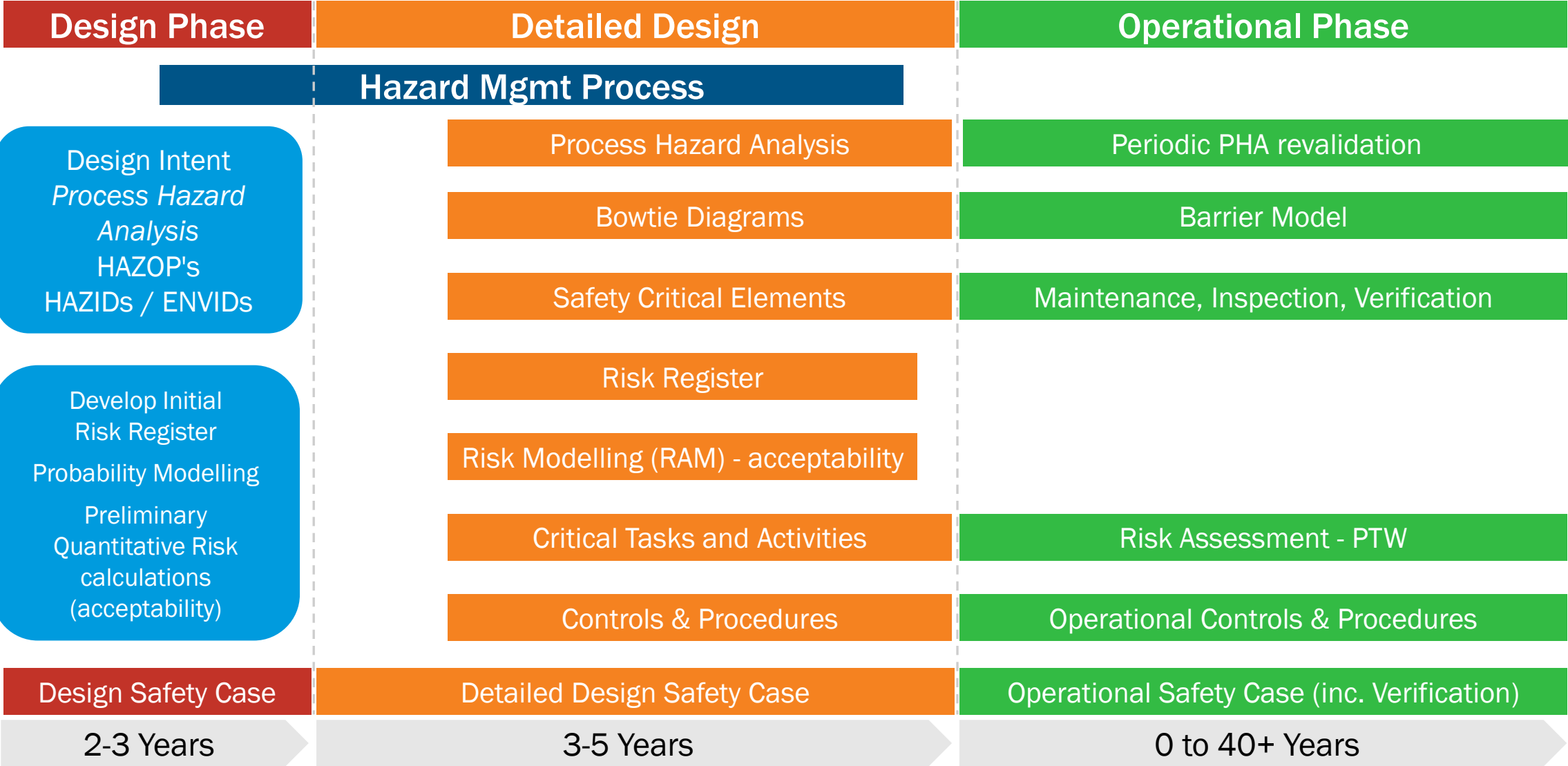
PROCESS SAFETY INCIDENT CAUSES



EPSC Process Safety Fundamentals



Components of a Safety Management System Over the Asset Lifecycle



What's in a KPI?



THE BOARDROOM

- 📊 **82%** of Safety Critical maintenance is achieved
- 📈 **79%** of staff have up-to-date competency training
- 🔧 Currently achieving **89%** of plan attainment



THE SUPERVISOR

- 📊 **18%** of Safety Critical maintenance is overdue
- 📈 **21%** of staff need training – but where are the gaps?
- 🔧 **11%** of the plan has not been attained



THE FRONTLINE

- 📊 The gas detector is out of service on unit
- 📈 Unaware of major hazards on the unit; emergency scenarios / drills
- 🔧 He needs to perform tasks faster to achieve plan attainment target

Digitization in service of safe operations?

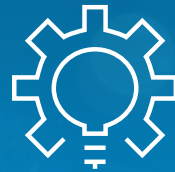
A true view of the operational reality by extracting, translating and aggregating the data from sensors, systems and human activity



Common currency
for disparate data



Unlocks meaningful
relationships,
previously unseen



Provides a realistic
view of the
operational reality



SHOWS IN REAL-TIME

- What's happening
- When it's happening
- Where it's happening
- What's driving the risk



Integrated
workflows ensure
safe & efficient,
consistent
execution

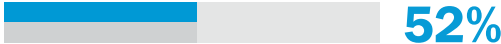
Boldly going where no organization could go before



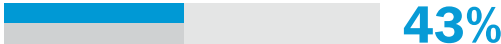
3x

growth in digital twin adoption

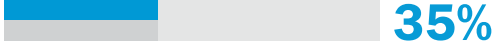
Top digital twin benefits



Safer operations



Plantwide productivity performance



Safer, more efficient shutdowns & turnarounds

Close the gaps: Operational Risk Management Digital Twin

The “Physical” Asset



The “ORM Digital Twin”



Understand



Predict



Act



Monitor

Close the gaps: Operational Risk Management Digital Twin

The “Physical” Asset



- Process Safety Critical Equipment status
- Overdue Safety Critical Maintenance
- Inspections
- Permitted Activity
- Operations Activity
- MoC
- Deviations
- Inhibits

Improve Operational Decision-making

- ▶ **Understand** how equipment status and activity all come together to impact cumulative risk
- ▶ **Predict** cumulative risk on the plant today & in the future
- ▶ **Pro-Act**ively manage productivity against risk
- ▶ **Monitor** the operational risk status of the asset

The “ORM Digital Twin”



A true digital twin is a virtual counterpart of a real object, which enables other software, systems and operators to interact with it rather than directly, bypassing the real object.

A digital twins must include:

- A model of the physical object
- Data generated by the object
- Unique one-to-one correspondence with the physical object
- The ability to monitor the object

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Lessons from 2020 survey of Process Safety professionals

OPPORTUNITY

Industry 4.0 and Digital Twins

Connecting process safety to the frontline

CASE STUDIES

Practical application of Barrier Health Models to surface systemic risks

Delivering real-time risk view of all activity & critical equipment status for a major Middle East refinery

DEVELOPMENT

Evolving the model to focusing on major hazard risk – dynamic risk pathways

A maturity model – setting out your path forward

Q&A - throughout

CASE STUDY



Objectives

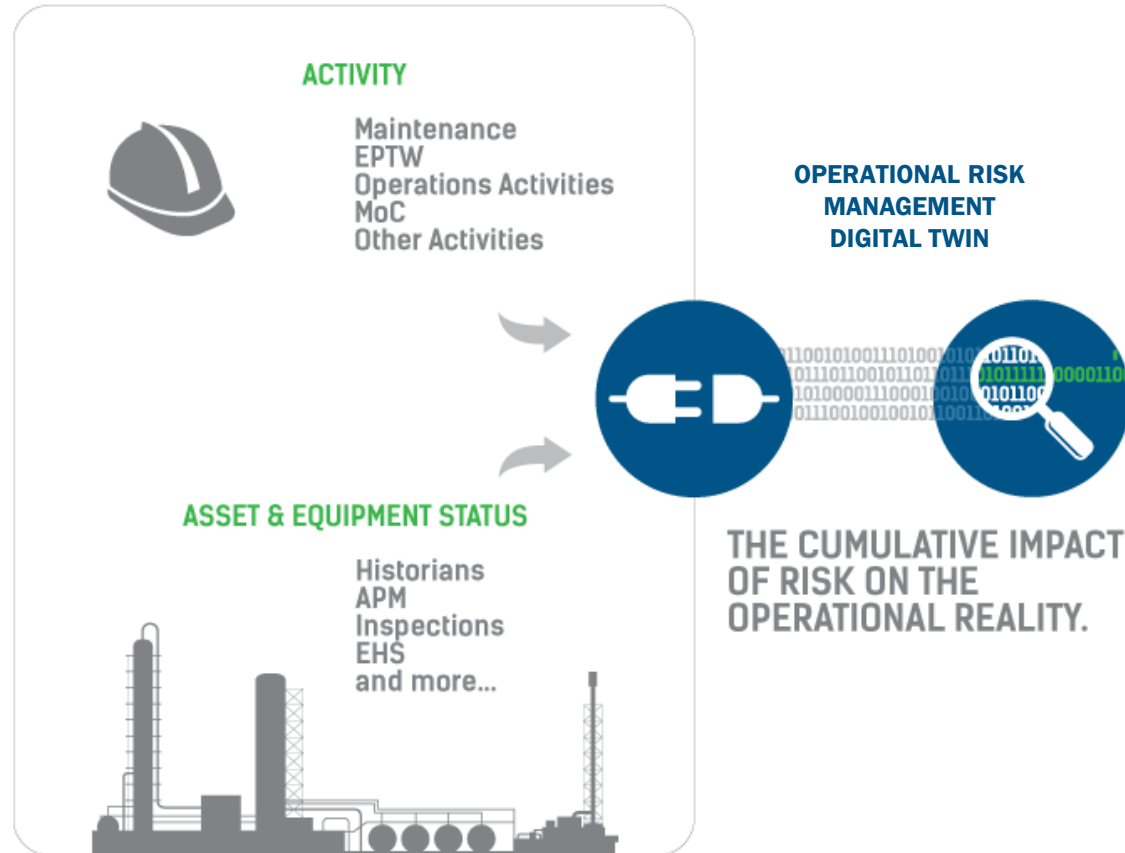
- Close the loop between operations, maintenance and engineering
- Right information at the right time to make the right decisions.
- Create intelligent integration of disparate data from vendors, systems, sensors, and human-derived activity to radically improve end to end operations.

ORM Digital Twin in Action

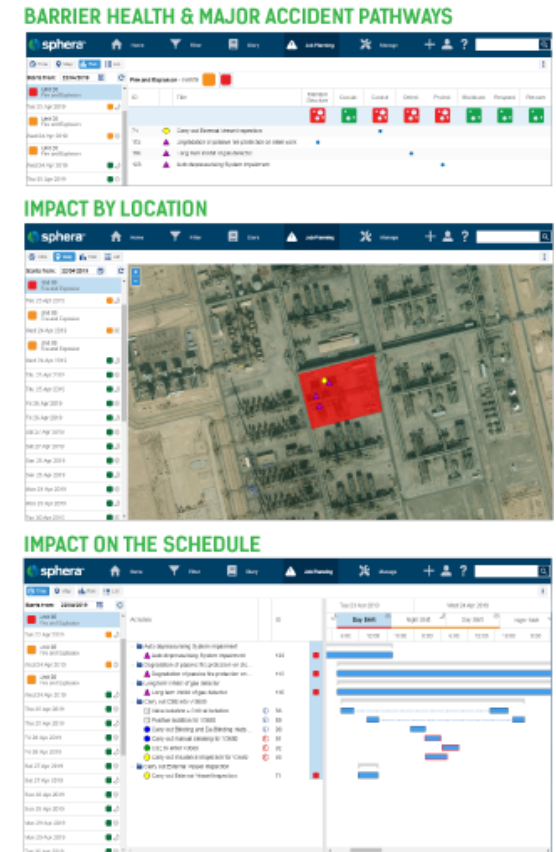
Very large NOC

“Greenfield” site

Big digital vision



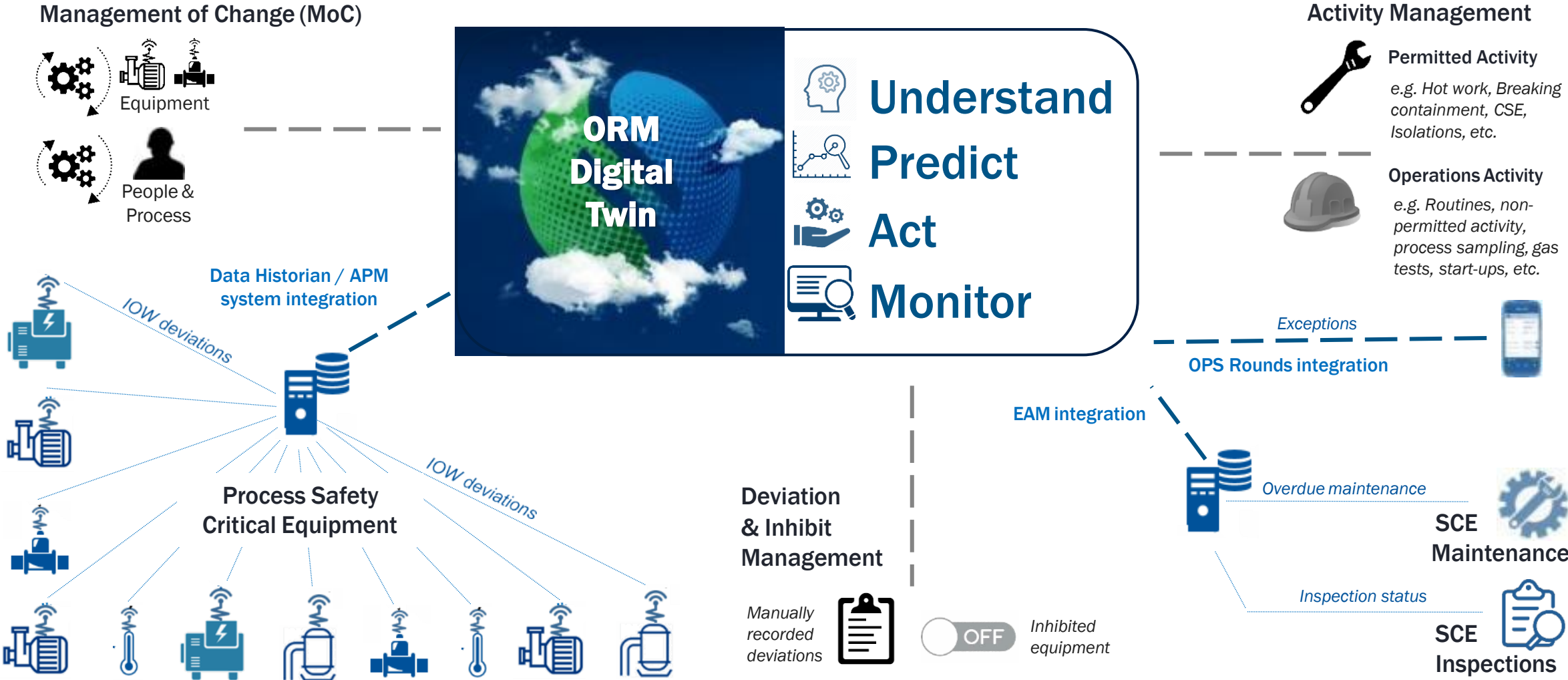
*One of many integration use cases



Integrations



Case Study: Data Sources



Case Study: Making Risk Visible by Location

Fundamental Barrier Grouping Model



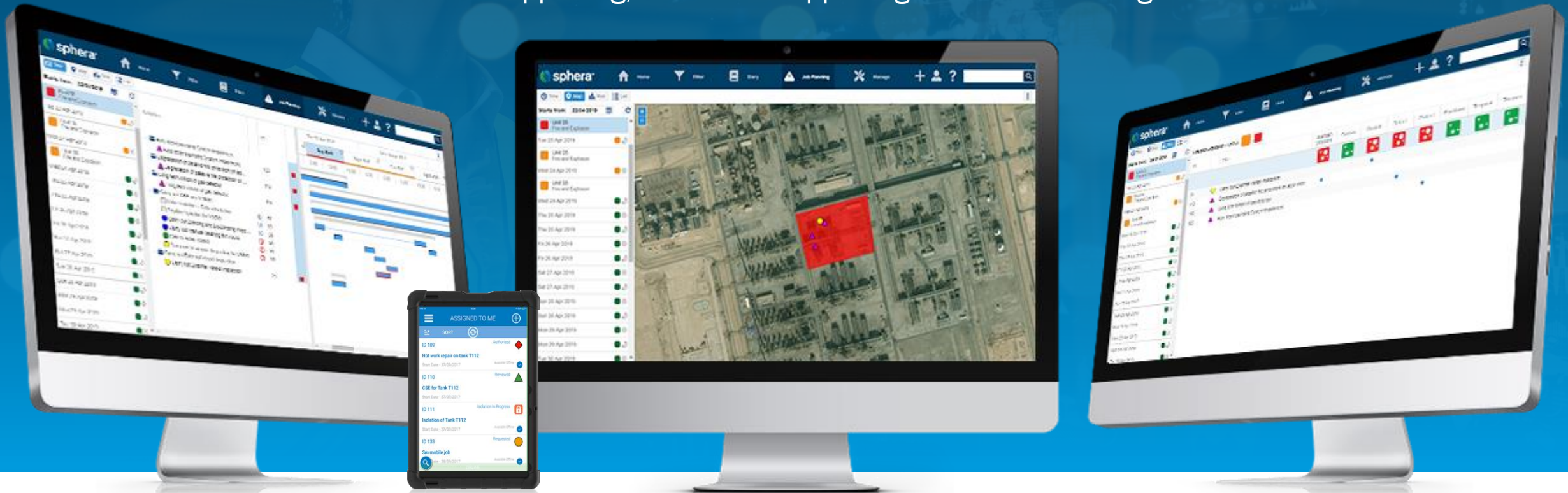
Data generated by vertical, functional silos and systems

- Overdue Maintenance
- Overdue Inspections
- Planned Maintenance
- High Risk Jobs
- Failed Inspections
- Field Observations
- Management of Change
- Incident reports
- Critical Equipment Status
- Audit findings
- Shift competence gaps
- IOW Deviations



Three Screens. One Operational Reality.

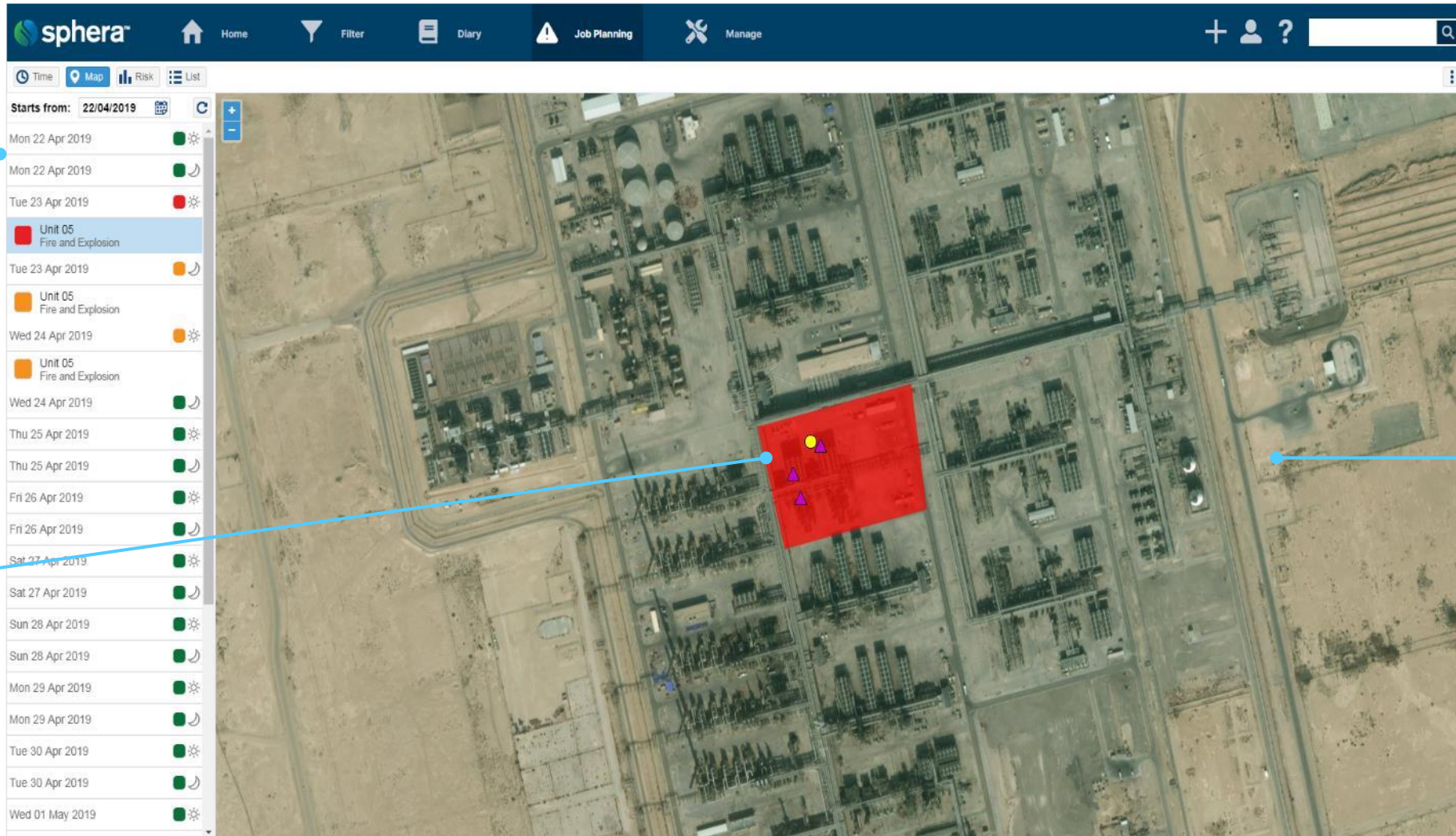
Know what's happening, where it's happening and what's driving the risk



Location: See the Risk on Your Assets

Easily see how the risk profile changes from shift to shift.

Icons, shape and colour indicate activity, type, state and risk levels.

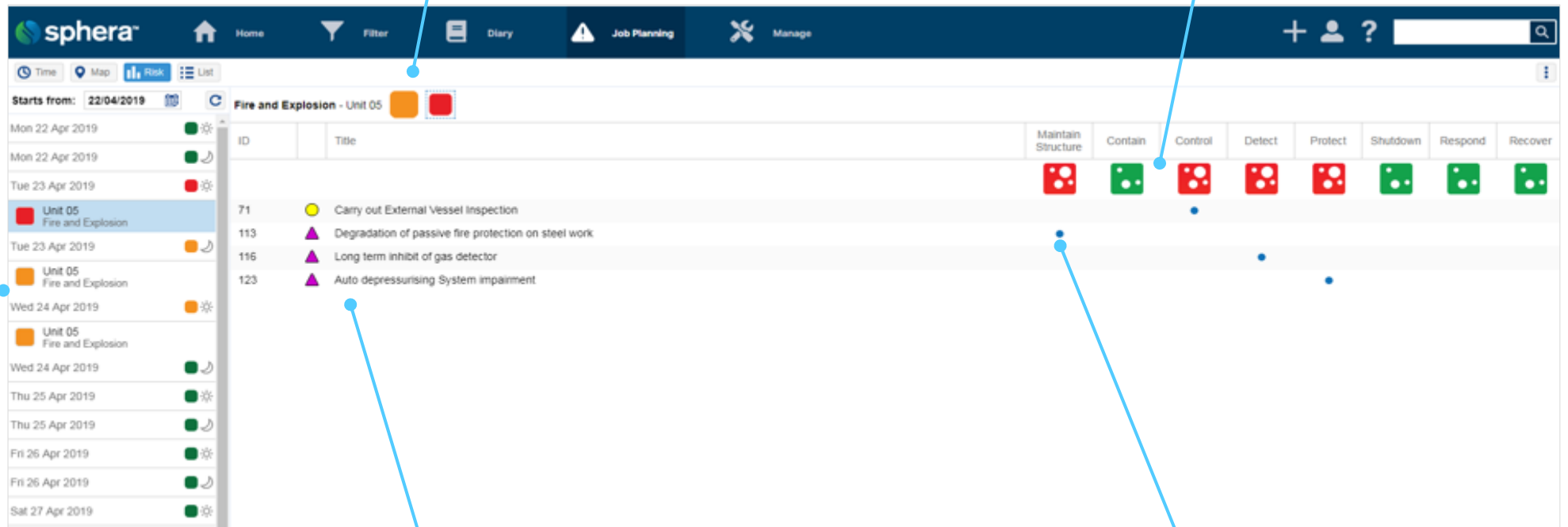


Easily pan & zoom.

Risk: Dynamic Risk Visualization

In real-time, on the next shift, tomorrow, and beyond.

Navigate from shift-to-shift to see the evolution of process safety barrier impact & cumulative risk.



Understand the hour-by-hour impact of cumulative risk by major hazard event.

See the real-time health of the impacted barriers.

Click to reveal the details of equipment health and deviations.

See how equipment health and deviations impact process safety barriers.

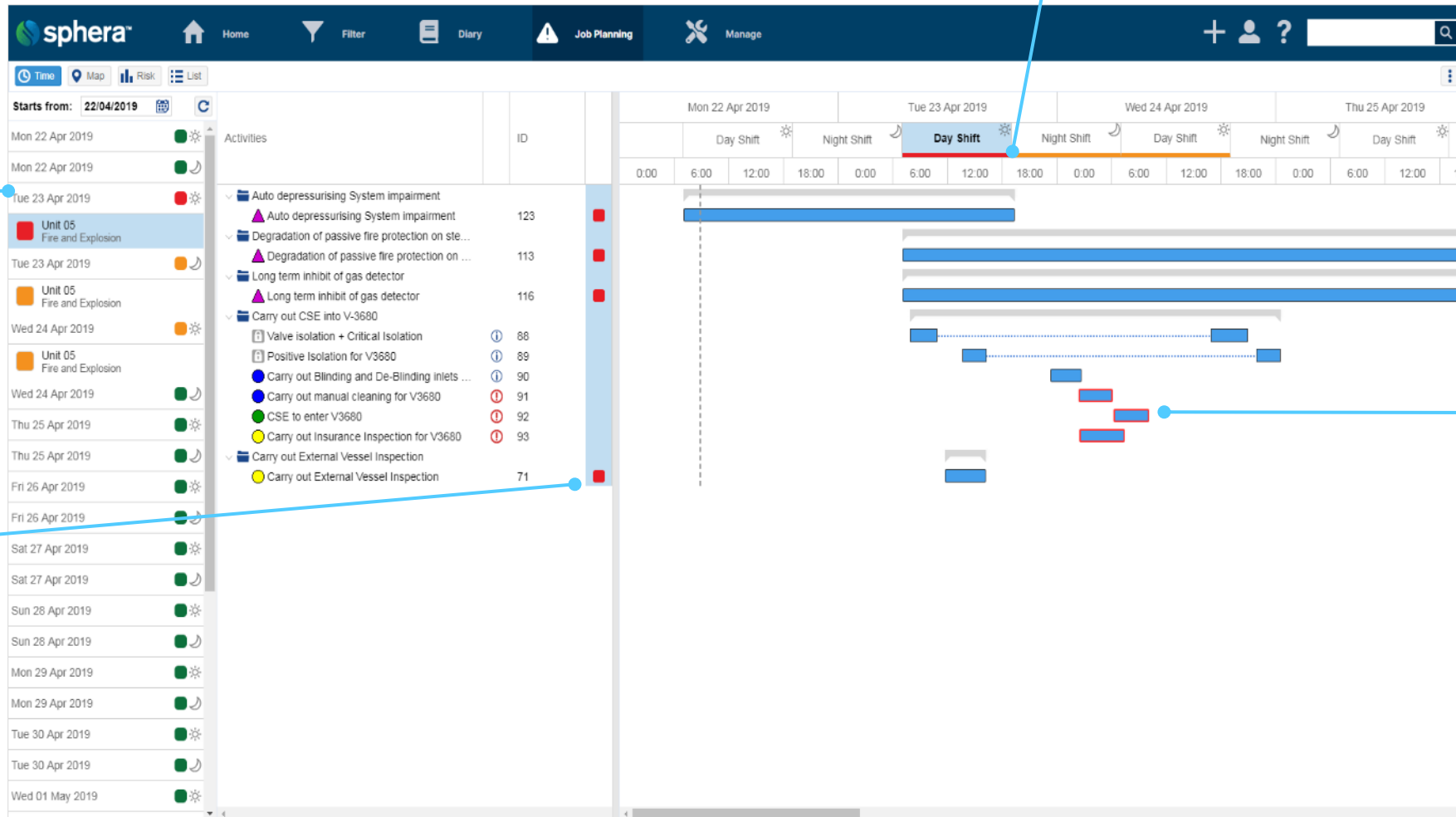
Time: Understand the Impact on the Schedule

Navigate from shift-to-shift to see the evolution of process safety barrier impact and cumulative risk.

Understand what is contributing to risk on the shift.

Understand the risk level on each shift.

See SIMOPS and safety conflicts.



The Technical Safety Challenge

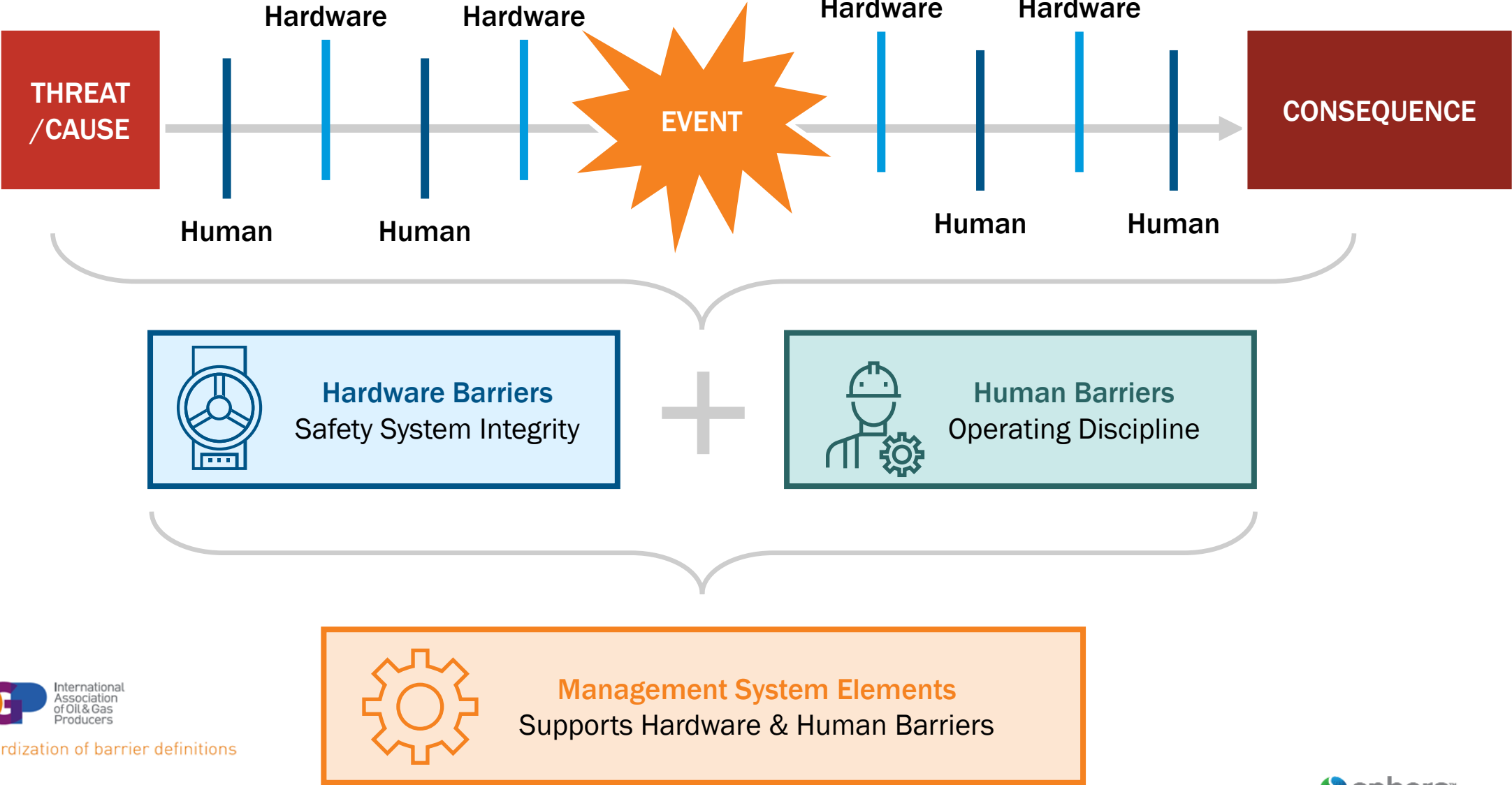
“...court reports from several accidents such as Bhopal, Flixborough, Zeebrügge, and Chernobyl **demonstrate that they have not been caused by a coincidence of independent failures and human errors, but by a systematic migration of organizational behavior toward accident under the influence of pressure toward cost-effectiveness in an aggressive, competitive environment.**”

— *Risk management in a dynamic society: A modelling problem.*
Jens Rasmussen

Complex systems migrate toward states of high risk but often we don't realize it until something bad happens...

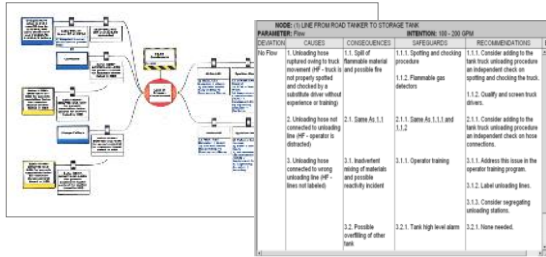


Major Loss Event and Scenario-specific Defined Barriers



Dynamic Risk Pathways

Policies and procedures



Bowtie Diagrams

HAZOPs

PHAs

Safety Cases

Real-time capture of risk related data



Intelligent translation & mapping

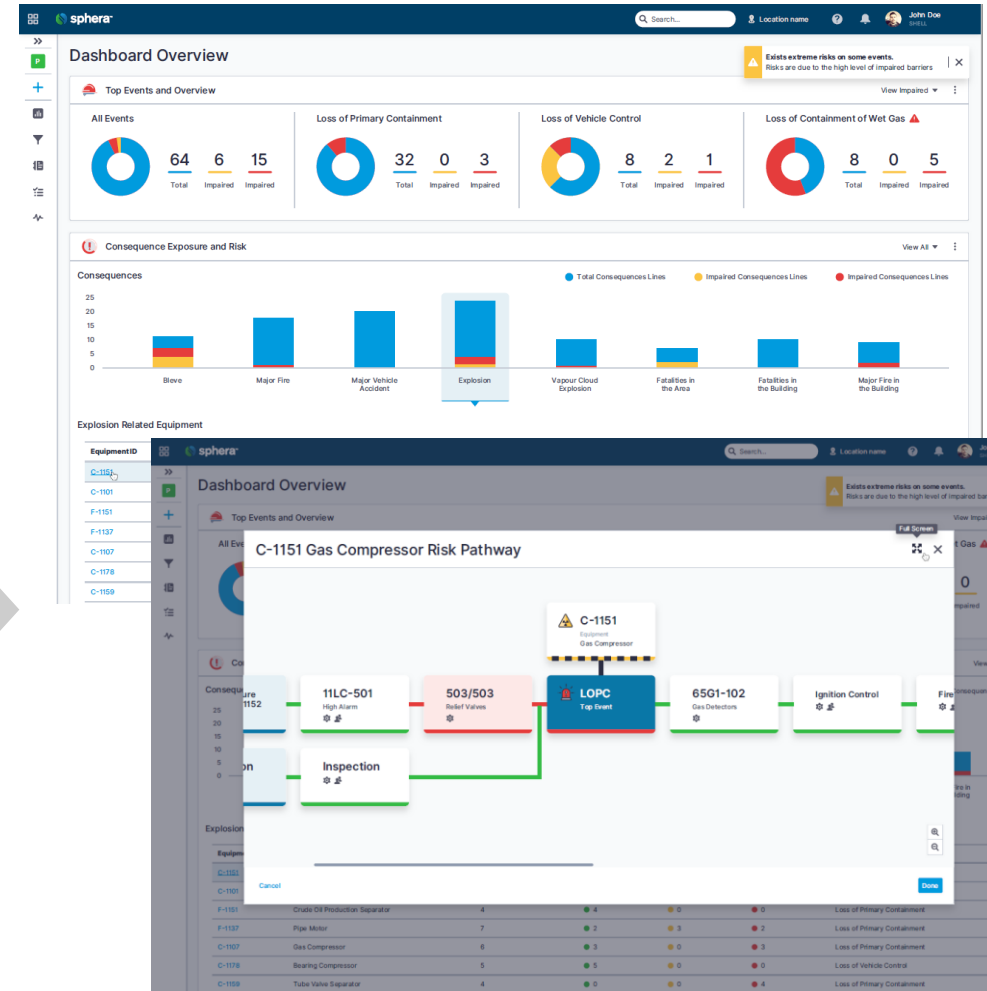
Complex operating environment



Operators trying to connect the dots



Real Time View of Safeguarding Barrier Status



Emerging Risk Pathways allow for early intervention

Process Safety Management Maturity Progression

49%

are unaware of MAH risk vulnerability

PHAs are conducted.
Audits & LOPC Incidents reported & Lessons.
KPIs established & tracked.

COMPLIANT

Process safety system supports barrier management. Critical Barriers and assurance tasks defined.
Deviation RA process for non-conformances.

EFFICIENT

Barrier management system provides a near real-time risk view of status of critical barriers and planned work by location to support frontline decision-making.

OPTIMIZED

Organizations have access to real-time visibility of barrier impairments with comprehensive tracking of critical equipment, assurance processes and operational data.
Risk visualizations based on barrier impact for defined Major Accident Hazard scenarios for assets

LEADER

Key themes and conclusions



There are gaps between process safety intent and what happens at the frontline – the dynamic nature of frontline operations is a challenge

Seize the opportunity to rethink safety and risk management in operations – **key takeaways:**

Improve the resilience of our assets using digital tools to drive effective, compliant business processes

Uncover the process safety-related data sources in asset application environment today

Connect these disparate data sources to the frontline to provide dynamic, real-time risk insight to support practical decision making

Reaching Operational and Financial Goals Requires an Integrated Approach to Risk Management



Optimize across the enterprise

- Corporate performance reporting
- Sustainable global growth
- Investor and public relations



Power your decisions

- Team and site performance
- Regulatory compliance
- Employee and environmental safety

Operationalize, Scale, & Optimize Integrated Risk Management

with our purpose-built solutions supported by information, innovation & insights



Sphera Delivers Integrated Risk Management Around the Globe

1 million+

Individual Users

8000+

Customers

100+

Countries

1000+

Colleagues



References and contacts for follow-up

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