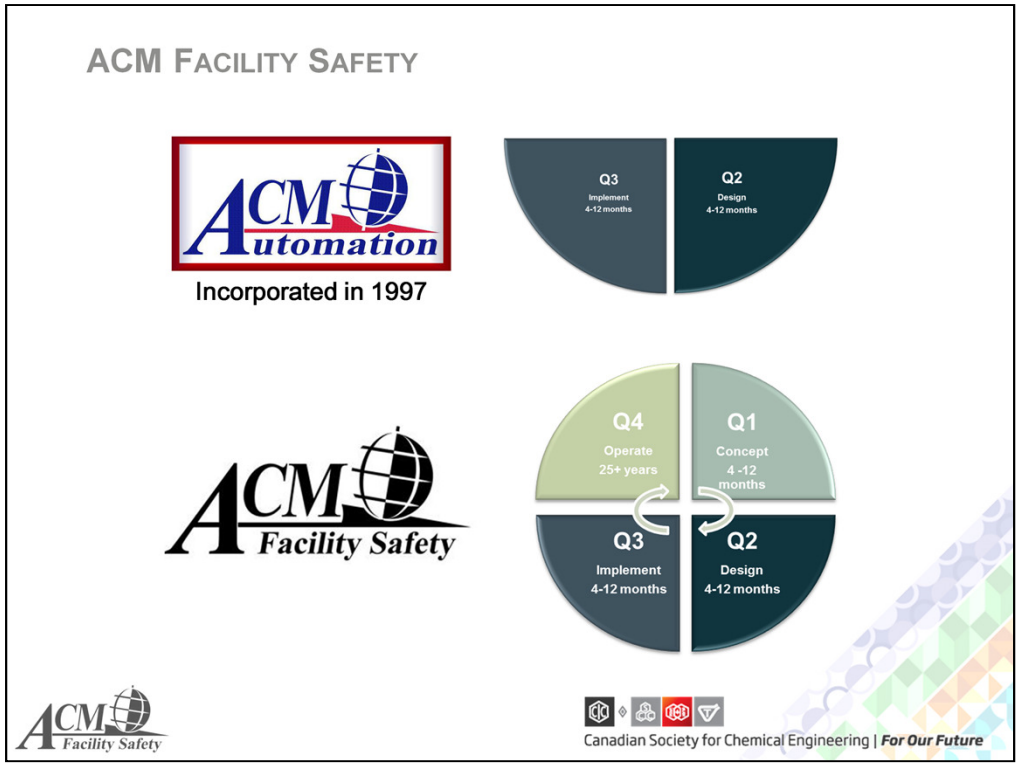
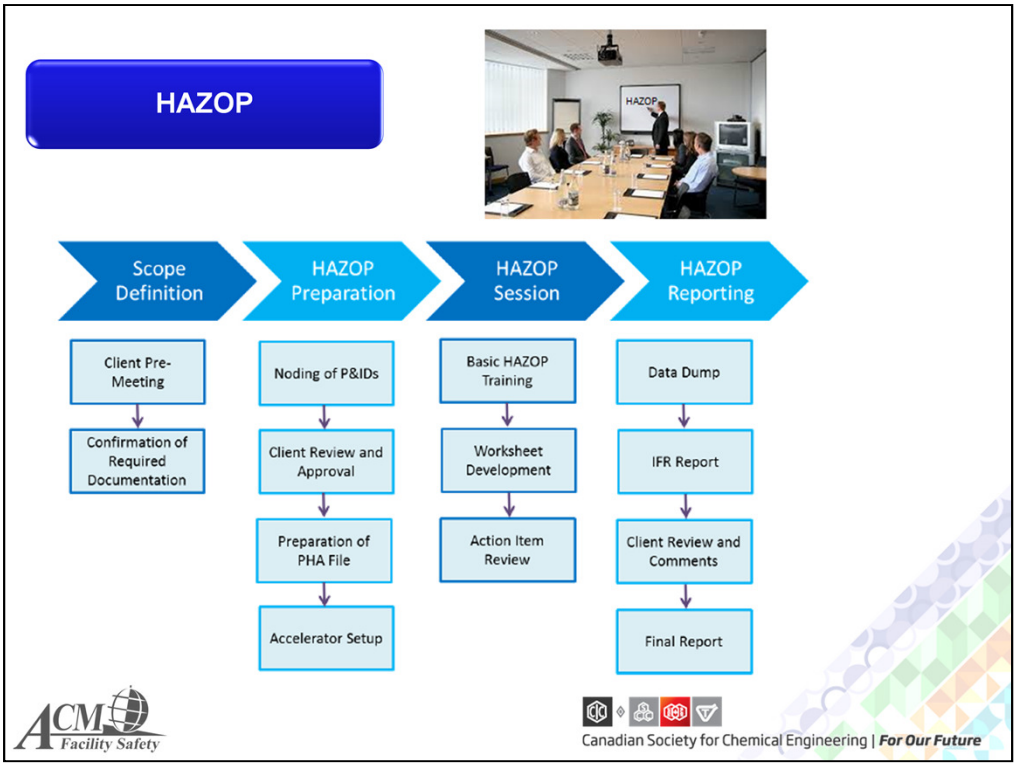
We spend around 2000 hours a year, some even cresting 3000 a year at our places of work. For most of us, we refer to work as a home, away from home. One of the most common methods of identifying and mitigating process risks, at our home, is the Hazard and Operability (HAZOP) study. These studies typically take place off site to minimize facility distractions and to accommodate sterile environments. Most of you reading this will equate the inner wall of hotel conference rooms and engineering offices with HAZOP. Weeks pass by offsite ending with a sigh of relief before returning home. After returning home, information stemming from the HAZOP is rarely brought up again and almost never validated to be true. We have a general idea that our safeguards work most of the time however, do we have any evidence that our protection layers taken credit for in HAZOPs are actually functioning in the field? Do we know if we are fully protected in our own home, as the team decided on a Monday morning or Friday afternoon? Are we achieving the risk reduction claimed in session at site? When maintenance needs to be performed, do we know our risk exposure? Not all safeguards are created equally, do we know which safeguards have the largest impact to facility risk? In this presentation we will take a look at what we can all do as next steps to taking HAZOP home and determine if we are operating safely.



ACM Facility Safety started as a Automation, Controls and Management company in 1997. Spotting a large gap in industry within the understanding of process risks, we expanded into the conceptual and operation phases to help companies understand the risk they face while operating. In the past 18 years we have learned a lot from PHA's, primarily this document is under utilized and difficult to manage. Fulfilling our purpose to make the world a safer place to live we have identified actions we can all immediately take.



The individuals in the room hold a lot of operational knowledge and are in high demand on site, in order to minimize interruptions the sessions are typically held off site, away from home. Weeks of brainstorming are spent systematically assessing Hazardous events, pages on pages on pages of key information is documented. But what happens with this document post HAZOP? It hits a shelf/ archival process, recommendations are extracted and passed along, 5 years later we revisit this story unless a incident forces us to dig up the records. Why wouldn't this document get used more? It is part of the 5 year risk plan for the facility, there is vital information in there. Unmanageable, hard copy data proves too big a task for most to take action on.

MAKE USE OF THE DATA WITH ANALYSIS

Node: 1. Distillation Unit
Deviation: 2. Overpressure. **Type:**
Document:
Design Conditions/Parameters:

Causes	Consequences	CAT	Before Risk Reduction S	L	RR	Safeguards	HAZOP Recommendations
1. Loss of pumparound flow	1. Overpressure of column leading to leaks or rupture leading to loss of containment resulting in fire and explosion leading to hazards to personnel.	H&S	6	5	Extreme	1. PSV on overhead will relieve full load. 2. BPCS - Pumparound low flow alarm with operator action. 3. SIS - PAHH-3112 will trip Heater.	1. Determine Required SIL level for PAHH-3112 triping Distillation Unit Heater.
	2. Overpressure of column leading to leaks or rupture leading to loss of containment resulting in fire and explosion leading to economic impact.	ECN	6	5	Extreme	1. PSV on overhead will relieve full load. 2. BPCS - Pumparound low flow alarm with operator action. 3. SIS - PAHH-3112 will trip Heater.	
	3. Overpressure of column leading to leaks or rupture leading to loss of containment resulting in fire and explosion leading to damage to the environment.	ENV	5	5	Extreme	1. PSV on overhead will relieve full load. 2. BPCS - Pumparound low flow alarm with operator action. 3. SIS - PAHH-3112 will trip Heater.	
	4. Overpressure of column leading to leaks or rupture leading to loss of containment resulting in fire and explosion leading to reputation impact.	REP	5	5	Extreme	1. PSV on overhead will relieve full load. 2. BPCS - Pumparound low flow alarm with operator action. 3. SIS - PAHH-3112 will trip Heater.	

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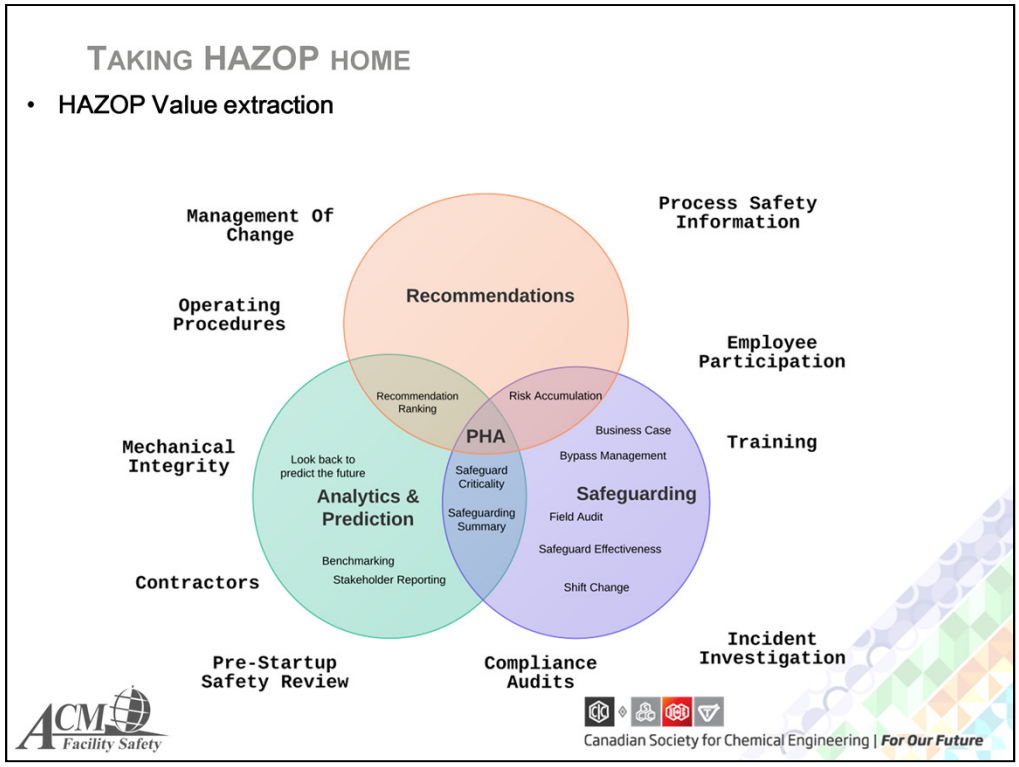
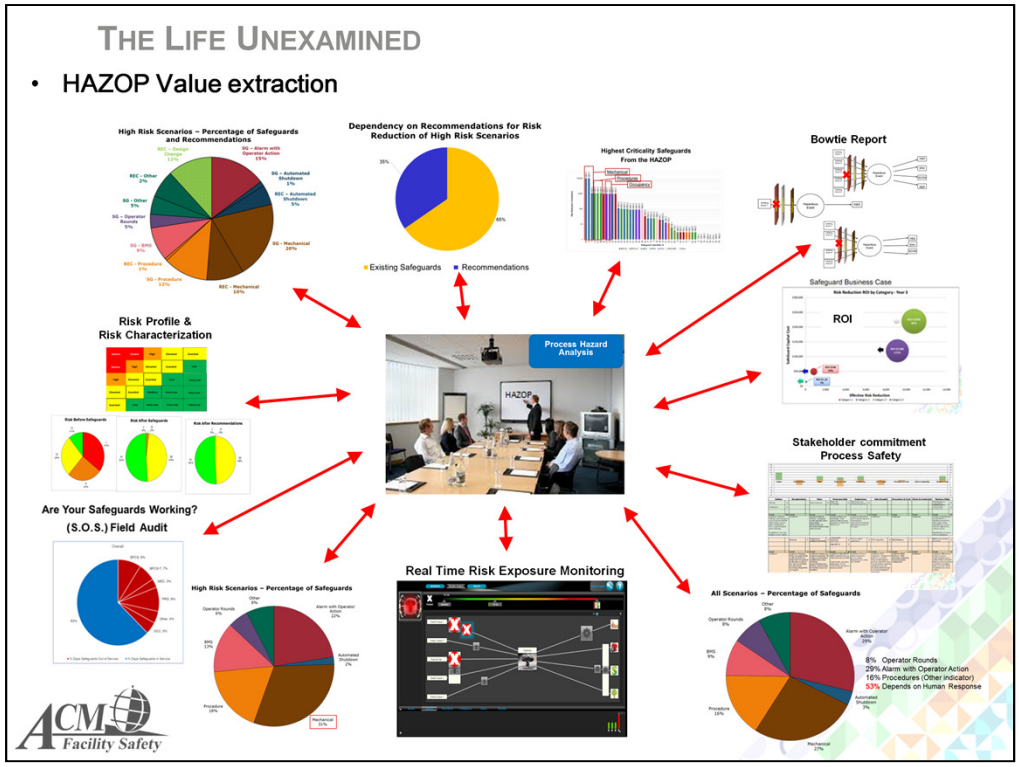
HAZOP worksheets work very well for the systematic process of identifying hazards and mitigating the risk associated with the hazards however when used to gain an understanding of safeguarding and recommendations, we could almost not have more work ahead of us using the sheets alone.

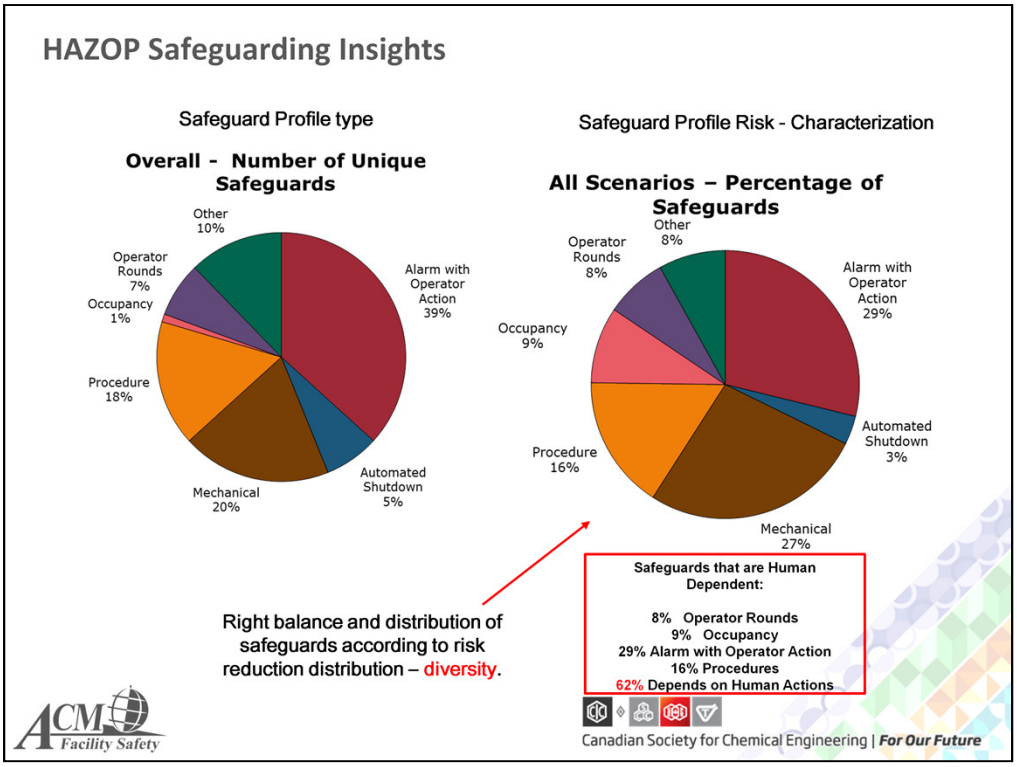


HAZOPs are the center of risk understanding. Without a PHA, the picture of risk cannot be established and understood. Extracting value from the center of this diagram strengthens all elements around.



The unexamined life is not worth living – Socrates. If we do not look over our risk life and the plans we have created for the next years, how do we know if we are getting the best result possible? If we were to plan our lives for the next 5 years in two weeks and then never look at these plans again how do you think the result would look?

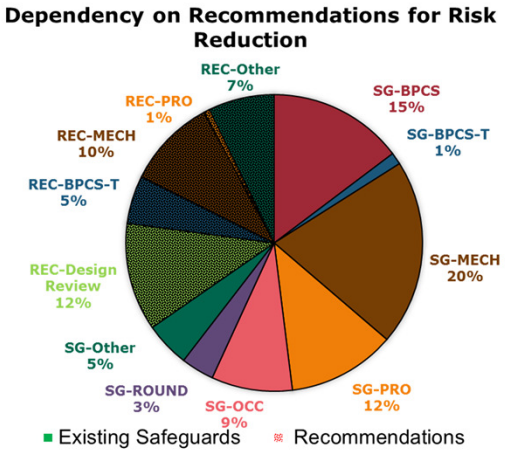
There are many ways to extract value from a HAZOP, first off what we should do is to make sense of the document, group like information and take advantage of data in a meaningful way. Take a look at safeguard distribution across the entire HAZOP and across high risk scenarios to learn areas of high safeguard reliance and areas of uniqueness. Rank Safeguards by criticality, determine which safeguards will have the highest impact to risk exposure if on bypass. Analyze Recommendations and rank them by highest risk reduction contribution to learn where to start on implementation, which recommendations, if completed first, will reduce risk exposure the most.



Getting data out of the HAZOP file allows for data manipulation and analysis of the HAZOP data. Breakdowns of the safeguards that were used for risk reduction are very easily understood when using graphics. These graphs shows us the types of safeguards that were relied on in the HAZOP to mitigate the risk. As you can see here, one conclusion we can draw is that the greatest reliance for risk reduction is on Alarms that require Operator action. Another conclusion is that 62% of risk reduction involves a human component. Are staff thoroughly trained? Do we have enough staff on site to handle loss of control situations? Are procedures well documented and auditable?

HAZOP Recommendation insights

- Some High Risk scenarios don't have enough existing safeguards to reduce the risk to a tolerable level
- If recommendations are implemented they will reduce the risk to a tolerable level



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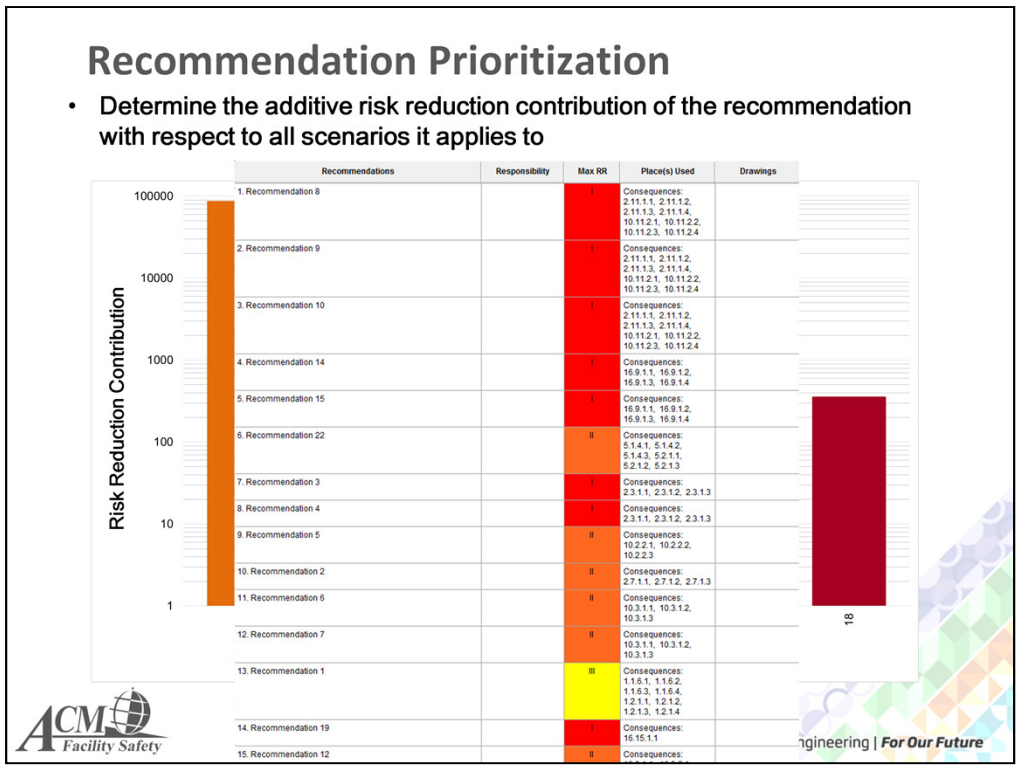
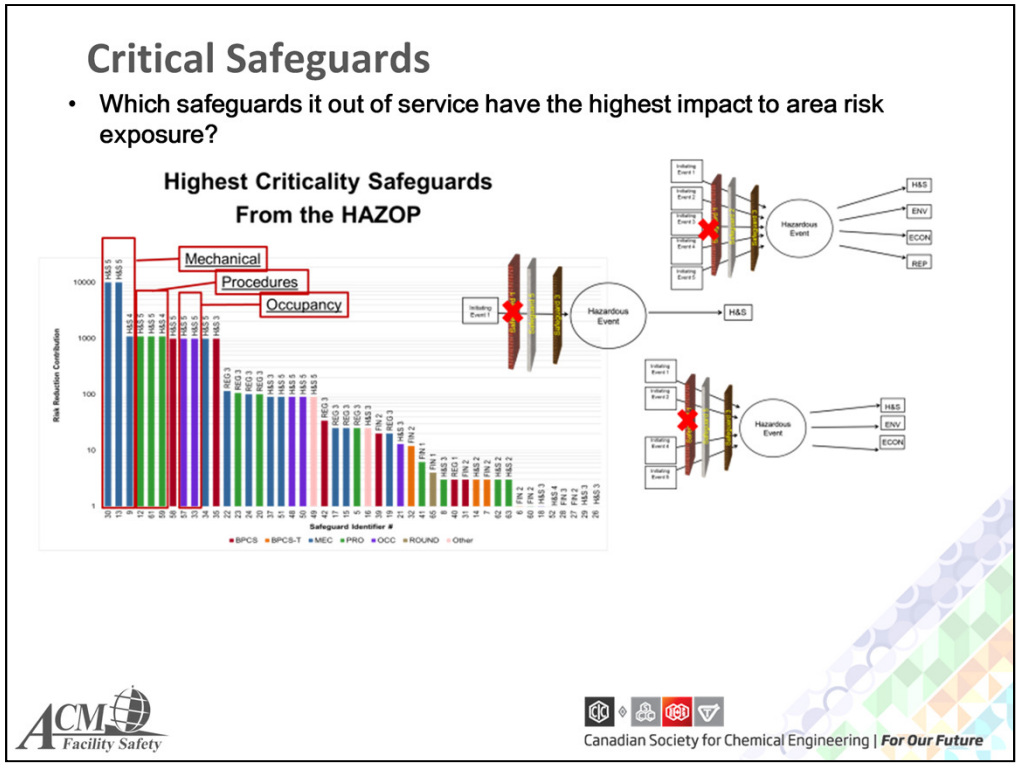
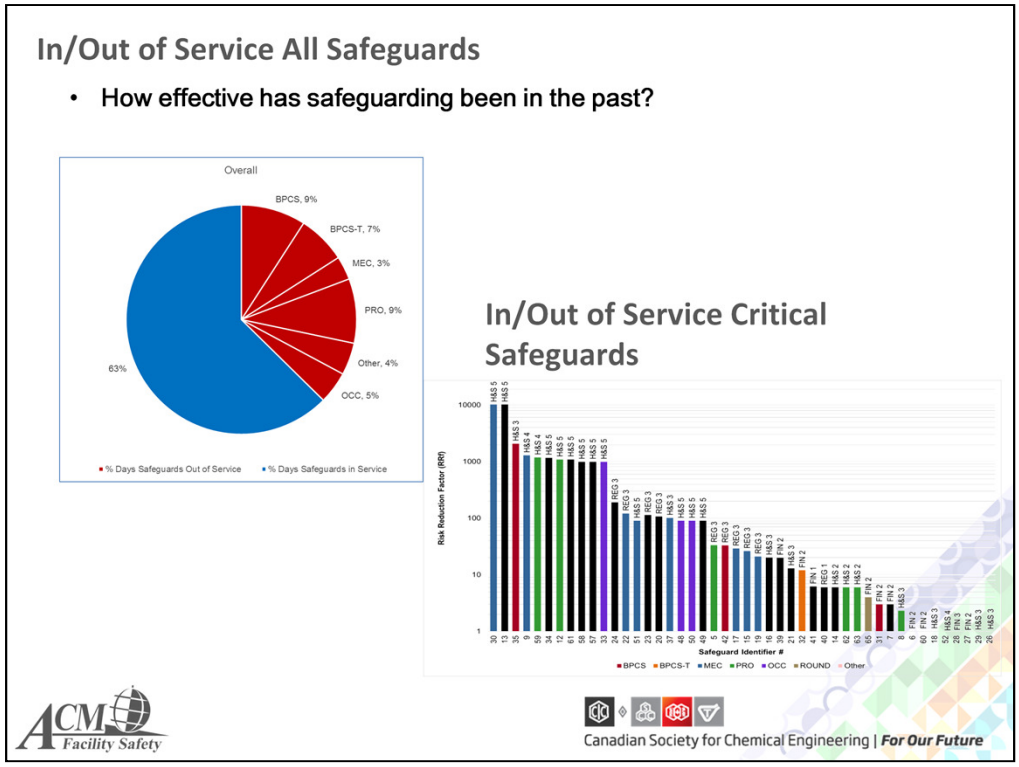
This graph shows that in 35% of our high risk scenarios we are relying on recommendations to take us to a tolerable level. We better hope those recommendations get implemented. Can we easily see this by looking at a HAZOP worksheet? Is it valuable information to have and track progress on?



Out of a HAZOP the easiest way to sort recommendations is by sorting for the recommendations by the highest risk ranking they are associated with. This sorting gives us an ideal picture of recommendations and their risk reduction contribution. However, this does not factor in recommendations that may be used in many medium to high risk scenarios as compared to recommendations that are only used in one high or very high scenario. Once we've calculated the cumulative risk reduction contribution of all the recommendation we can compare the results and we get our recommendation prioritization. There can be a significant difference in risk reduction contribution of each recommendation. By ranking recommendations in this manner we quickly learn which recommendations we should complete first, the recommendations which have the highest impact in reducing our risk exposure. Track Risk exposure as recommendations are completed to provide Key Performance Indicators out of a HAZOP



What are the most critical safeguards in a facility? Which safeguards, if not working, increase risk exposure the greatest? What does this increase in risk exposure look like? Do field level personnel know these answers, they are the ones on the front lines interacting with Safeguards and making decisions daily. Train facility personnel on the most critical safeguards and what impact bypasses have in order to empower risk based decision making.



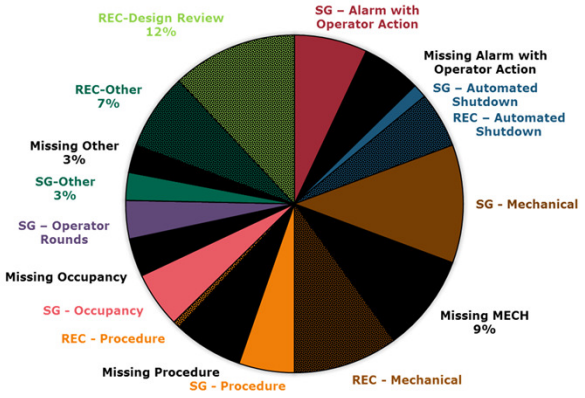
Once the critical safeguards have been determined, do we know the performance of these safeguards in the past? Look into historical data to review your risk life, validate what is being said in the HAZOP with what is actually happened in the field. Would you want to go into a revalidation not knowing if the safeguards you have taken credit for over the last 5 years have actually been in place and working.

Establish safeguarding KPI's around risk exposure and bypasses.

Bringing it all together

- Are the safeguards you took credit for the in HAZOP actually in service, have recommendations been implemented?

High Risk Scenarios – picture of historical risk reduction



67% of risk reduction is missing currently

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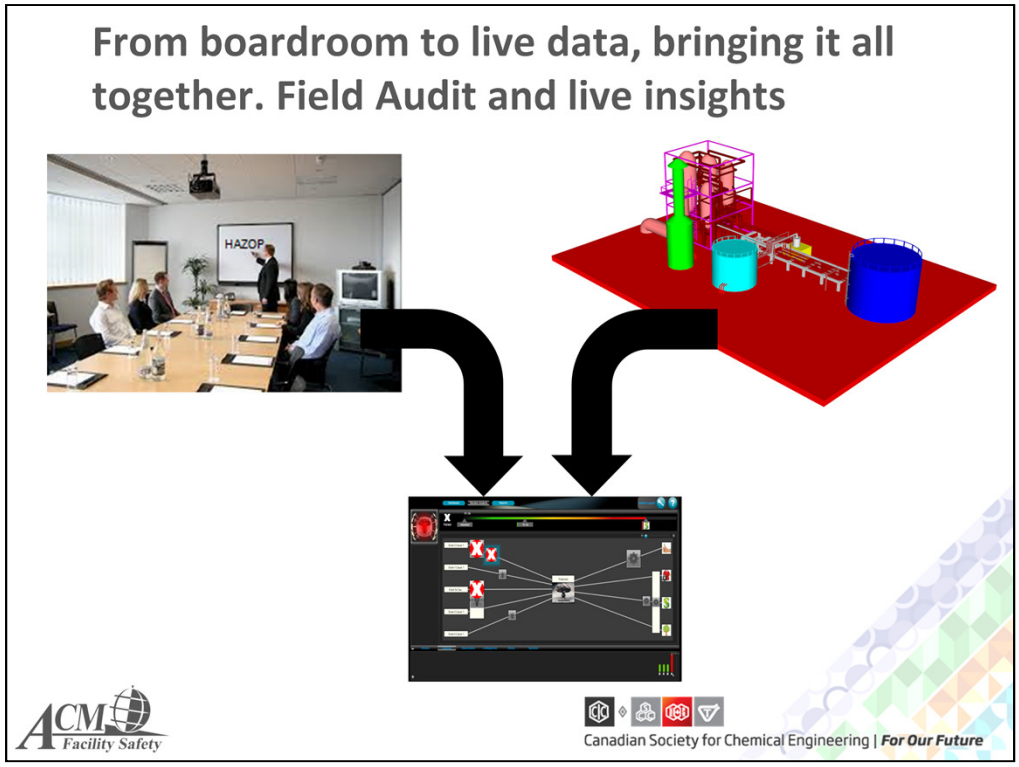
When we break down the entire picture of risk reduction from the HAZOP by looking at completed recommendations as well as, out of service safeguards we see 67% of our risk reduction has been missing historically. Is this valuable information to know? How could you use this information today?



Connecting the analysis in a HAZOP with the live operational information is the next step. Live integration to equipment monitoring is the next step beyond awareness out of a HAZOP, real time risk awareness. Set KPI's based on exposure.

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