Benchmarking Process Safety Performance

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P2SAC
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About PSRG

- Established in 1997 in Houston, TX (28+ years)
- Global Process Safety, Risk Management & Plant Reliability consulting and training firm
- More than 100 technical professionals averaging 29+ yrs experience
- Diverse industry experience with more than 1000 customers in 90 countries
- Tailored solutions to meet and exceed client expectations
- Member of AIChE CCPS, IChemE PSC, P2SAC and VPPPA

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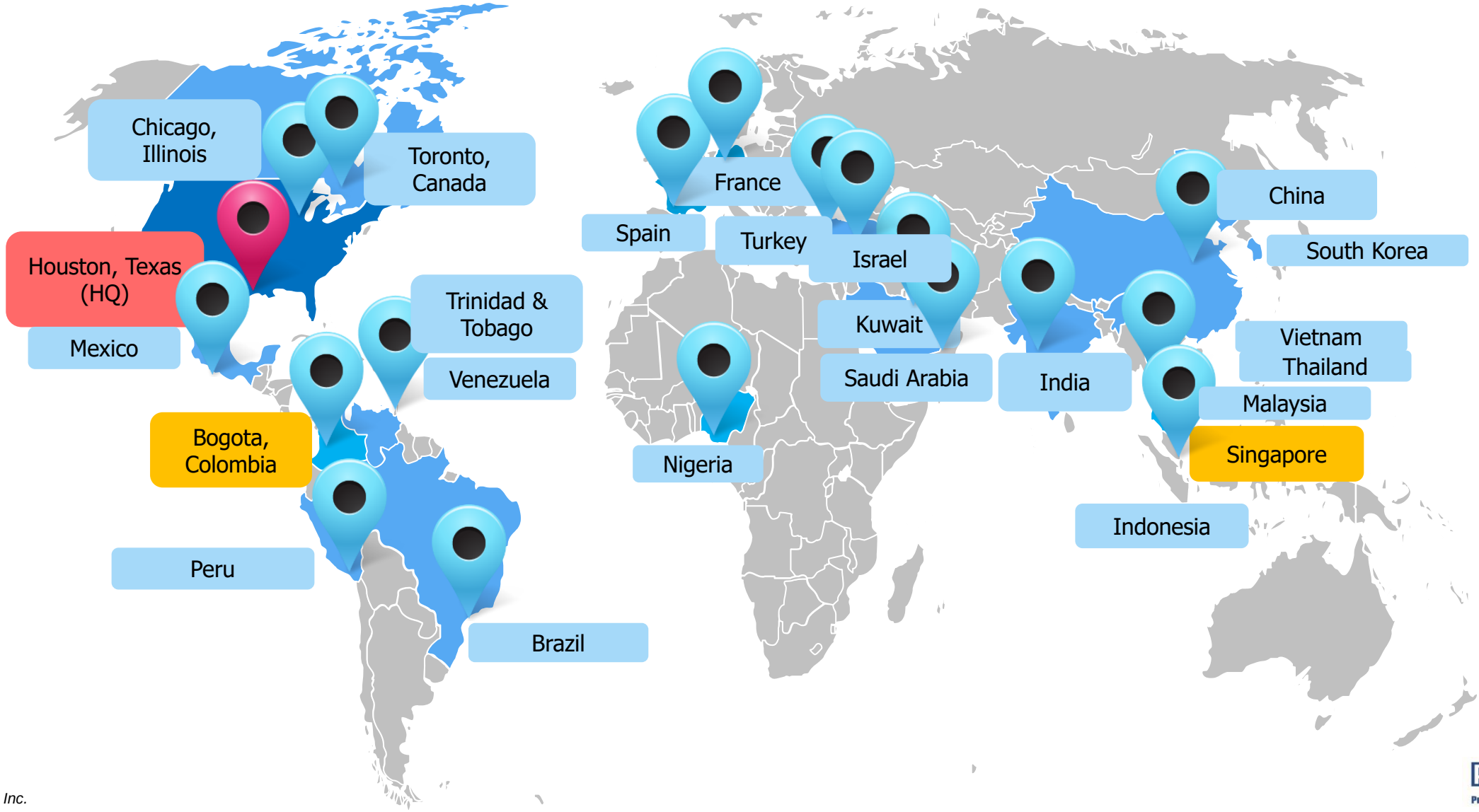
PSRG – Global Reach



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Agenda

- What is Process Safety Performance and its impact on Organizations?
- What is benchmarking and how it is done?
- Ideas and Best Practices
- Discussion / Conclusion

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Safety Moment - ALCOA

- Focusing on what matters most pays off:
  - Aluminum Company of America (ALCOA) CEO Paul O'Neills first presentation as the CEO in 1987 emphasized that "profits didn't matter as much as safety"
  - The emphasis on safety made an impact. Over O'Neills tenure, ALCOA dropped from 1.86 lost workdays (LWD) to about 0.13 injuries per 100 workers. At the time, the national average was 5 injuries per 100 workers
  - During the same time, ALCOA market capitalization was improved 900%. Its market value went up from 4 Billion to 28 Billion USD

  - Focus on worker safety improved several processes in the organization

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Process Safety Performance

"What gets measured gets managed — even when it's pointless to measure and manage it, and even if it harms the purpose of the organisation to do so".

V. F. Ridgway, from paper titled "Dysfunctional Consequences of Performance Measurements", 1956

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Importance of Process Safety Performance

- Critical for organizations that operate in industries involving hazardous processes
- Ensures protection of employees, communities, and the environment from potential incidents
- Reduces the risk of catastrophic events, such as explosions, fires, and chemical releases
- Helps organizations comply with regulatory requirements and maintain a positive reputation in the industry

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Impact of Process Safety Performance on Organizations

- Reduced downtime and increased productivity
- Reduced costs by minimizing property damage, injury, litigation, and regulatory penalties
- Improved employee morale, engagement, and overall organizational culture
- Increased trust and confidence among stakeholders (customers, investors, and the general public)

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Question:

Which one, do you think, is the biggest contributor for the "cost" of an incident? (Choose one)

A) Litigation, Fines, Cleaning, Insurance

B) Property Damage, Loss of Equipment / Facility

C) Loss of Production

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What is Performance Benchmarking?

- Involves collecting information how well an organization is doing in terms of outcomes
- Comparing these outcomes internally and externally
- Internal Benchmarking – between different departments or units
- External Benchmarking – against direct competitors or industry

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Internal vs. External Benchmarking

	Pros	Cons
Internal Benchmarking	Easy access to internal data	Limited external perspective
(improves cross-departmental learning)	Enables knowledge sharing within the org.	May miss innovative practices from other orgs.
External Benchmarking	Provides insights into industry-leading practices	May have limited data from industry
(evaluates the org's performance against industry standards)	Helps identify gaps and areas of improvement	Maybe limited in industries with few players

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Question

Does your Site benchmark Process Safety Performance?

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Data for Process Safety Performance

"In God we trust. All others must bring data."

W. Edwards Deming

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Lagging Indicators (After-the-Fact Metrics)

- Total Recordable Incident Rate (TRIR)
- Lost Time Incident Rate (LTIR)
- DART (Days Away, Restricted, or Transferred)
- Workers' Compensation Costs
- Number of Fatalities / Serious Injuries

- U.S. Bureau of Labor Statistics (https://www.bls.gov/iif/) – iif: injuries, illnesses, and fatalities.
- OSHA's Injury Tracking Application (ITA) (https://www.osha.gov/injuryreporting/ita)
- EPA's Enforcement and Compliance History Online (https://echo.epa.gov/facilities/facility-search)

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Leading Indicators (Proactive Metrics)

- Training Completion Rates
- Near-Miss Reporting Frequency (more or less?)
- Safety Observations and Inspections
- Corrective Action Closure Rates
- Behavior-Based Safety (BBS) Data
- Employee Participation: Surveys, Safety Meetings, Toolbox Talks, etc.

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Hindsight is 20/20

- Performance measurement occurs after the performance
- How can you get ahead of the curve and improve performance before performing?
- Can we have an approach focusing on internal processes while aspiring to meet / exceed industry best practices?

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An Idea About Assessing Current Performance and Potential Improvement Areas

- PSM Maturity Model™
- Gap analysis focuses on weaknesses (gaps)
- Identify strengths in existing systems that could be easily extended for successful implementation of an effective PSM program

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Business Maturity Models

- Management frameworks used to gauge the maturity of an organization in various disciplines or functions
- Help pinpoint specific areas of improvement to reach the next level of maturity
- Helpful tools for enabling continual improvement and improving processes
- Business Maturity Model concept can be extended to Process Safety to gauge PSM maturity using a rating system
  - PSRG Maturity Model™ utilizes a 4-level rating system

T. Kunt, M. Breen, S. Gokce, M. Munsil, "Maturity model approach for building effective process safety management systems", Process Safety Progress, 2023 (https://doi.org/10.1002/prs.12543)

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Process Safety Management Maturity Model (1)

- Most companies that implement the PSM elements, may be at varying maturity levels in their process safety performance
- Organizations often find it difficult to understand the maturity level of each PSM element

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Process Safety Management Maturity Model (2)

- The rating system provides a maturity level for each element and overall, within an organization's process safety management
- These maturity levels are indicators of an organization's strengths and weaknesses
- Organizations can use these indicators as a guide to build a sustainable process safety performance

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Business Maturity Model Background

- Capability Maturity Model (CMM) was first introduced in 1986 to improve existing software development processes
- In 2006, CMM was superseded by the Capability Maturity Model Integration (CMMI®)
  - Developed by Software Engineering Institute at Carnegie Mellon University
  - Superseded to address some CMM drawbacks

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Maturity Model Levels

The Original CMMI®	PSRG Maturity Model™
Based on 5 levels of Maturity Rating System	4-Level Rating System (combines last two high maturity levels of CMMI®)
Initial	Reactive
Managed	Dependent
Defined	Independent
Quantitively Managed	Optimized
Optimizing	

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PSRG Maturity Model™ Levels 1 and 2

Level 1 (Reactive)	Level 2 (Dependent)
Immature safety system and reactive overall	Structured and documented policies with focus on following procedures
Organization has no formal process safety management system in place	Organization has a basic process safety management system in place, but it is not well defined or consistently applied
Risks are managed on an ad hoc basis	

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PSRG Maturity Model™ Levels 3 and 4

Level 3 (Independent)	Level 4 (Optimized)
Individuals use a wide range of tools and organizational behaviors to care for themselves with managers acting when needed	Everyone takes proactive approach, peer to peer focus, assessment through continuous improvement where all employees are ambassadors of the program
Organization has a well-defined process safety management system that is consistently applied across the organization	Organization's process safety management system is continuously improved with data analysis and other performance metrics

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Adaptable Approach

- PSM Maturity Model Assessment can be applied using various PSM frameworks such as:

- OSHA's PSM Standard
- EPA's Risk Management Program (RMP)
- Europe's Seveso Directives
- CCPS Risk Based Process Safety (RBPS)

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Implementation of PSM Maturity Model (1)

- PSM Maturity Model is not a one-size-fits-all solution
  - Used as a tool for continual improvement
- Organizations should adapt it to their specific needs
- Reaching the highest level of maturity indicates a continually improving process to eliminate safety risks

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Implementation of PSM Maturity Model (2)

- Based on the strengths and weaknesses identified during the assessment, an implementation plan can be prepared targeting the next level of maturity
- An assessment of multiple sites provides across-the-board comparison and to move a site and organization to a higher level of PSM maturity
- The implementation program can be tied to leading and lagging indicators for an easy assessment of program progression
- Finally, the PSM Maturity Model defines a best-in-class safety management system for the whole organization

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Why Maturity Models?

- Helps an organization to establish a process for monitoring and reporting process safety performance progress
  - Develop tracking metrics and key performance indicators (KPIs)

- PSM Maturity Model analysis is not a one-time event
  - Should be conducted on a regular basis to ensure:
    - The organization's PSM system remains effective
    - Risks are continuously identified and managed

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Example – Employee Participation

Level 1 Reactive	Level 2 Dependent	Level 3 Managed	Level 4 Optimized
No written or limited written plan	Written plan of action	Evidence that employees participates and assist development of PHAs etc.	S&H Committee published agendas and meeting minutes
No or little documented evidence of employee involvement	Partial evidence that employees participate and assist with PSM elements	Organized S&H Committee (hourly and management staff)	Tracking system for all actions from safety committee along with metrics
No evidence of consultation with employees about PSM	S&H Committee that discusses PSM issues	Evidence of a continual improvement process	Employees involved in continual improvement

Combining all Elements of PSM

- A similar assessment methodology can be established for each element of the specific PSM framework or standard
- Each element can be assessed separately and combined together to provide an overall level of maturity for the specific PSM program
- Below is an example of the combination of maturity level scores for the assessed elements

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OSHA PSM Element	Level 1	Level 2	Level 3	Level 4	Level
Employee Participation		2.5			2.5
Process Safety Information	1.5				1.5
Process Hazard Analysis		2.0			2.0
Operating Procedures		2.0			2.0
Training			3.0		3.0
Contractors				4.0	4.0
Pre-Startup Safety Review	1.0				1.0
Mechanical Integrity		2.5			2.5
Hot Work			3.0		3.0
Management of Change	1.5				1.5
Incident Investigation	1.5				1.5
Emergency Response and Planning			3.0		3.0
Compliance Audits			3.5		3.5
Number of Elements per Level	4	4	4	1	31
Overall Score					60%

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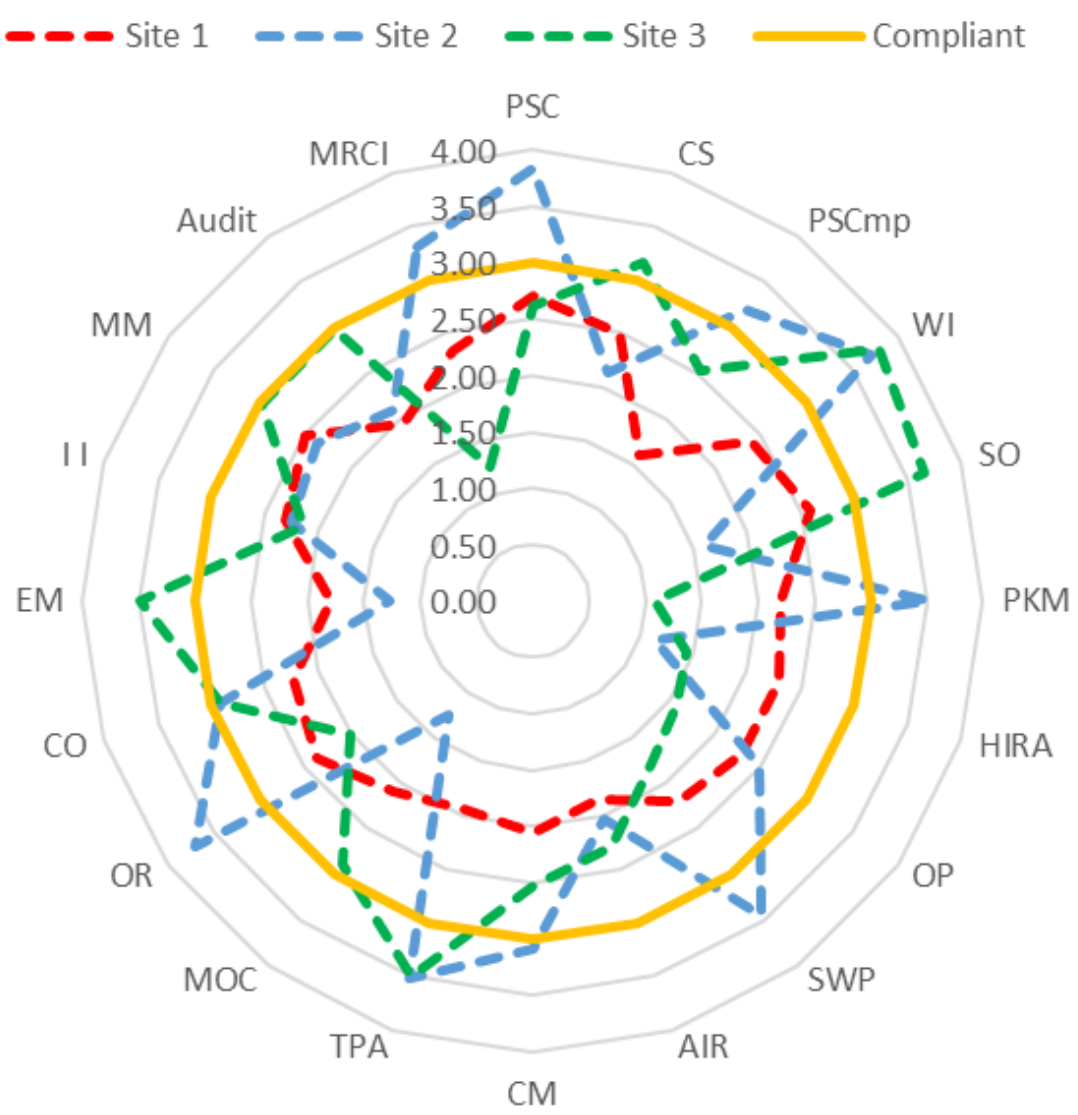
Comparing Multiple Sites

- This approach can also be used to compare multiple sites over the same PSM framework
- Level 3 is a target RBPS compliant state



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Turning Maturity Model into Actions

- Apply the maturity model for each element to understand the maturity level
- Drill down further into each of the gaps identified for that element
- Develop an indicator for the gap identified
- Track improvement progress (actionable, reasonable measures)
- Once the gaps are closed and the element reaches the next maturity level, repeat the process to select more meaningful indicators from that maturity level

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Tying it all back to the “Benchmarking”

- Obtain suggested improvement ideas from users of the process
- Test suggested ideas, measure the results, and update the work practice until the next suggested improvement and share results
- When employees express and develop their ideas for process improvement, they see the value of the change
- Make improvements in small, incremental steps which can be more readily accepted, and results observed sooner

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Summary

- Process Safety Performance is crucial for an organization’s bottom line
- Benchmarking can be done internally or externally
- A combination of internal and external benchmarking can be achieved by implementing a Maturity Model approach
- By regularly conducting gap analyses and working to improve their process safety management systems, organizations can reduce risks while improving their operations

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Thank you for your attention!

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