# TIMES ARE CHANGING…

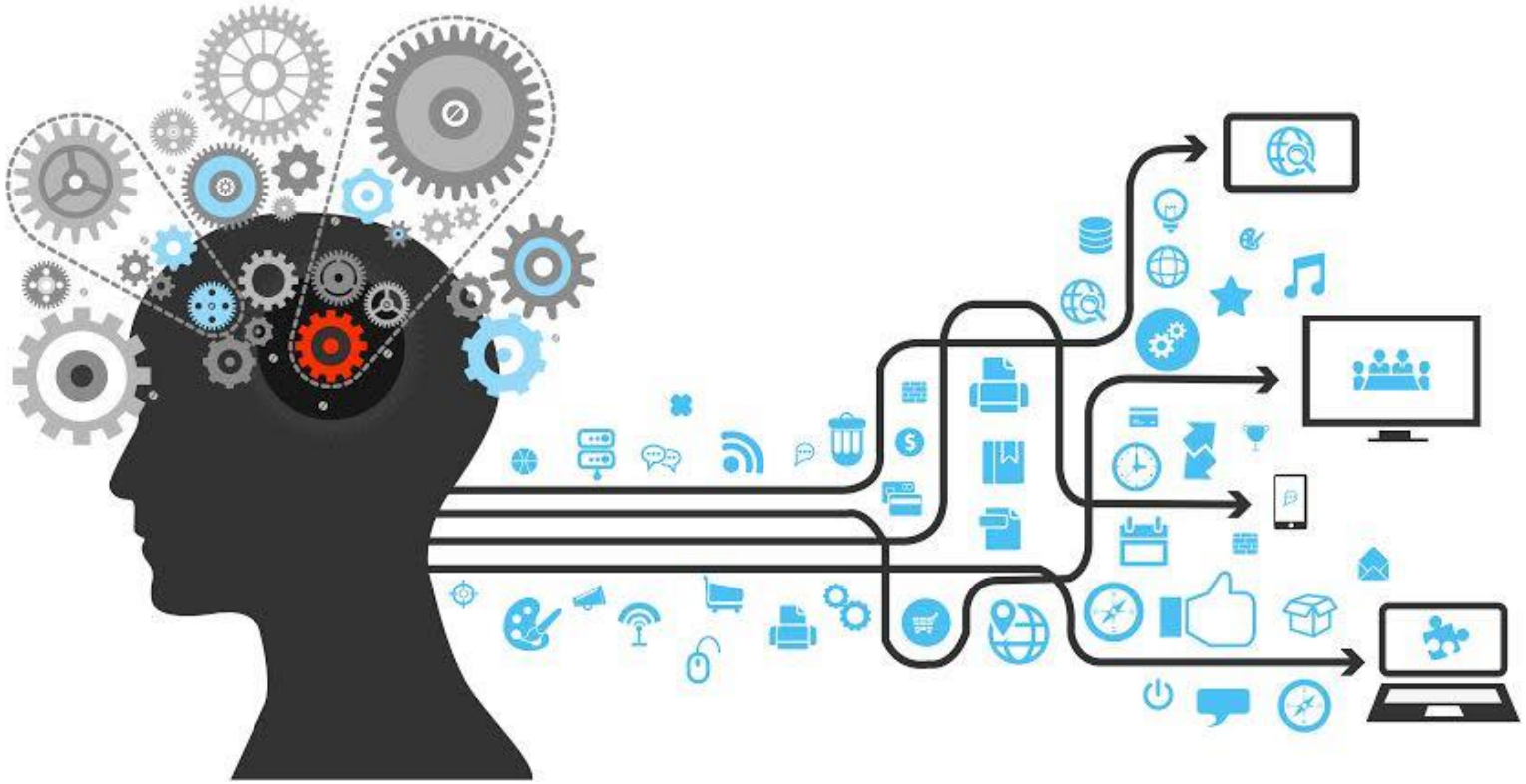


Image from www.towardsdatascience.com

# Risk Intelligence for PSM

## An evolution in risk assessment thinking

Presented by Beth Chisholm

ACM Facility Safety

# INDUSTRY NEED

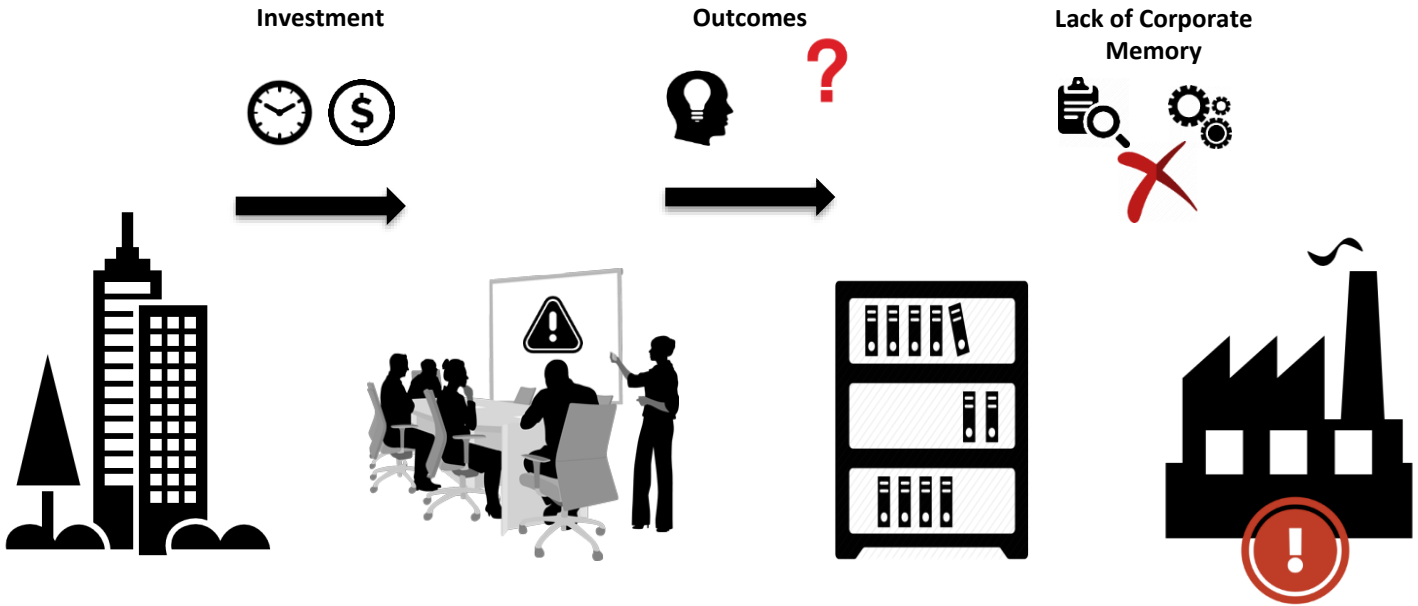
More than **30 years** of **PSM** history since Bhopal. . .

1. Accidents are **still happening**

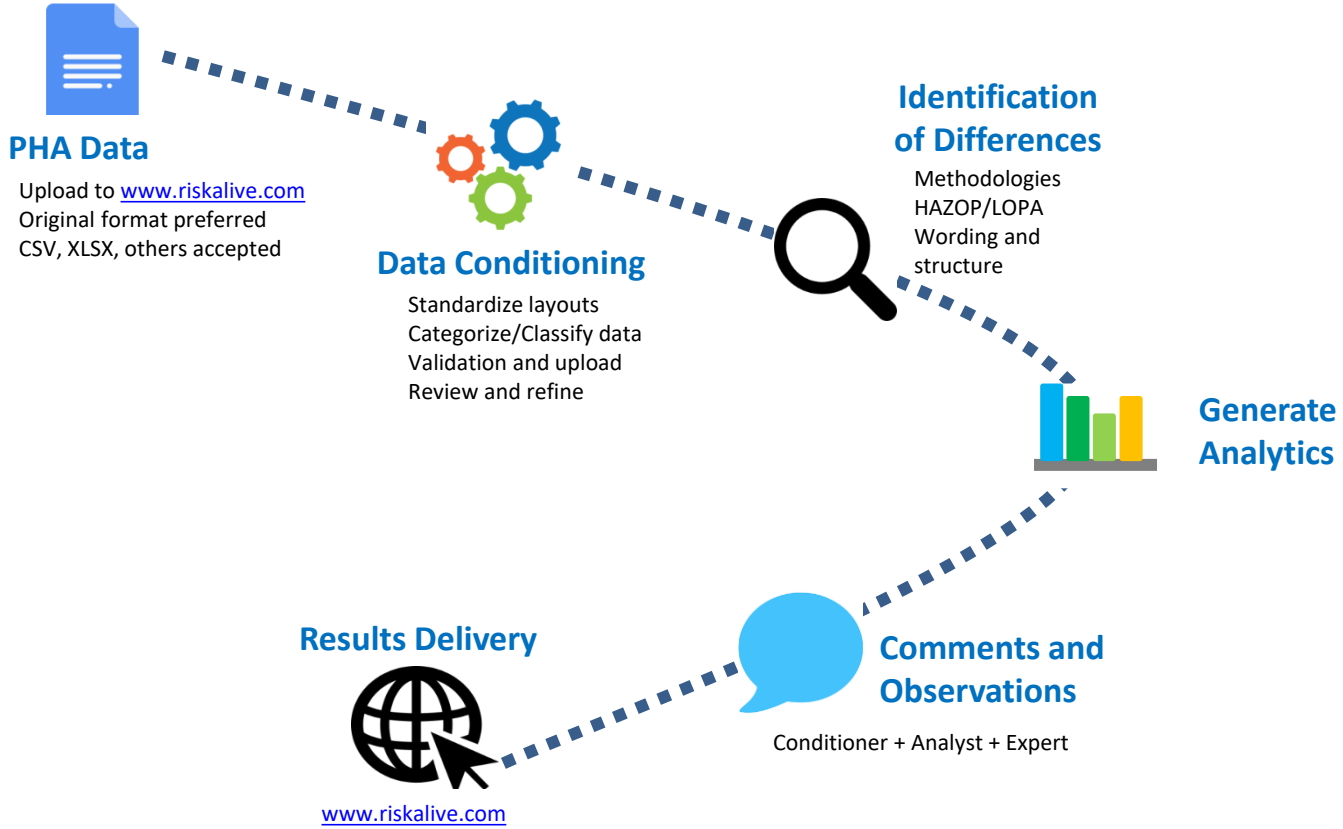
2. The sharing and learning from unsafe days is **limited, slow and often 10 years too late**.

3. Even sophisticated owners still suffer from “**failure to learn**”, “**silo learning**” and “**lack of knowledge retention**”

# CURRENT STATE



# RISK INTELLEGENCE PROCESS

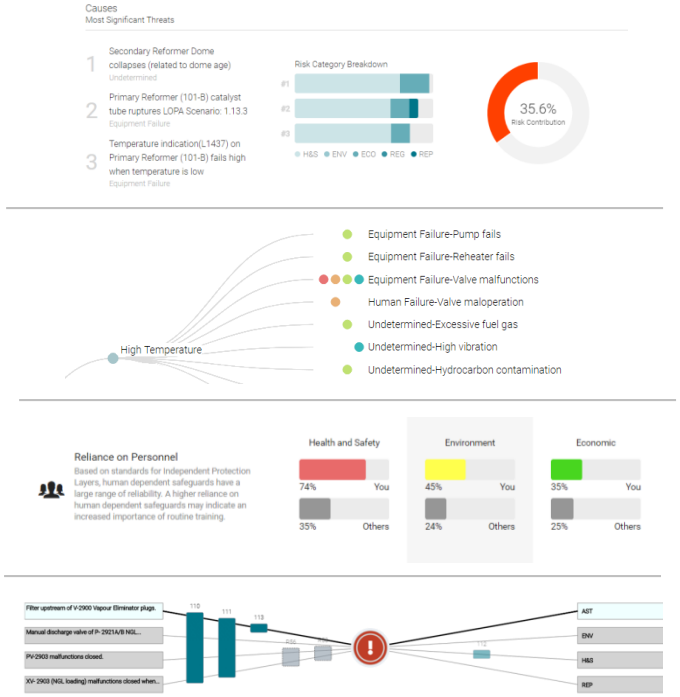


# RISK ALIVE

## Turn 1000s of pages of worksheets. . .

**A**rtificial **I**ntelligence
**M**achine **L**earning
**N**atural **L**anguage **P**ro.
**S**ubject **M**atter **E**xpertise

## into <u>Visualized Learnings</u>



# CAUSES

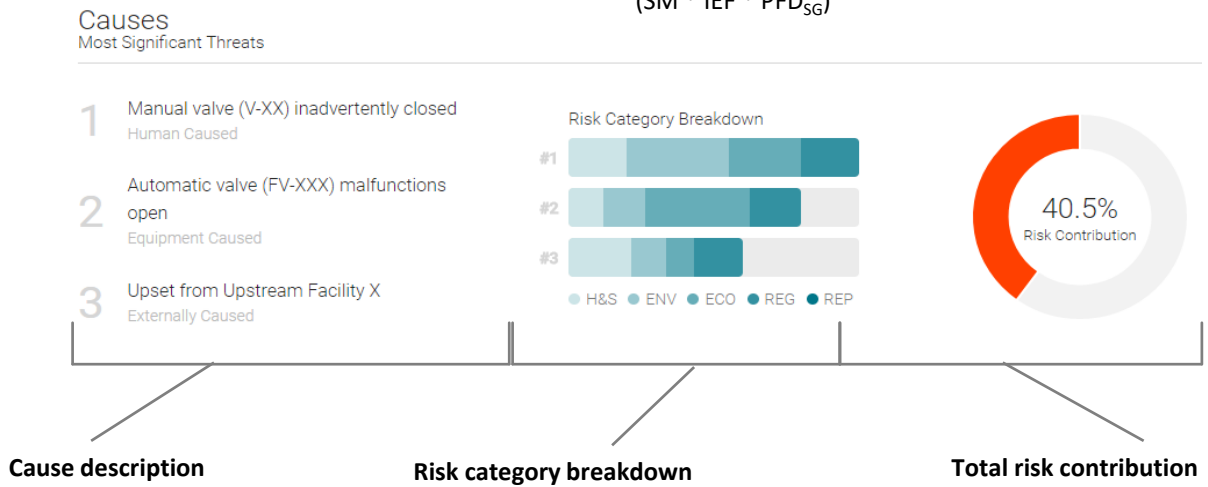
**Why is it important?**

The most critical causes are not obvious when looking at PHA documentation and it is difficult to communicate risks to front-line personnel following a PHA. Risk Alive takes a scientific approach to identifying these items and ranking them in order from most to least critical and presents the learnings in a shareable way anyone in the organization can understand.

**How does it work?**

Cause Criticality Before Safeguards, is determined by multiplying the Severity Multiplier (SM), which is related to the tolerability of a scenario as in the client's risk matrix, by the frequency of the event before consideration of safeguards (IEF - initiating event frequency). The impacts of the cause across various consequence receptors are summed together to reflect the risk of the cause. (SM * IEF).

Cause Criticality After Safeguards, is determined by multiplying the Severity Multiplier (SM), by the frequency of the event after consideration of safeguards. (SM * IEF * $PFD_{SG}$)



# SAFEGUARDS

**Why is it important?**

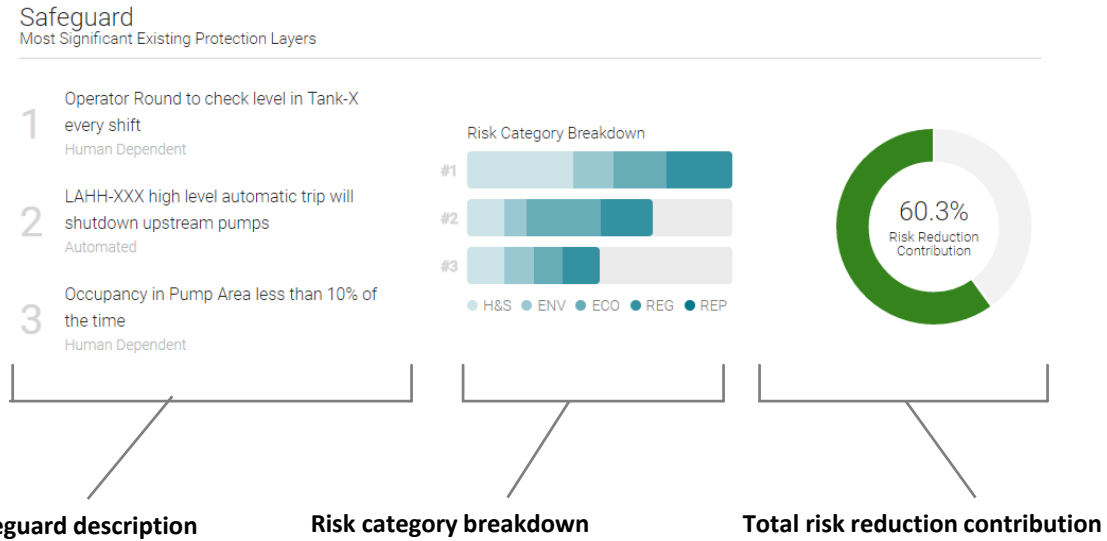
Most processing units have hundreds of safeguards, all of which require maintenance and all provide a level of risk reduction. Understanding the most critical safeguards and their risk reduction contribution allows plant personnel to ensure these safeguards are effective and functioning.

**How does it work?**

Safeguard Criticality is determined by multiplying the Severity Multiplier (SM), which is related to the tolerability of a scenario as in the client's risk matrix, by the change in frequency of the event based on the existence of that specific safeguard.

(SM * (Frequency w/o $SG_X$ – Frequency /w $SG_X$)).

The value of the Safeguard is summed across all occurrences.



# SAFEGUARD RANKING

**Why is it important?**

Safeguards are intended to reduce the likelihood of unwanted events (fires, explosions, loss of containment). The ability to view all safeguards together and filter by type makes auditing and maintaining safeguards highly efficient. Improves maintenance/audit efficiency and risk reduction in a facility.

**How does it work?**

Safeguard Criticality is determined by multiplying the Severity Multiplier (SM), which is related to the tolerability of a scenario as in the client's risk matrix, by the change in frequency of the event based on the existence of that specific safeguard.

SM * (Frequency without $SG_X$ – Frequency with $SG_X$)).

The value of the Safeguard is summed across all occurrences.

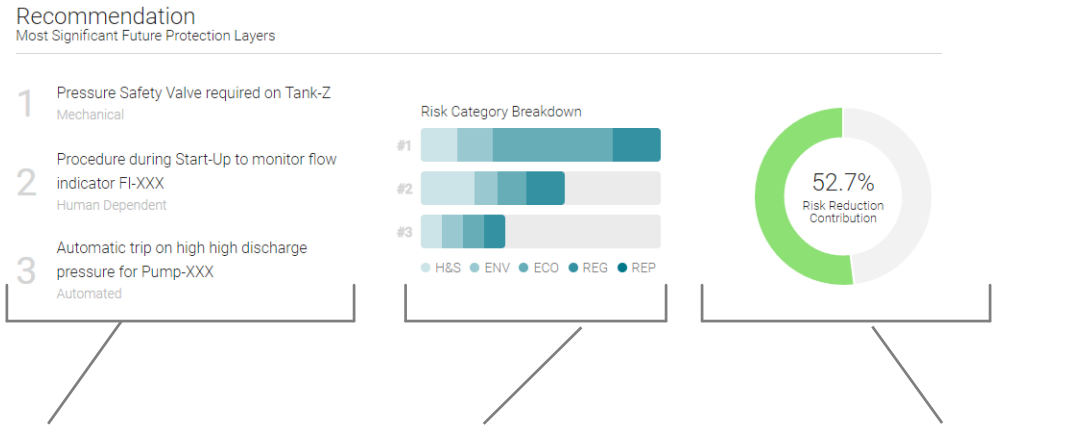
# RECOMMENDATIONS

**Why is it important?**

The top 3 recommendations in PHA studies typically make a significant contribution to risk reduction in a processing unit. Because recommendations are time consuming and expensive to implement, knowing the most critical items will optimize spending and reduce the time a facility operates with high or very high risk scenarios.

**How does it work?**

Recommendation Criticality is determined by multiplying the Severity Multiplier (SM), which is related to the tolerability of a scenario as in the client's risk matrix, by the change in frequency of the event based on the theoretical existence of that future safeguard. If there are multiple recommendations on a scenario, only one recommendation is considered at a time.
(SM * (Frequency without REC – Frequency with REC)).
The value of the Recommendation is summed across all occurrences.



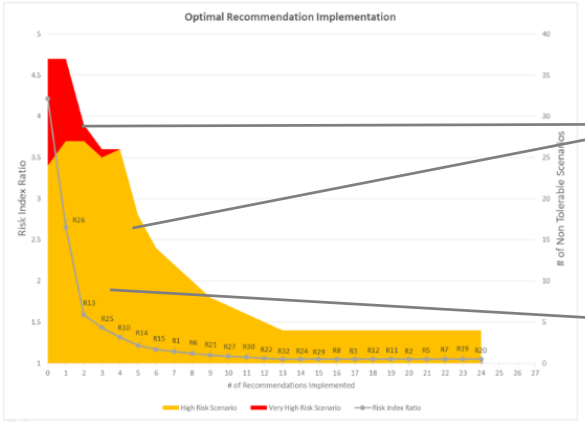
# RECOMMENDATION SEQUENCER

**Why is it important?**

Each time a recommendation is implemented, the risk profile of a facility or processing unit changes, making the initial sequence of recommendations potentially obsolete. Traditional recommendation implementation strategies result in higher costs, slower reductions in High and Very High risk scenarios and lower quality implementations. Risk Alive works with clients to model the ideal sequence of recommendations based on shut-downs, capital costs and lead times.

**How does it work?**

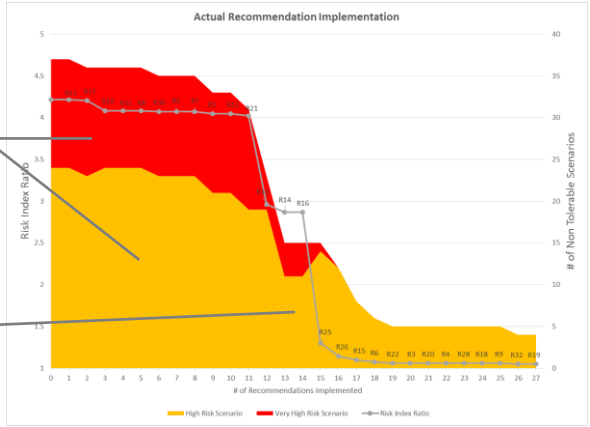
All recommendations are process through criticality engine which determines the most critical recommendation. This initial most critical recommendation is then converted to a safeguard and the remaining recommendations are re-processed through criticality. This iterative process continues until all recommendations have been sequenced.




Optimal Recommendation Sequence

**Number of High and Very High risk scenarios**

**Line graph**




Actual Recommendation Sequence

***Only through and iterative calculation can corporations model and optimize the spending related to recommendations.***

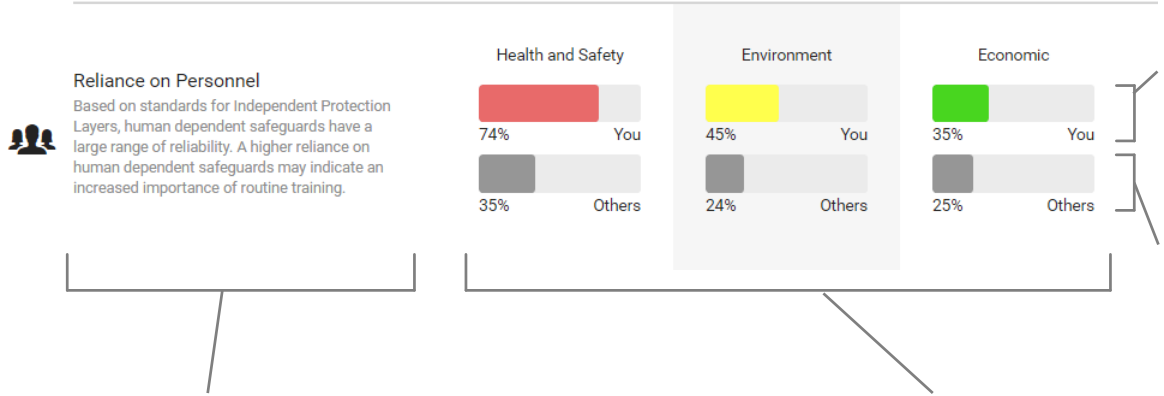
# REPORT CARD – RELIANCE ON PERSONNEL

**Why is it important?**

Comparing a processing unit or type of equipment to others provides insights into how the rest of industry is staying safe. Risk Alive includes 6 metrics which compare facility to the rest of industry by leveraging a data repository comprised of thousands of data sets. These metrics will lead to important questions about your facility. Risk Alive can also provide drill-down information based on any metric to answer your most important questions.

**How does it work?**

Values for each metric related to "Your" facility are calculated directly from data in PHA documents. For example, Equipment threats indicates the percentage of threats which are categorized by equipment failure. The same calculations are used for the "Others" values




**"You" represents your facility metrics**

**"Others" includes comparable processing units or equipment from the Risk Alive database scenarios.**

**Metric name and description**

**Metric comparison**

Red = significantly different than "Others" (greater than 1.5 SD)
Yellow = moderately different than "Others" (between 0.5 SD and 1.5 SD)
Green = minor or not different than "Others (less than 0.5 SD)

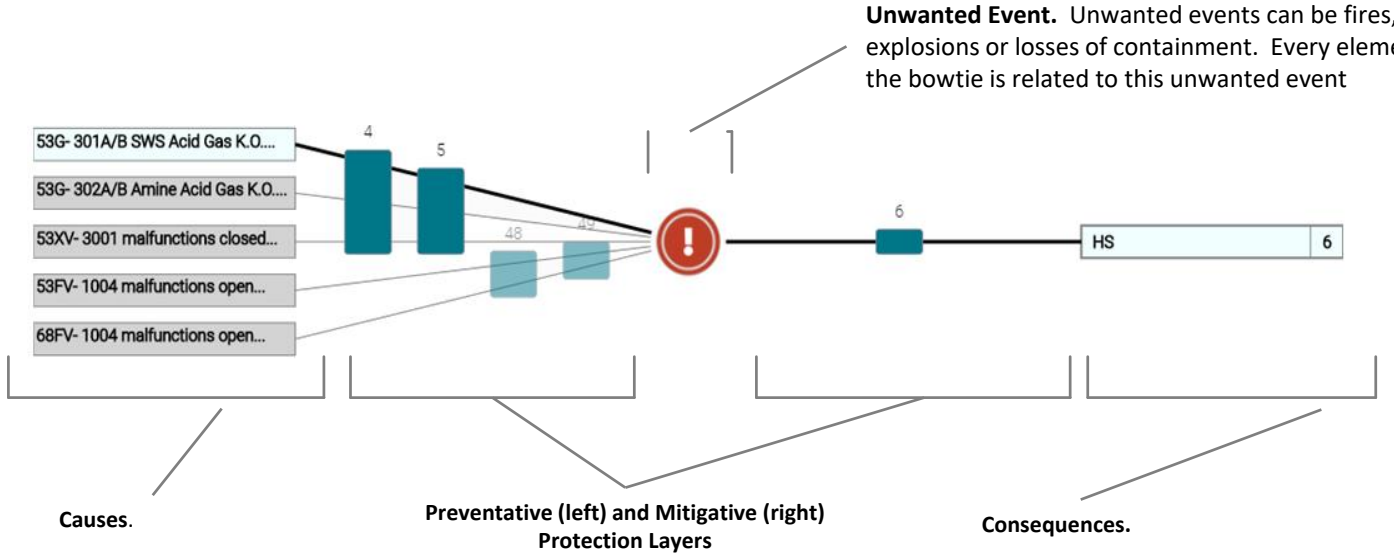
# HAZARDOUS SCENARIO VIEWER

**Why is it important?**

The bowtie visualization is an ideal method of displaying all elements within a hazardous scenario. Among other uses, each bowtie can demonstrate the impacts of bypassing safeguards, the significance of threats and how threats and consequences are associated. Use the Hazardous Scenario Viewer to plug into MOC processes or make personnel more aware of entire scenarios in one easy to understand and interactive visualization.

**How does it work?**

Each cause/consequence item from the PHA is assigned a Bowtie Center value which summarizes the unwanted event. All cause/consequence pairs which chare a common Bowtie center and grouped together in the visualization. Protection layers are also added to visualization linked to their associated cause/consequence.



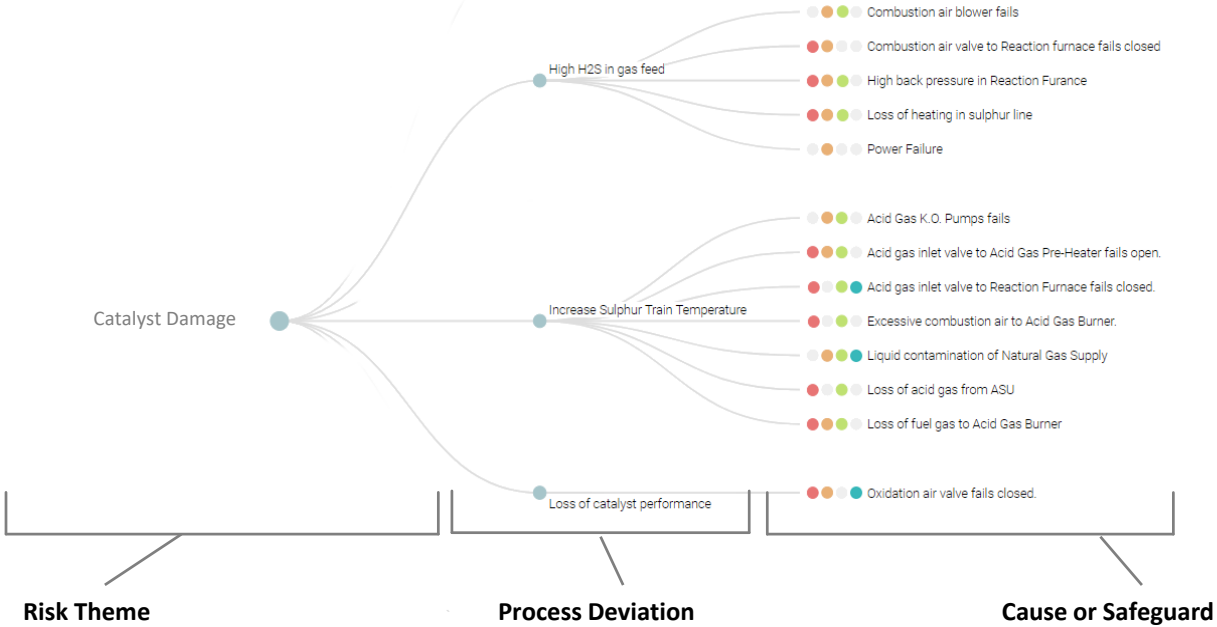
# FACILITY UNIT COMPARISON

**Why is it important?**

Traditional PHA studies do not leverage the accumulated knowledge within an organization or across industry. By graphically representing overlap or uniqueness between facility units, organizations can understand which threats were not considered and which safeguarding strategies have been deployed. Improves PHA consistency and completeness.

**How does it work?**

Risk Themes are identified across PHAs from multiple facilities and are then linked with the related Process Deviations. All safeguards and causes related to those Process Deviations are then generalized to increase readability and comprehension. The result is a hierarchical representation of the overlap or uniqueness between facilities.



# QUESTIONS

*“The world as we have created it is a process of our thinking. It cannot be changed without changing our thinking.”*
***— Albert Einstein***