From Data to Insights:

Harnessing Leading Indicators for Improved Process Safety

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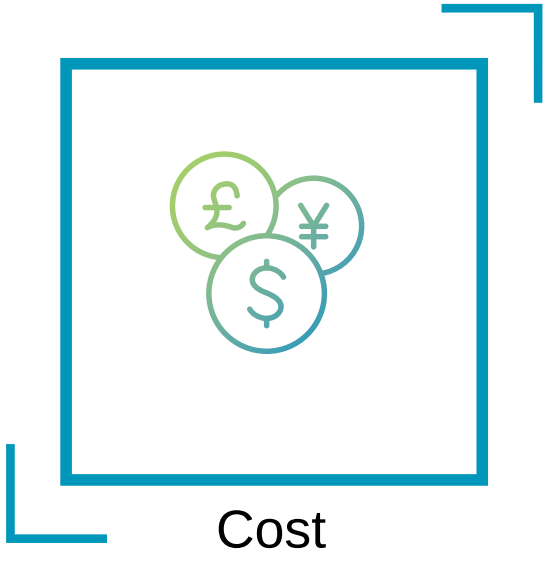
The Big 3 of Successful Operations Management

Safety

Environment



Cost

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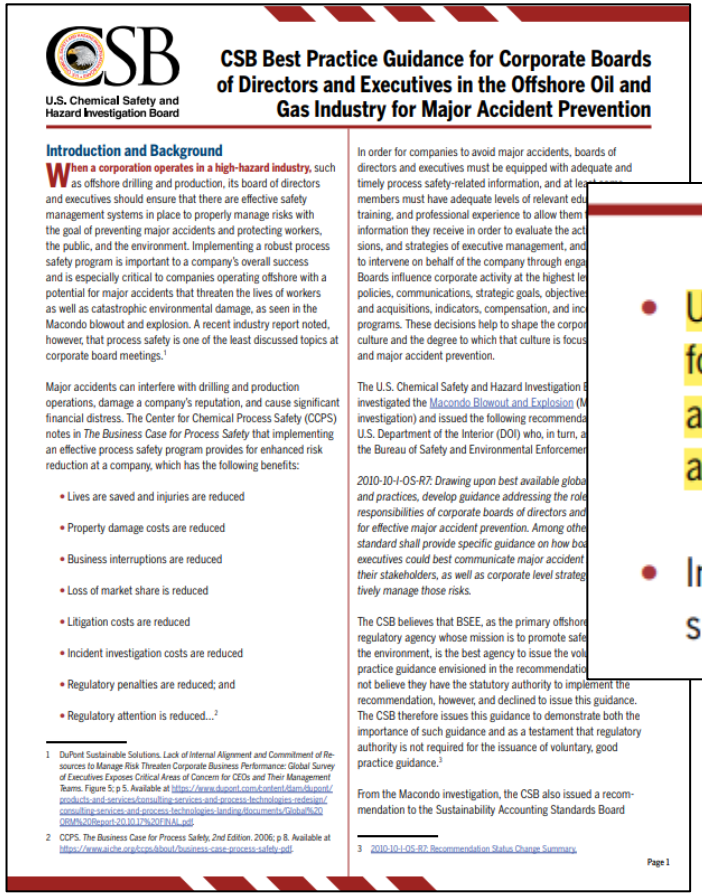
To Measure is to Know



U.S. Chemical Safety and Hazard Investigation Board

CSB Best Practice Guidance for Corporate Boards of Directors and Executives in the Offshore Oil and Gas Industry for Major Accident Prevention

Introduction and Background

When a corporation operates in a high-hazard industry, such as offshore drilling and production, its board of directors and executives should ensure that there are effective safety management systems in place to properly manage risks with the goal of preventing major accidents and protecting workers, the public, and the environment. Implementing a robust process safety program is important to a company's overall success and is especially critical to companies operating offshore with a potential for major accidents that threaten the lives of workers as well as catastrophic environmental damage, as seen in the Macondo blowout and explosion. A recent industry report noted, however, that process safety is one of the least discussed topics at corporate board meetings.[1]

Major accidents can interfere with drilling and production operations, damage a company's reputation, and cause significant financial distress. The Center for Chemical Process Safety (CCPS) notes in *The Business Case for Process Safety* that implementing an effective process safety program provides for enhanced risk reduction at a company, which has the following benefits:

- Lives are saved and injuries are reduced
- Property damage costs are reduced
- Business interruptions are reduced
- Loss of market share is reduced
- Litigation costs are reduced
- Incident investigation costs are reduced
- Regulatory penalties are reduced; and
- Regulatory attention is reduced...[2]

In order for companies to avoid major accidents, boards of directors and executives must be equipped with adequate and timely process safety-related information, and at le
members must have adequate levels of relevant edu
training, and professional experience to allow them
information they receive in order to evaluate the act
sions, and strategies of executive management, and
to intervene on behalf of the company through enga
Boards influence corporate activity at the highest le
policies, communications, strategic goals, objective
and acquisitions, indicators, compensation, and inc
programs. These decisions help to shape the corpor
culture and the degree to which that culture is focus
and major accident prevention.

The U.S. Chemical Safety and Hazard Investigation B
investigated the Macondo Blowout and Explosion (M
investigation) and issued the following recommenda
U.S. Department of the Interior (DOI) who, in turn, a
the Bureau of Safety and Environmental Enforcemer

*2010-10-I-OS-R7: Drawing upon best available globa
and practices, develop guidance addressing the role
responsibilities of corporate boards of directors and
for effective major accident prevention. Among othe
standard shall provide specific guidance on how boa
executives could best communicate major accident
their stakeholders, as well as corporate level strateg
tively manage those risks.*

The CSB believes that BSEE, as the primary offshore
regulatory agency whose mission is to promote safe
the environment, is the best agency to issue the volu
practice guidance envisioned in the recommendatio
not believe they have the statutory authority to implement the
recommendation, however, and declined to issue this guidance.
The CSB therefore issues this guidance to demonstrate both the
importance of such guidance and as a testament that regulatory
authority is not required for the issuance of voluntary, good
practice guidance.[3]

From the Macondo investigation, the CSB also issued a recom-
mendation to the Sustainability Accounting Standards Board

1 DuPont Sustainable Solutions. *Lack of Internal Alignment and Commitment of Resources to Manage Risk Threaten Corporate Business Performance: Global Survey of Executives Exposes Critical Areas of Concern for CEOs and Their Management Teams.* Figure 5; p 5. Available at https://www.dupont.com/content/dam/dupont/products-and-services/consulting-services-and-process-technologies-redesign/consulting-services-and-process-technologies-landing/documents/Global%20DBM%20Report-20.10.17%20FINAL.pdf.

2 CCPS. *The Business Case for Process Safety, 2nd Edition.* 2006; p 8. Available at https://www.aiche.org/ccps/about/business-case-process-safety-pdf.

3 2010-10-I-OS-R7: Recommendation Status Change Summary.

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- Use effective leading and lagging safety indicators to allow for continual monitoring of the company's performance and implemented policies to ensure they take appropriate actions and achieve anticipated results.
- Institute a cross-industry approach to the learning and sharing of lessons from significant process safety incidents.

https://www.csb.gov/assets/1/17/csb_macondo_bod_guidance.pdf?16585

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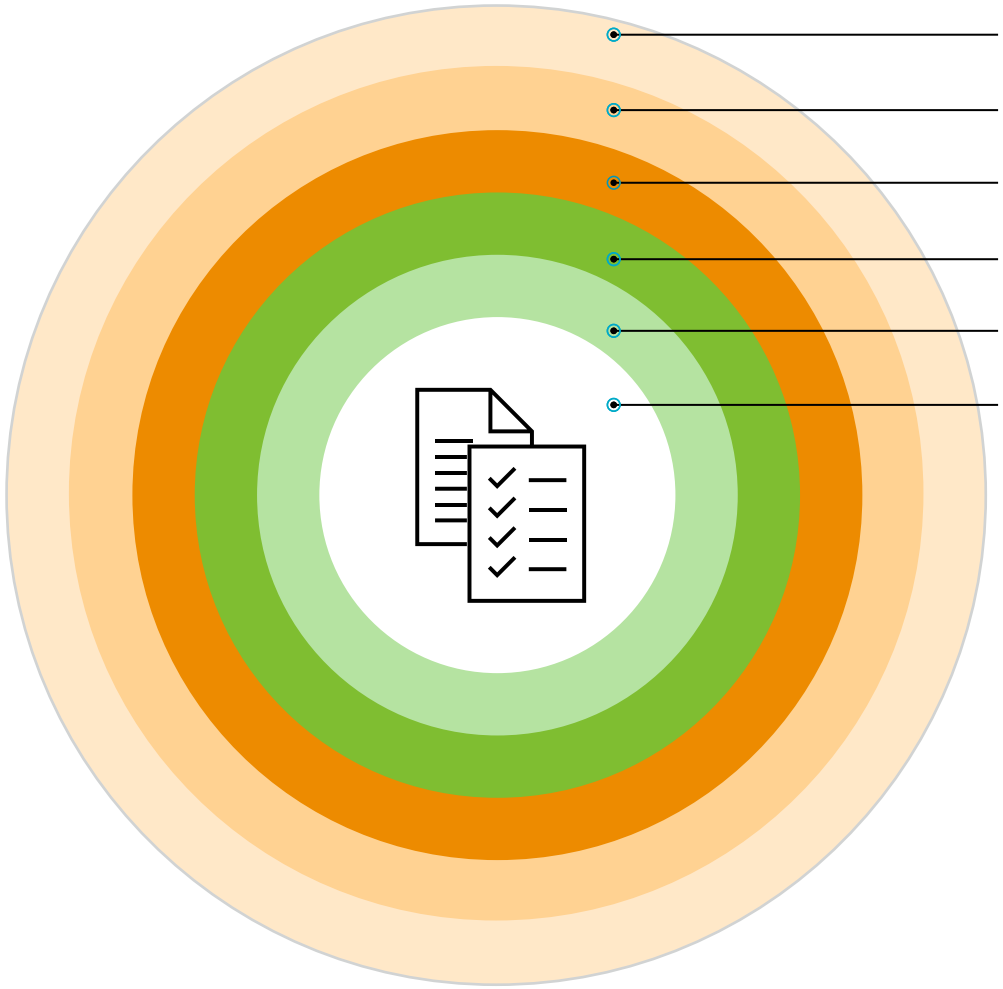
Layers of Process Safety



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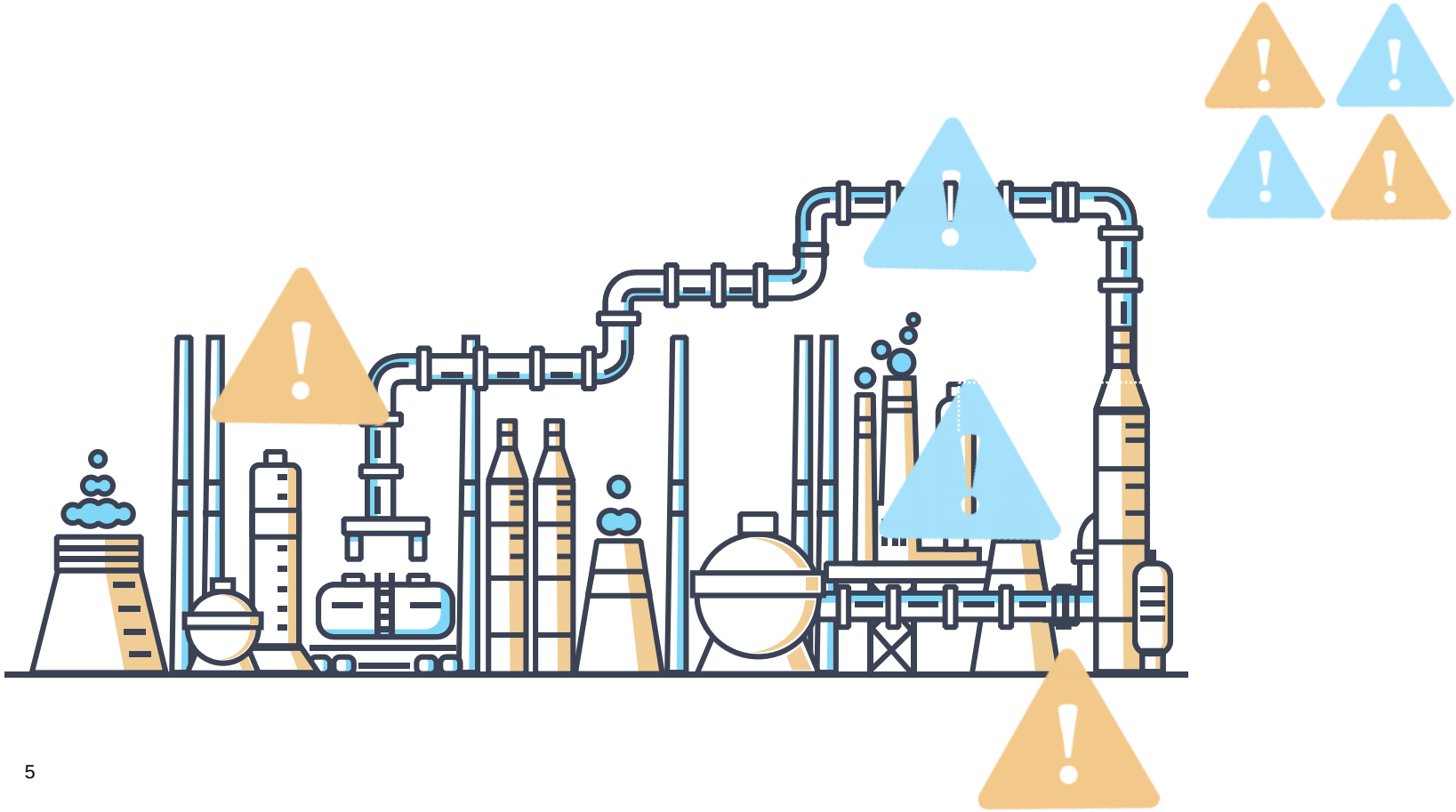
Measuring Operational Performance

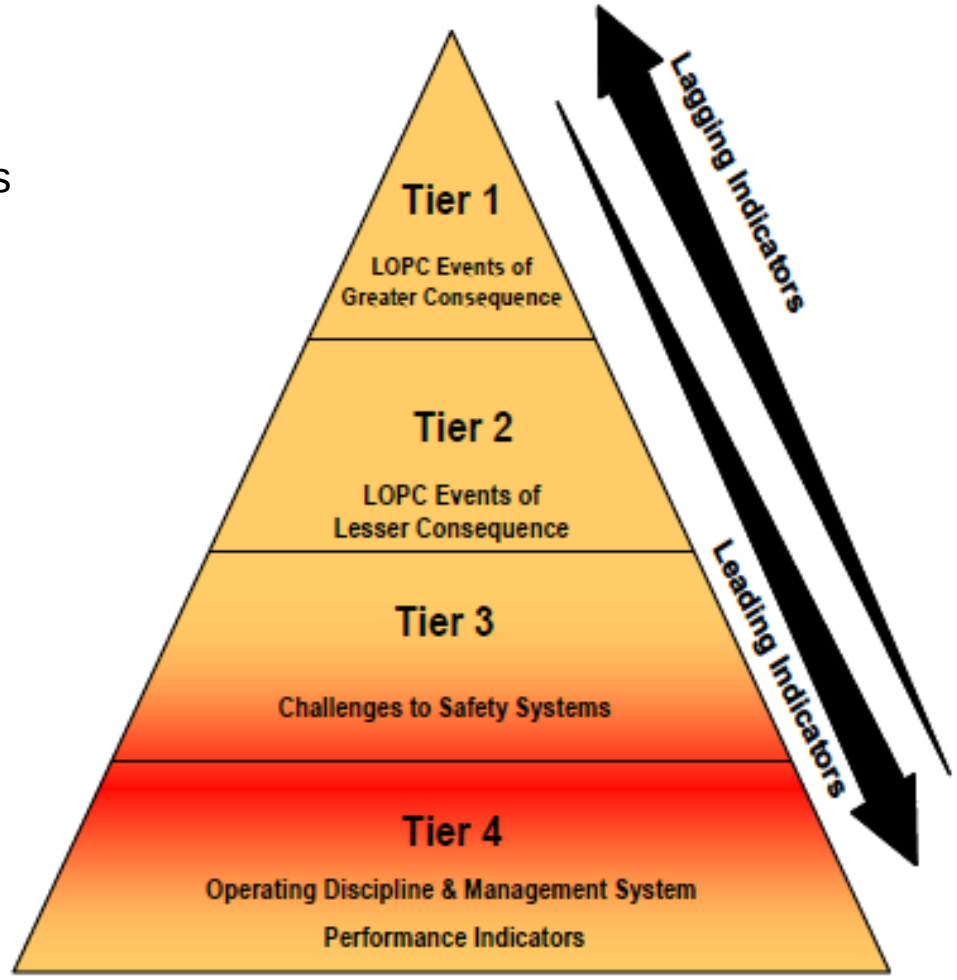


Sources of Poor Performance
Incomplete shift handover
High Alarm Rates
Uncontrolled changes
Poorly performing control loops
Unknown equipment limits
Frequent shutdowns
Poor control of work processes
Permit violations
Inefficient Operation
… many, many more …

Leading and Lagging Indicators

The Incident Pyramid

- Identifies leading and lagging process safety indicators to drive performance
- Tier 1 is the most lagging, Tier 4 is the most leading
- Tiers 1 and 2 are measure of actual releases and may be used for national reporting
- Tiers 3 and 4 are intended for internal or site use



Based on API 754-Process Safety Performance Indicators for the Refining and Petrochemical Industries

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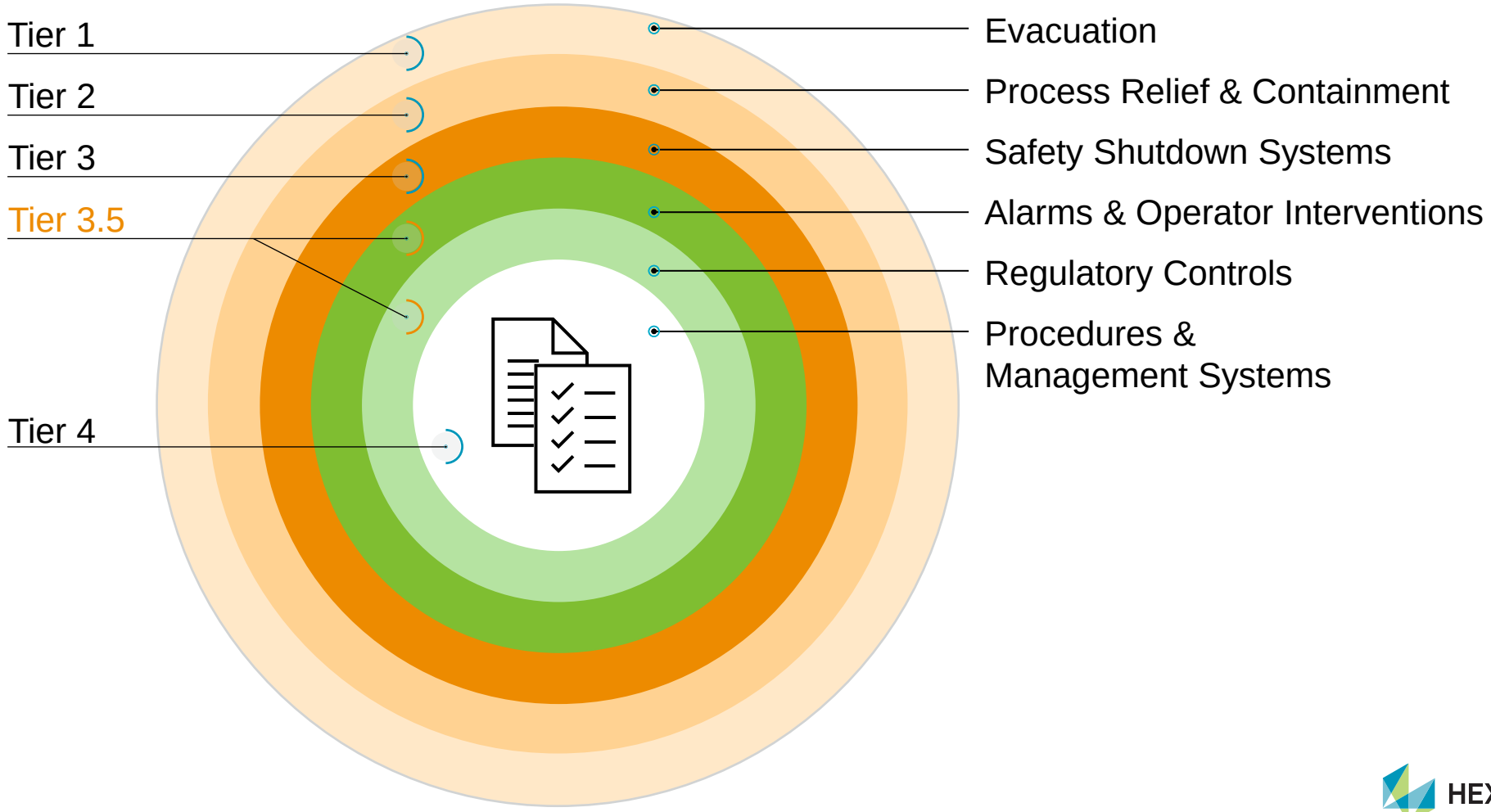
Tier 3/4 leading indicators

- Tier 3
  - Safe Operating Limit Excursions
  - Demands on Safety System
  - Inspections/Testing outside of acceptable limits
- Tier 4
  - Operating discipline and management system performance
    - PHAs complete and on time
    - Process Safety Action Item Closure
    - Work permit compliance
    - Management of Change
    - Procedures current and accurate
    - Equipment Inspections
    - Operator fatigue
    - Etc.

Layers of Protection for Process Safety



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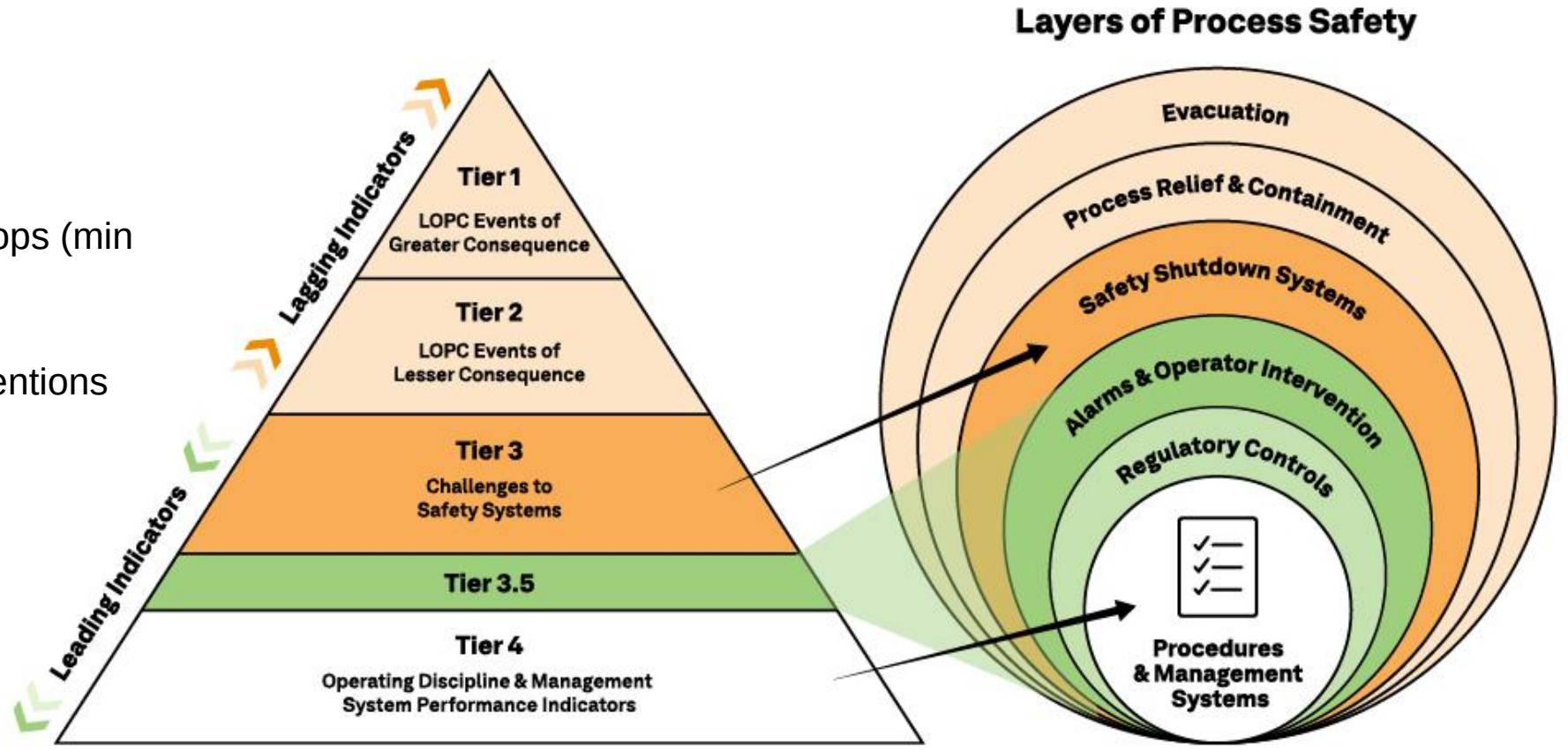
Tier 3.5 Leading Indicator Examples

- Regulatory Controls
  - Loops in Manual
  - Loop Stability
  - Loop Response
  - Activation of Override Loops (min flow, pressure relief, etc.)

- Alarms and Operator Interventions
  - Alarm Floods
  - Alarm Suppression
  - IPL Related Alarms
  - Active Bypasses
  - Operator Loading
  - Audit Mismatches



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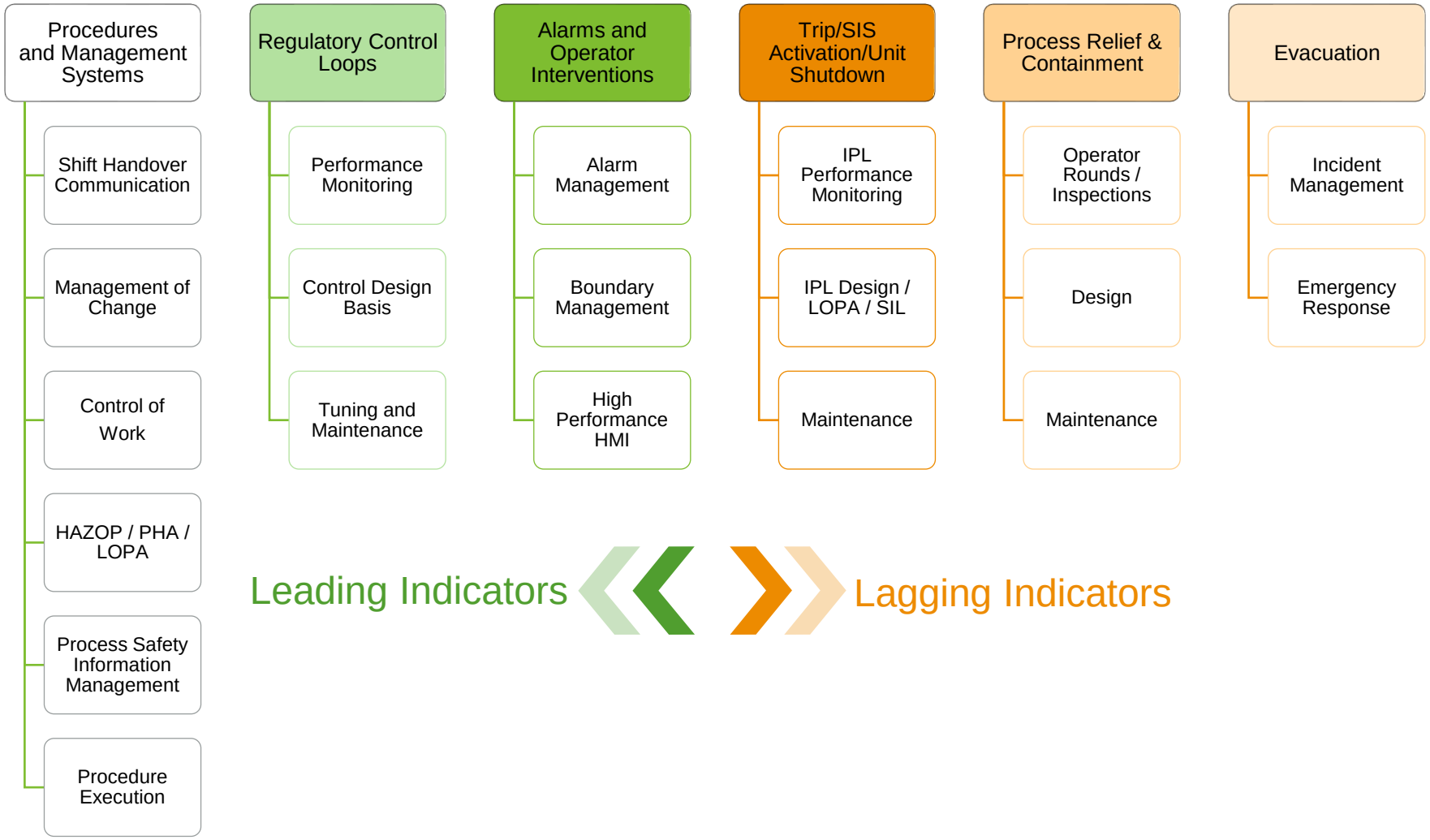
Work Processes of Process Safety for each Layer of Protection

Comprehensive metrics cover them all



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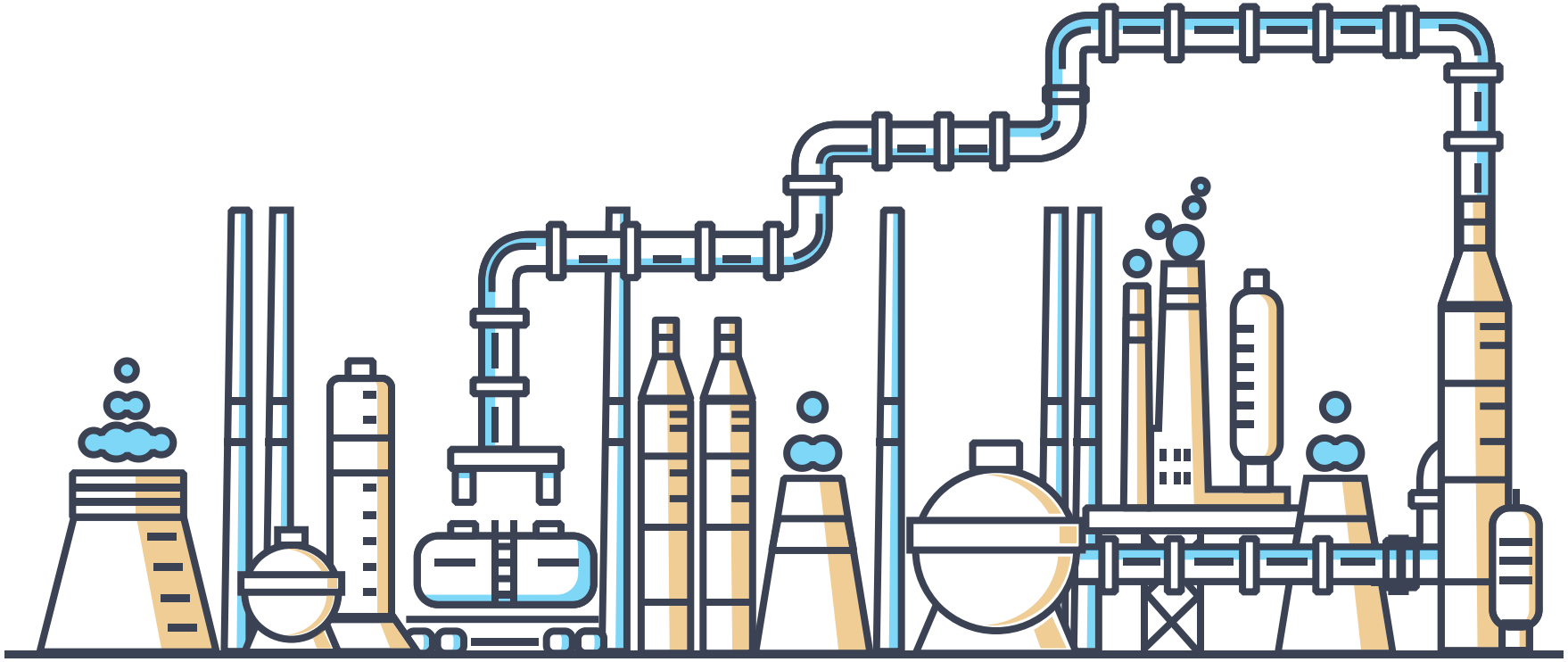
An Example - Two Identically Designed Sites



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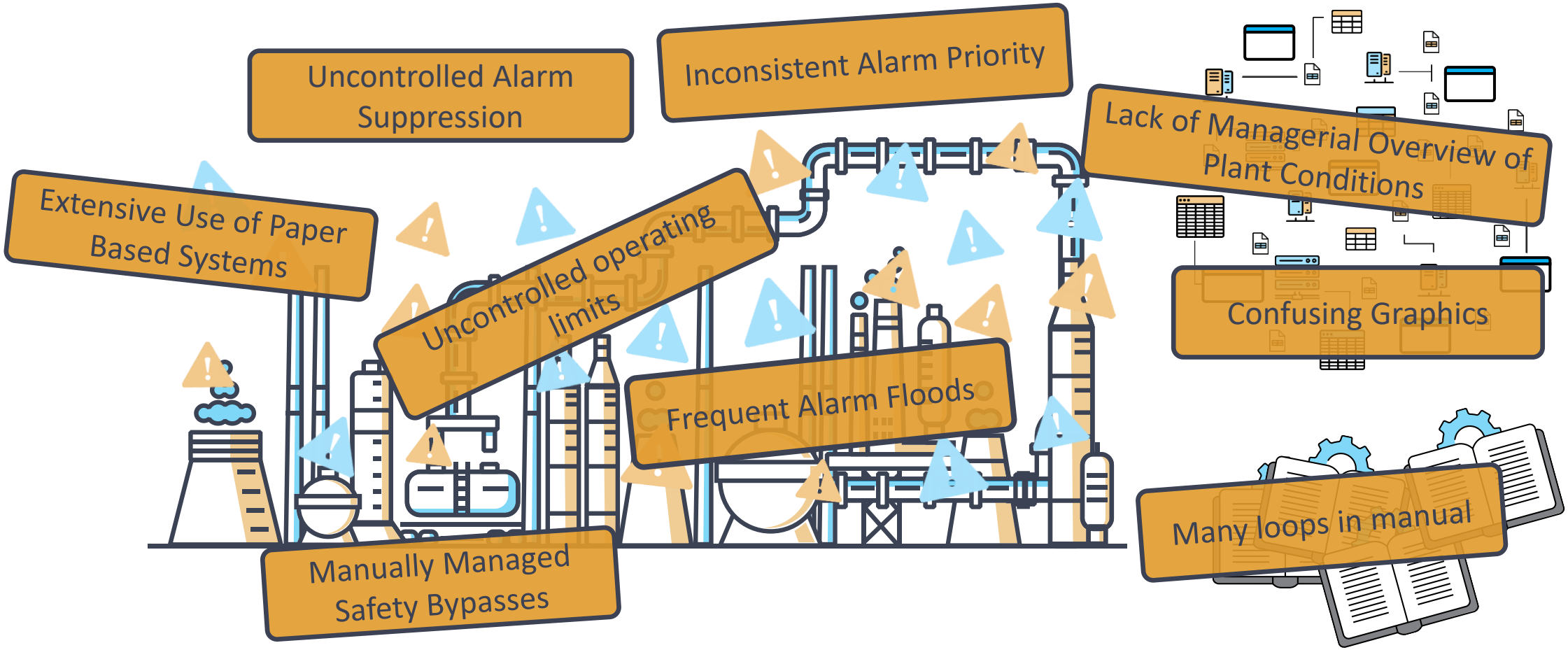
Two Identically Designed Sites | Site A



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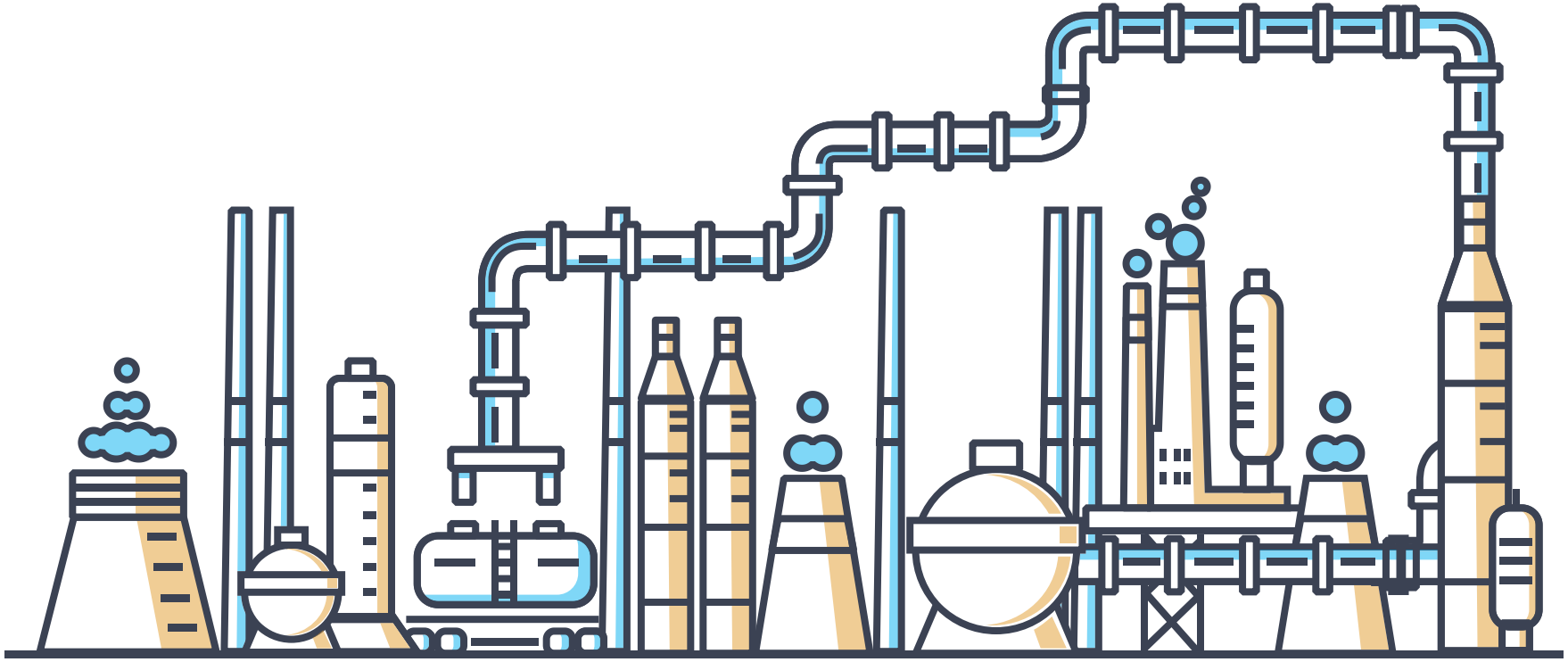
Two Identically Designed Sites | Site B



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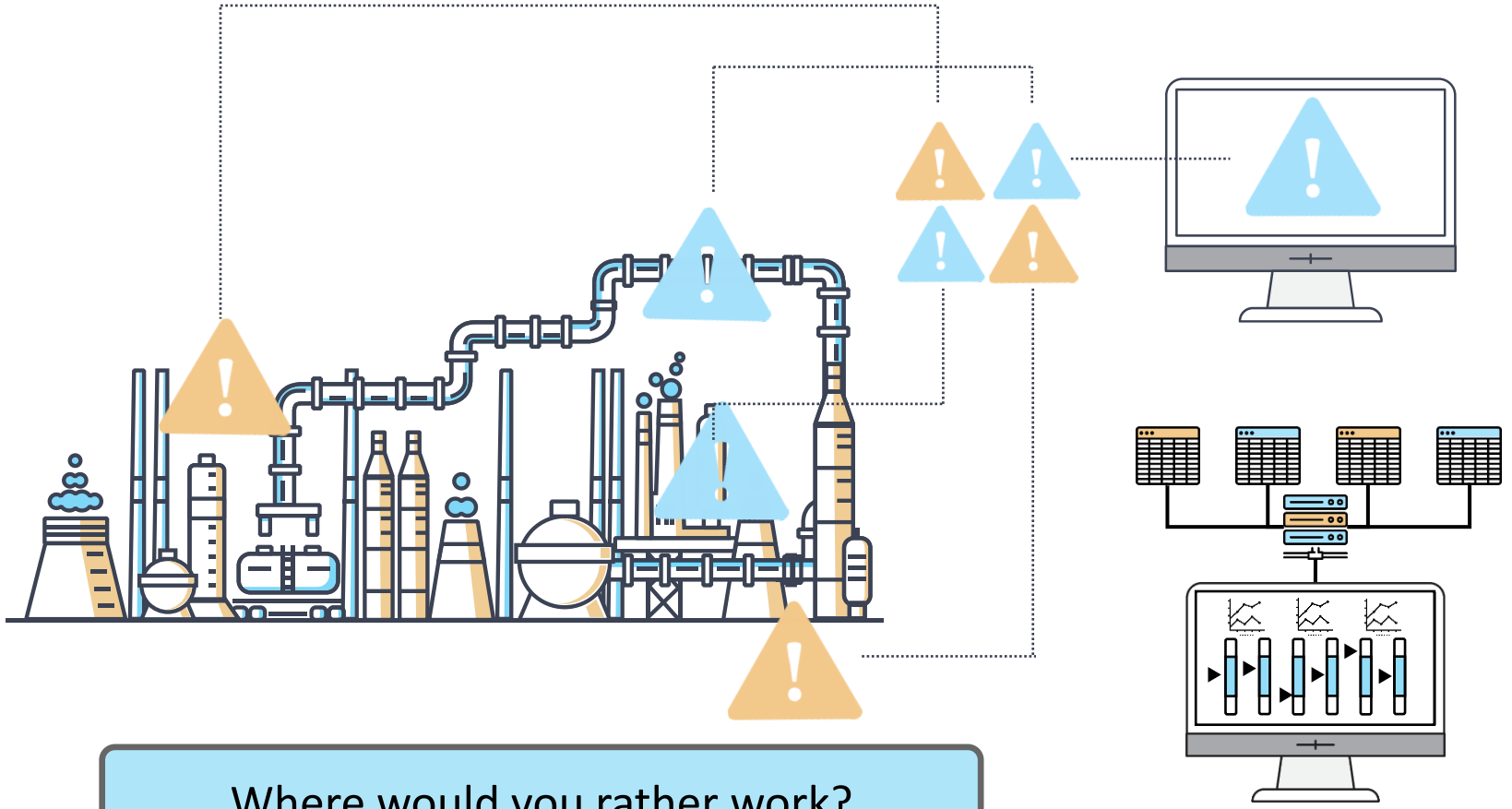
Two Identically Designed Sites | Site B



Where would you rather work?

- Effective Alarm System
- Optimized Control Loops
- Safe Operating Limits Managed & Monitored
- Digital Procedure Lifecycle Management
- Collaborative Digital Shift Handover
- Fully Digitalized Logbooks, Permits, Duties, etc.
- Actionable KPI’s

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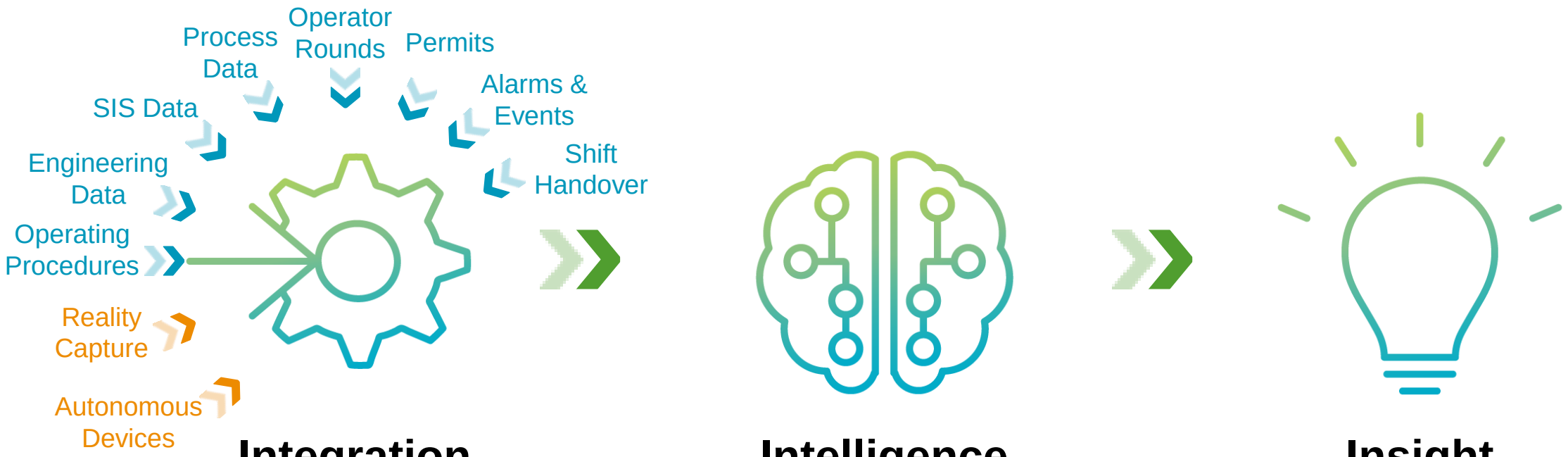
Enterprise Risk Management and Analytics



Integration

Disparate systems, different types of data

Immediate access to comprehensive data

Intelligence

Data Mining, Contextualization, Normalization, Analytics and Optimization

Rapid understanding of information

Insight

Data science partnered with domain expertise

Improved outcomes of decisions

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Thank you
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