



Using elements of safety culture as a predictor of process safety outcomes

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1. About Safety Culture
2. Process Safety Culture Survey Overview
3. Study Hypotheses & Results
4. Synopsis

Agenda

Culture is both tangible and intangible



We identified three components of process safety culture



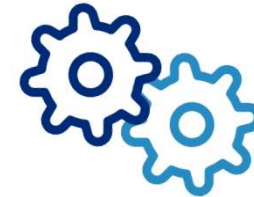
Design Integrity

We design and build so that risks are as low as reasonably practicable (ALARP).



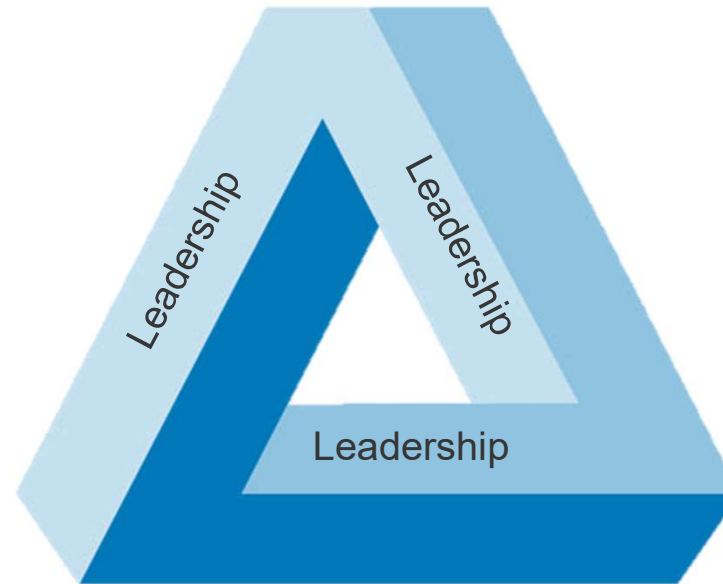
Technical Integrity

We maintain the hardware and software barriers.



Operational Integrity

We work within the operational design parameters.



Understanding Safety Culture

We wanted to test a few main hypotheses:

1

Employees view personal safety culture in the same way they view process safety culture.

2

Personal safety culture does not predict process safety culture.

3

Process safety cultural elements are correlated to process safety outcomes (Tier 1 and 2 incidents).

We utilized Mercer's proprietary personal safety survey questions and database (Illustrative):

1. My Company is an environmentally responsible company.
2. Lessons learned from safety and environmental incidents are effectively communicated by management.
3. Senior leadership encourages reporting important information up-the-line, even if it's bad news.
4. At my Company, senior leadership's actions are consistent with what they say (they "walk the talk").
5. Senior leadership does a good job of explaining the reasons behind major decisions
6. Management responds as quickly as possible when safety problems are discovered where I work.
7. My Company is an effectively managed, well-run organization.
8. My Company is a safe place to work.
9. I am satisfied with my physical working environment (facilities, workspace, safety, lighting, air quality, temperature, etc.).
10. Where I work, everyone takes personal responsibility for complying with safety rules and procedures.
11. Where I work we never compromise our safety in order to meet other targets (costs, deadlines, etc.).
12. Safety is a high priority where I work.
13. Employees can express their ideas / views without fear of negative consequences.
14. Accidents are always reported at this site.

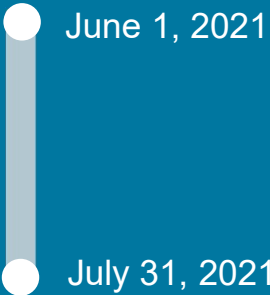
We then created a set of process safety culture survey questions: (Illustrative)

1. Process safety is taken seriously at this site.
2. Our written operating procedures are easy to understand.
3. Site management effectively communicates our process safety results (examples include loss of primary containment, over pressurization, safety device failures, fires, etc.).
4. At this site we have the right resources to focus on process safety.
5. We operate within the operating limit of our equipment.
6. Before a process or procedural change happens at this site, we use a Management of Changes (MOC) process.
7. At this site, we utilize Permit to Work when required.
8. Our approach to process safety management is based upon risk management and continuous improvement; It's not just about regulatory compliance.
9. In my unit I understand the hazards and the safeguards that are in place for safe operations.
10. I participate in hazard reviews and assessments (examples may include Hazard & Operability (HAZOP) reviews, Pre-Start Up Safety Reviews (PSSR), Process Hazard Analysis (PHAs)).
11. Preventative maintenance on safety critical equipment is done according to the maintenance schedule.

We worked with the American Chemistry Council to launch the process safety culture survey



Administration



Questionnaire

- Safety culture assessment
 - 6 dimensions
 - 31 multiple choice items
 - 1 open-ended question
- Process safety assessment
 - 4 dimensions
 - 28 multiple choice items
 - 1 open-ended question

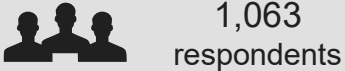


External Benchmark

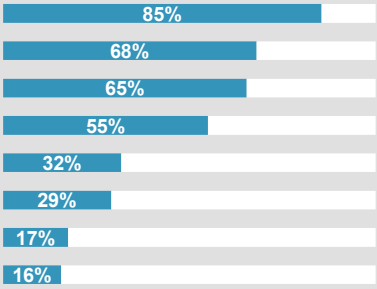
Global Average



Response Rate

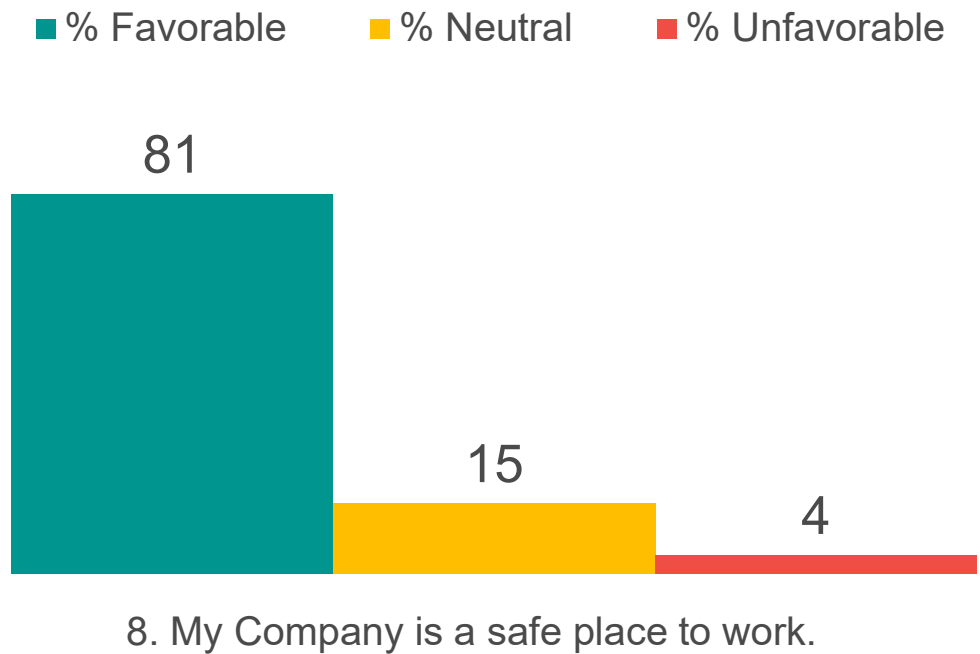


8 Companies participated*



Employee perceptions of overall safety

Overall safety scores are on par with our Mercer Global Benchmark Averages



Difference to Norm: -3

Analysis Results: Hypothesis 1

1

Employees view personal safety culture in the same way they view process safety culture.

2

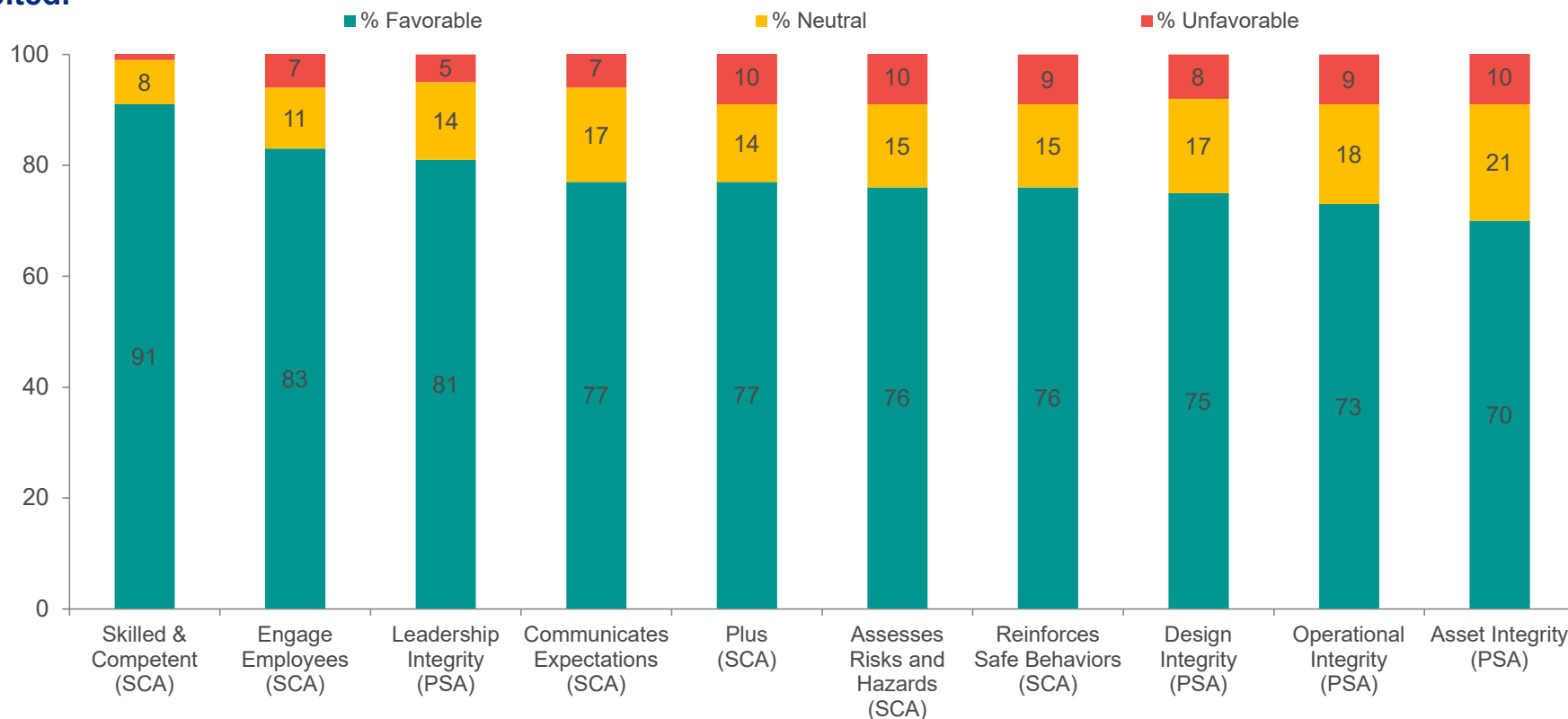
Personal safety culture does not predict process safety culture.

3

Process safety cultural elements are correlated to process safety outcomes (Tier 1 and 2 incidents).

Survey Dimension Summary – All Companies

Safety Culture Assessment (SCA) dimension scores are consistent with expectations. Similarly, we expected Process Safety Assessment (PSA) scores to be somewhat lower because they reflect specific behaviors that need to be exhibited.



Analysis Results: Hypothesis 1

1

Employees view personal safety culture in the same way they view process safety culture.

2

Personal safety culture does not predict process safety culture.

3

Process safety cultural elements are correlated to process safety outcomes (Tier 1 and 2 incidents).

Working conclusion: Employees view the components of process and personal safety differently.

Analysis Results: Hypothesis 2

1

Employees view personal safety culture in the same way they view process safety culture.

2

Personal safety culture does not predict process safety culture.

3

Process safety cultural elements are correlated to process safety outcomes (Tier 1 and 2 incidents).

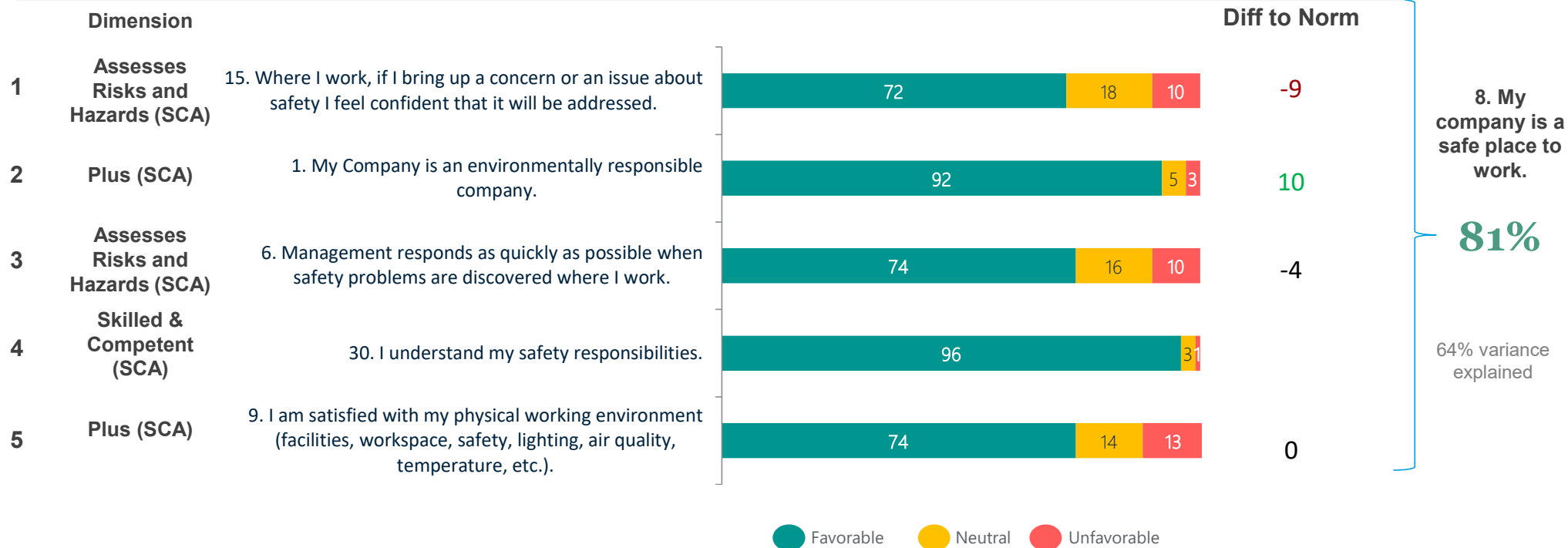
Key drivers of safety using SCA and PSA

- We ran a statistical model to determine which questions best predict safety.
- **Sixty-eight percent** of the variance of overall perceptions of safety is explained by the five questions below.
- To boost employee attitudes about safety (at 81%), leaders will have to maintain the high scores and raise the bar on the least favorable of the items below.



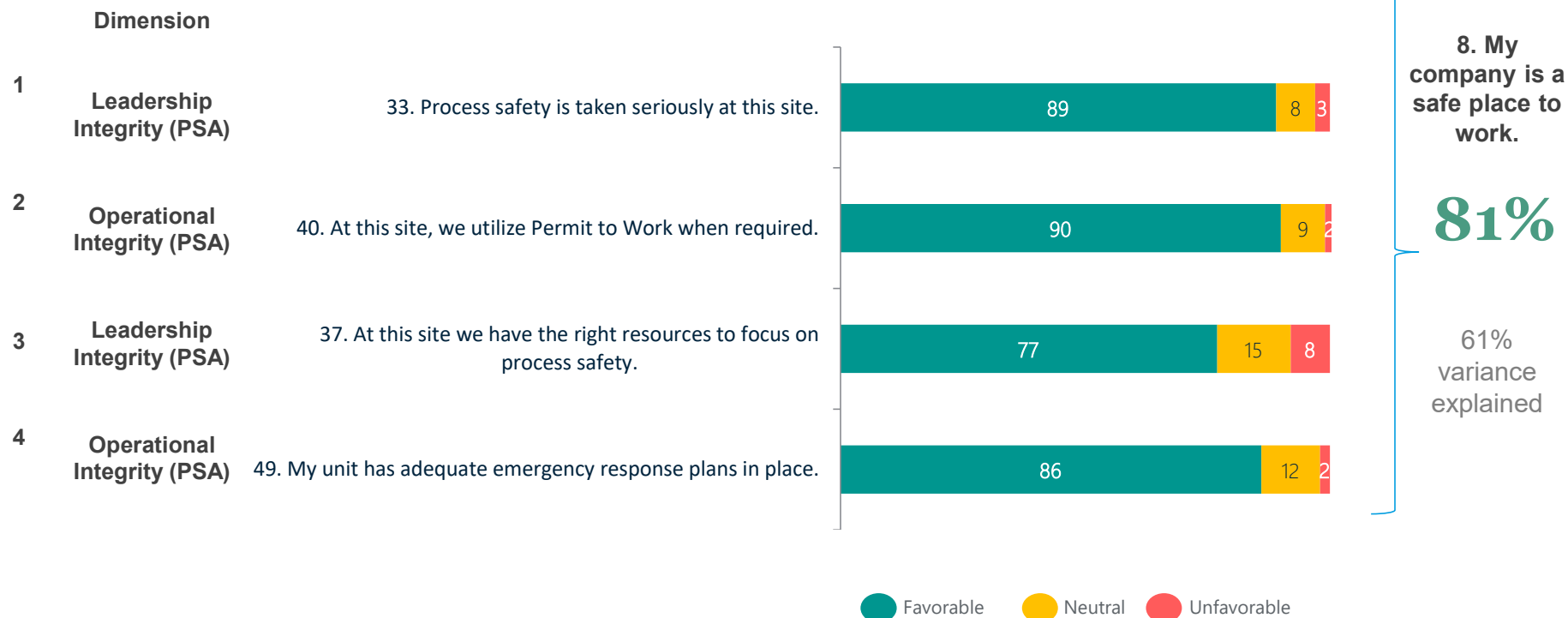
Key drivers of Safety using SCA

- We ran a statistical model to determine which questions best predict safety.
- **Sixty-four percent** of the variance of overall perceptions of safety is explained by the five questions below.
- To boost employee attitudes about safety (at 81%), leaders will have to maintain the high scores and raise the bar on the least favorable of the items below.



Key drivers of safety using PSA

- We ran a statistical model to determine which questions best predict safety.
- **Sixty-one percent** of the variance of overall perceptions of safety is explained by the five questions below.
- To boost employee attitudes about safety (at 81%), leaders will have to maintain the high scores and raise the bar on the least favorable of the items below.



Analysis Results: Hypothesis 2

1

Employees view personal safety culture in the same way they view process safety culture.

2

Personal safety culture does not predict process safety culture.

3

Process safety cultural elements are correlated to process safety outcomes (Tier 1 and 2 incidents).

Working conclusion: The best predictors of how employees feel about safety are derived from a combination of both process and personal safety questions.

Analysis Results: Hypothesis 3

1

Employees view personal safety culture in the same way they view process safety culture.

2

Personal safety culture does not predict process safety culture.

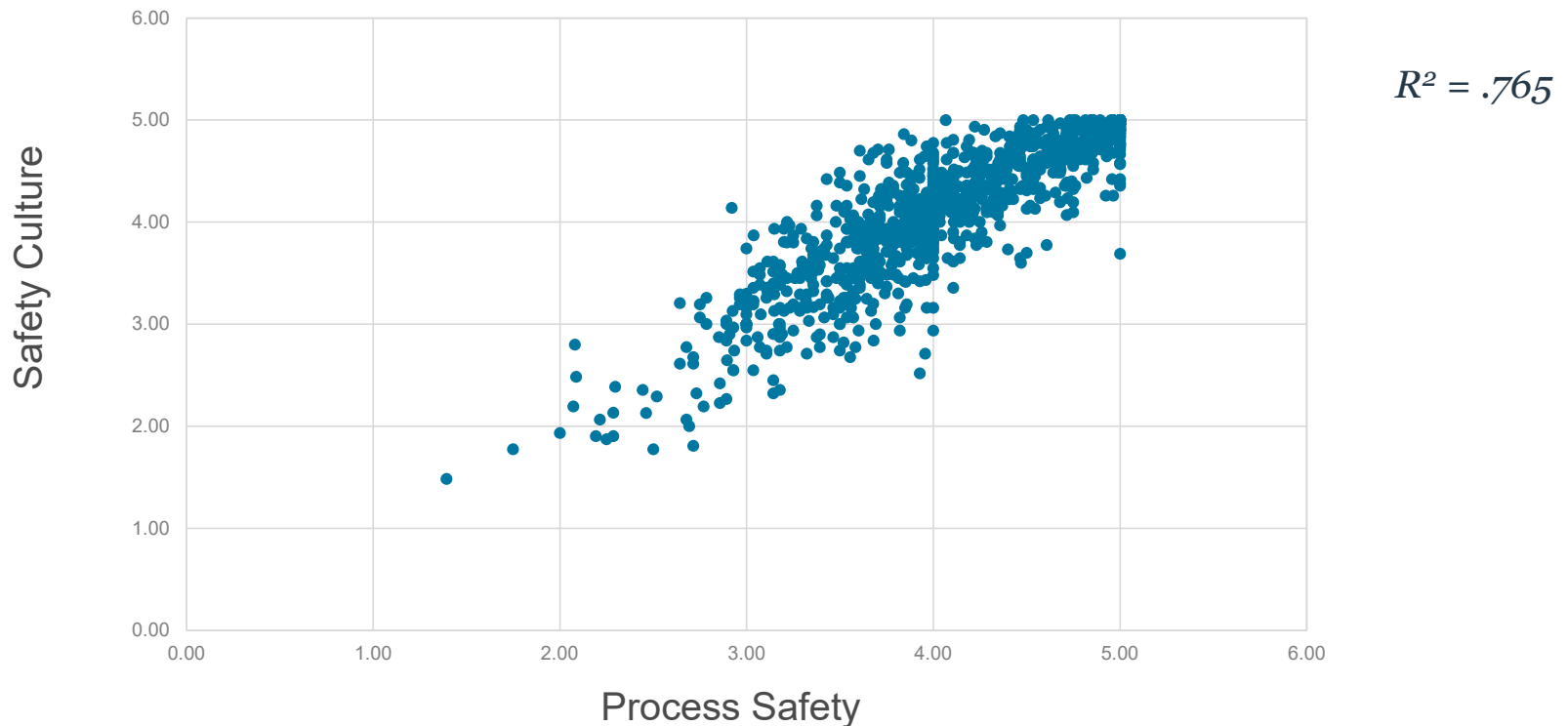
3

Process safety cultural elements are correlated to process safety outcomes (Tier 1 and 2 incidents).

Does a process safety assessment predict a safety culture?

Answer: Yes! Our survey results show that these two are strongly linked.

A PSA significantly predicts safety culture $R^2 = .765$. Employees who feel that their process safety needs are being attended to are **significantly more likely** to believe they work in a strong culture of safety.



Does PSA and SCA predict safety outcomes?

Correlates with Days Away From Work (DAFW)

| Dimension | Question |
|---------------------------|---|
| PSA Operational Integrity | 57. I understand the design limits of our equipment. |
| PSA Operational Integrity | 38. We operate within the operating limit of our equipment. |
| SCA Skilled & Competent | 30. I understand my safety responsibilities. |

Correlates with Tier 1

| Dimension | Question |
|---------------------------|---|
| PSA Leadership Integrity | 36. Site management effectively communicates our process safety results |
| PSA Design Integrity | 43. I participate in hazard reviews and assessments. |
| PSA Operational Integrity | 34. We always operate according to procedures. |
| SCA Reinforces Behaviors | 21. My immediate manager holds employees accountable for following safety procedures. |
| SCA Reinforces Behaviors | 20. My immediate manager's actions are consistent with what he/she says. |
| SCA Engage Employees | 27. I would feel comfortable reporting a safety incident or near miss. |
| SCA Comm Expectations | 23. My immediate manager puts our team's safety ahead of his/her own ambitions. |
| SCA Reinforces Behaviors | 24. In the last 12 months, my supervisor has reviewed my work to make sure I am working safely. |
| SCA Plus | 19. My immediate manager is accessible to me when needed. |
| SCA Reinforces Behaviors | 4. At my Company, senior leadership's actions are consistent with what they say (they "walk the talk"). |

Companies need to get these three items right!

*Note analysis controlled for the size of the organization

Analysis Results: Hypothesis 3

1

Employees view personal safety culture in the same way they view process safety culture.

2

Personal safety culture does not predict process safety culture.

3

Process safety cultural elements are correlated to process safety outcomes (Tier 1 and 2 incidents).

Working conclusions:

Process and personal safety are very strongly correlated.

There are a few questions that indicate correlation with serious incidents and events.

Synopsis



STRENGTHS TO LEVERAGE

- Employees across the cohort said they understand what **they need to do to** maintain a safe environment and have had the **necessary training**.
- **Upward communication** around safety is strong: Employees can communicate **near misses or incidents** and they believe **leadership encourages** this behavior.
- **Process safety 'table stakes' are met; it is taken seriously** and companies have good **emergency response** plans.
- Employees report **decision making authority** in their jobs, and feel **supported by their immediate manager**.



OPPORTUNITY AREAS

- Safety execution is lower than expected: **drills are not being performed**, management of maintenance **backlogs**, and focus on fixing problems rather than **placing blame** are all areas needing attention.
- Safety operations have some issues: **alarms** are less manageable, **overrides** are more common than expected, and unit **shutdowns** are more frequent than ideal.
- Leadership is not communicating **reasons for decisions**, which is causing employees to feel less positive about the organization.



RECOMMENDED ACTIONS

Target safe operations

1. *Have clear **procedures** and **accountabilities** for **bypasses** and **overrides**.*
2. *Monitor and **measure maintenance backlogs** and **time to close work orders** as part of the **process safety KPIs**.*
3. *Initiate **alarm reduction** (**alarm flood**) efforts to **reduce nuisance** and/or **unnecessary alarms**.*
4. *Review **operational and maintenance integrity programs** to **reduce unplanned shut downs**.*
5. *Implement programs for **tabletop exercises** and **unit-wide drills**.*
6. *Include **human factors** analysis in **incident investigations***

Questions?

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