TAKING SAFETY TO NEW LEVELS: THE NEXT 25 YEARS

Around the world, process safety management (PSM) is becoming central to worker safety and managing risk. PSM implementation protects personnel, equipment, and production uptime, and is associated with lower cost of maintenance, insurance and capital.

It is gaining traction here in Canada among various industries, governments and provincial regulators. It's the focus of the Canadian Standards Association's Z767 *Process Safety Management* standard, the proposed second edition of which is currently out for review.

To get ahead of the curve, over 25 people from coast to coast, as well as guests from Sweden, participated in the *Taking Safety to New Levels: The Next 25 Years* workshop on September 18, 2023, in Ottawa. The overall intent of the session was to ensure safety is keeping up with the pace of the industry. The group discussed the enhanced adoption of process safety management (PSM), focusing on two critical drivers: inherently safer design (ISD) and safety culture.

The participants identified key issues, trends and opportunities to strengthen safety across our sector.

KEY SPEAKERS

Dr. Paul Amyotte, P.Eng., Distinguished Research Professor and Professor of Chemical Engineering at Dalhousie University (Facilitator)

Kayleigh Rayner Brown, MASc, P.Eng., Obex Risk Ltd.,

Julie Griffiths, MSc, P.Geo., Shaw Renewables and WPAC Safety Committee Chair

Bill Laturnus, BC Forest Safety Council

Jose Barranco, WorkSafeBC

Karen Brandt, Brandt Strategy Inc

LEARNING OUTCOMES

Upon completion of the workshop, participants were able to:

- Explain why inherently safer design is typically more effective than other levels in the hierarchy of controls (add-on safety devices and procedural safety measures).
- Identify the key features of an effective safety culture.
- Consider how to incorporate inherently safer design principles and safety culture aspects in a safety management system appropriate for high-hazard industries.
- Provide recommendations on effective ways to share and communicate new safety initiatives, tools and learnings across their organization and sector.

BC Forest Safety Safety is good business · OBEX RISK · DALHOUSIE UNIVERSITY · WORKSAFE BC · WOOD PELLET ASSOCIATION OF CANADA

EVOLUTION OF PROCESS SAFETY MANAGEMENT IN HIGH-HAZARD INDUSTRIES

Dr. Amyotte introduced process safety management (PSM) and inherently safer design (ISD) to the group. He discussed the elements, definitions and systems of PSM and provided a business case. He noted that while we may think of PSM to avoid catastrophic events, we can also prevent other harmful events of lesser disastrous proportions.

Dr. Amyotte referenced *What you Don't Have, Can't Leak*, a 1978 article by Trevor Kletz (1922 - 2013), a pioneer of ISD. Kletz questioned why we rush to implement add-on safety devices and develop procedural safety measures without first considering whether we can address hazards at the source. In the tragic incidents at Flixborough and Bhopal, was there truly a need such huge inventories of hazardous materials? The fact is, what you don't have, can't leak.

That's where PSM comes in. It is an organization's all-encompassing program to ensure that people, property, the environment, and business operations are protected from loss-producing incidents. It includes a broad range of elements, from hazard analysis to safety culture to key performance indicators, which all work together to achieve safer operations and include all levels of a plant from leadership to the frontline workers. For decades, we relied on the traditional approach to safety through the occupational health and safety lens, focussing on the responsibilities of workers and having a safety program in place.

> Process safety goes beyond personal safety and systematically manages the risk posed by hazardous processes to personnel, equipment, business and the environment.

PROCESS SAFETY MANAGEMENT ELEMENTS			
PROCESS SAFETY LEADERSHIP	**UNDERSTANDING HAZARDS AND RISKS**	**RISK MANAGEMENT**	**REVIEW AND IMPROVEMENT**
Accountability	Process knowledge and documentation	Training and competency	Investigation
Regulations, codes, and standards	Project review and design procedures	Management of change	Audits process
Process safety culture	Process risk assessment and risk reduction	Process and equipment integrity	Enhancement of process safety knowledge
Conduct of operations — senior management responsibility	Human factors	Emergency management planning	Key performance indicators

THE IMPORTANCE OF INHERENTLY SAFER DESIGN

Considering ISD within PSM helps prevent and mitigate incidents like dust fires and explosions. Effective risk reduction involves implementation of ISD, engineered equipment, and procedural measures. ISD helps make processes safer and more robust. There is evidence ISD may make plants more economical through reduced risk, capital cost, and requirements associated with more complex risk management controls. ISD also supports continuous improvement.

> *"We need to question the status quo. We need better communication. We need to be better leaders and hold ourselves accountable. PSM requires us to get there together, we need to do a better way of sharing."*
>
> — Julie Griffiths, Shaw Renewables and WPAC Safety Committee Chair

ISD focusses on elimination of hazards and treatment of hazards at the source, rather than only relying on add-on equipment and procedures. ISD is based on four principles: minimization, substitution, moderation and simplification.

Practical examples of ISD in wood processing plants include:

- Removing unnecessary or hazardous equipment, like fans (minimization).
- Substituting equipment components (i.e., shaft) to prevent failure and ignition source (substitution).
- Relocating hazardous equipment, like cyclones, outside and away from personnel (moderation).
- Relocating fibre storage away from air intake screen for dryer (moderation).
- Considering human factors—use HMI (human-machine interface) system that clearly indicates status (simplification).

ISD INTRODUCTION

MINIMIZATION

Remove hazardous equipment no longer in use

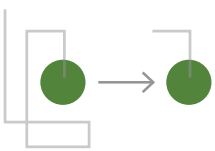
SUBSTITUTION

Use alternate material of construction or equipment that is more robust for given application

MODERATION

Optimize dust conveying velocity to minimize dust deposits

SIMPLIFICATION



Design processing equipment and procedures to eliminate opportunities for errors and excessive use of add-on safety features

Kletz and Amyotte (2010); Rayner Brown et al. (2022) Credit: Obex Risk Ltd. (2023)

While we may not focus on ISD initially when evaluating a process, we need to start shifting our mindset towards exploring these options and "move higher up the ladder" regarding the hierarchy of controls—the preferred order of risk reduction measures.

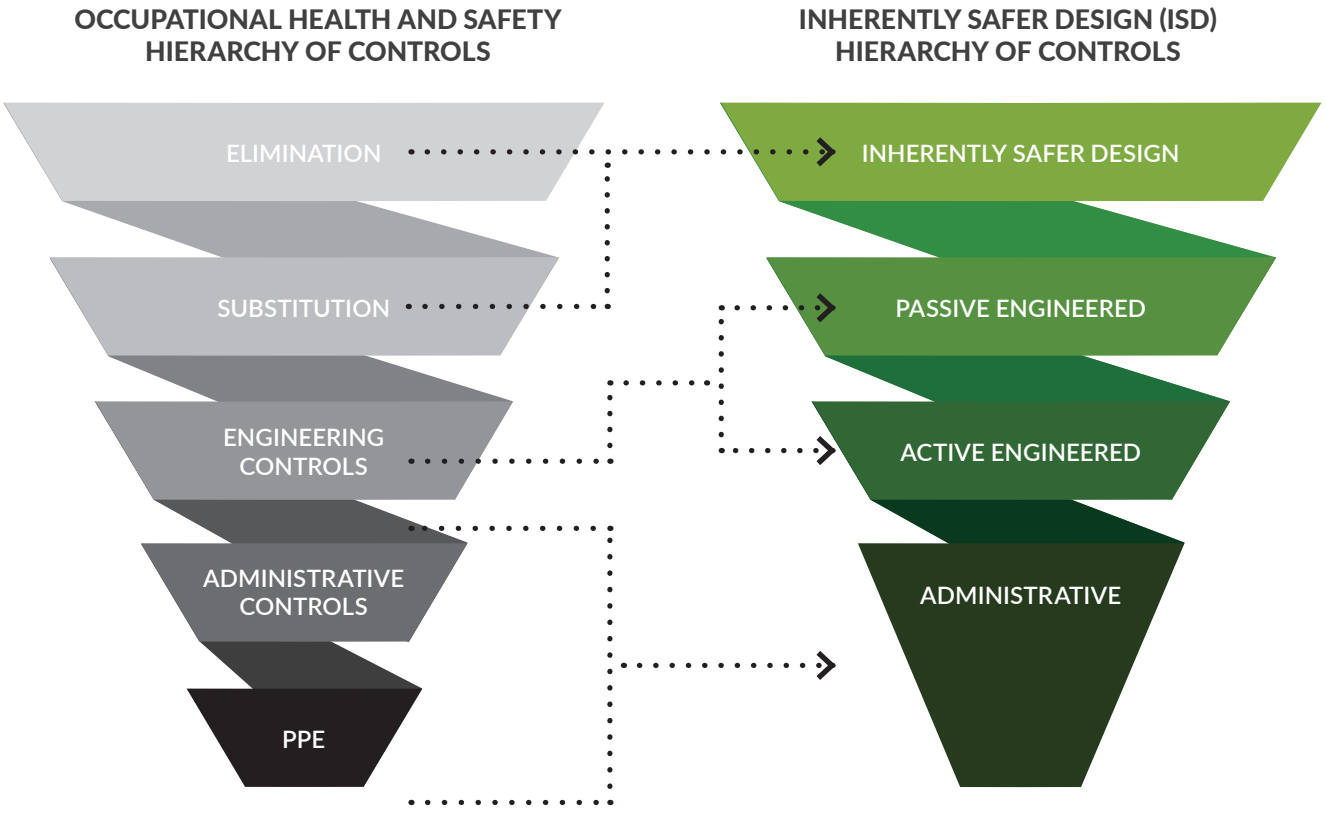
> *"I commend the pellet sector for adopting so many of these initiatives. The interest in PSM from the sector is apparent. If not PSM, then what else? The status quo of continued reliance on pure procedures/ health and safety measures isn't enough; it's about adapting PSM to your sector."*
>
> — Dr. Paul Amyotte, P.Eng., Distinguished Research Professor and Professor of Chemical Engineering at Dalhousie University (Facilitator)

Opportunities to do this include during management of change, investigations, and risk assessments, with a consideration of long-term benefits that can be recognized, rather than those through only short-term fixes.

It is important to recognize that process safety is a continuous process of improvement, so we must continually challenge ourselves to ensure we are reviewing and improving all the time; Dr. Amyotte noted that an effective safety culture plays a role in this.

For more information on ISD: pellet.org/isd/ (and keep your eye out for a page on PSM)

REDUCING COMBUSTIBLE DUST HAZARDS: HIERARCHY OF CONTROLS



Credit: CCOHS (2023)

Credit: Obex Risk Ltd. (2023)

ISD AND PSM PARTICIPANT OBSERVATIONS

CHALLENGES WORKSHOP PARTICIPANTS IDENTIFIED IMPLEMENTING PSM

- **Buy-in from all levels of each company:** Need to communicate the goals and objectives of PSM. It's about the survival and resiliency of the collective industry; there is a 100% correlation between safety and profitability. Consider PSM as part of business continuity planning.
- **Lack of staffing at every company:** Should pool industry resources through WPAC and share with members to efficiently use resources.
- **Knowledge transfer:** Need to find and provide resources and share best practices within each company and across the industry.
  - Every plant is doing good things: needs to be shared across the industry.
  - Create opportunities to have people together more often.
  - Examples of gaps:
    - The bow tie analysis approach is very high level. It needs to be shared with the people on the floor in an understandable way. Bow tie workshops should be multi-disciplinary and involve personnel across the organization, including supervisors, operators, and maintenance personnel.
    - Often, it's the employees on the floor who identify a solution. A culture of sharing ideas needs to be encouraged.
- **We don't know what we don't know:** We can only manage the risk we know about; need a facilitator to provide guidance and expertise.
- **Keeping momentum:** it takes several years to implement a PSM, along with maintaining the system and continuously improving it.

OPPORTUNITIES TO RAISE AWARENESS AND ENCOURAGE VOLUNTARY IMPLEMENTATION OF PSM

- Develop a Process Safety in Wood Products Conference.
- Identify gaps, resources and learning materials to communicate, share and ensure the industry retains knowledge.
- Explore a train-the-trainer program as part of LEAN manufacturing principles.
- Identify metrics for benchmarking.
- Provide resources to enhance leadership buy-in and accountability.
- Explore ways to create PSM ownership.
- Consider establishing a team dedicated to dust and fire management prevention that meets regularly, audits and shares outcomes and aspects of incidents and near misses, which can help support the prevention of large incidents, like fires and explosions.

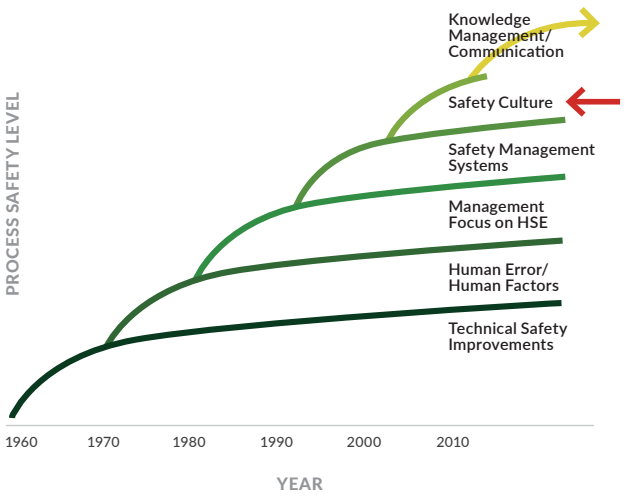
> *"We've have achieved some great things—critical control management and bow tie analysis implemented across BC was a significant accomplishment, along with ISD research, belt dryer safely, and the operator training program. And we have great partnerships with the BC Forest Safety Council and support from WorkSafeBC.*
>
> *Where we need to improve is increased participation in monthly safety meetings. Process safety management is a big initiative, and we need more engagement from the sector—it requires support from the CEOs."*
>
> — Gord Murray, Executive Director WPAC

PROCESS SAFETY CULTURE AND COMMUNICATIONS

Dr. Amyotte spoke to safety culture, sharing his learnings and best practices. In the evolution of process safety, safety culture only started in the early 2000s, but it's not a new concept and has been around since the 1700s.

Safety culture is how things are done in an organization, including shared practices, attitudes and perceptions that influence behaviour. In a company with an effective culture, employees share common values that worker health and safety is paramount. Management is committed and visible, everyone throughout the organization is actively participating, and there is good communication between all levels of employees. People anticipate unsafe acts, engage in injury and disease prevention, and, most importantly, take ownership of health and safety issues.

EVOLUTION OF PROCESS SAFETY



Kletz & Amyotte (2019)

> *"In general, the problem is not that we don't know what to do, but rather that we do not always actually do what we already know how to do, and what we know we should do."*
>
> — Dennis Hendershot (JLPPI, 2015)

In Dr. Amyotte's department, the Department of Process Engineering and Applied Science at Dalhousie University, they have recently incorporated the four elements of safety culture[1] into their research and teaching activities.

REPORTING CULTURE

We are working to foster a reporting culture by raising awareness surrounding incident reporting. All members of the Department should understand why to report, what to report, how to use the online reporting system, and what will happen once a report is made.

JUST CULTURE

We are working to foster a just culture by making safety responsibilities clear to all members of the Department and by responding to incident reports in an objective manner. Those reporting are thanked for bringing the incident to light and are consulted to develop a solution. Our incident investigation process is concerned with determining root causes, not finding fault with those involved.

LEARNING CULTURE

We are working to foster a learning culture to ensure that all members of the Department keep educating themselves about safety best practices and learning from reported incidents. In addition to the annual Department Research Safety Day, we also arrange specialized training sessions for faculty, staff, and students. Let us know if you are looking for training in a specific area and we would be happy to point you in the right direction!

FLEXIBLE CULTURE

We are working to foster a flexible culture by encouraging all members of the Department to take ownership of safety. The combined expertise of technical staff, students, and faculty members can enhance safety-related decision-making processes.

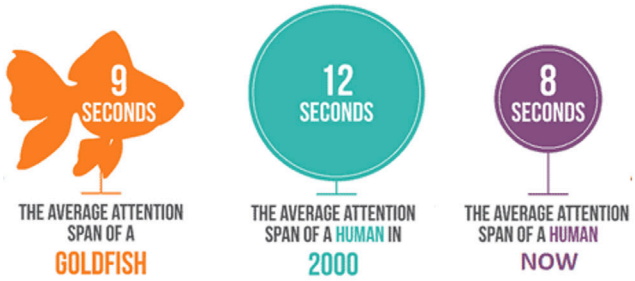
1 Andrew Hopkins, "Safety, Culture and Risk. The Organisational Causes of Disasters", CCH Australia Limited, Sydney, Australia (2005).

TALKING SAFETY IN THE 21ST CENTURY

There are 2.6 million 15 to 24-year-olds in the workforce in Canada. According to the Association of Worker's Compensation Board of Canada, there were over 35,000 lost-times claims by people 24 and under in 2021. That's an average of 95 claims/day and 13% of all claims. With this in mind, Karen Brandt spoke on ways to effectively communicate in a technology-rich world. Everyone's attention spans have shortened. We now have a shorter attention span than a goldfish.

To help reduce workplace injuries, we need to communicate with technically savvy workers in ways they absorb information. These workers like things to be informal and interactive—quizzes and simulations they can access anywhere quickly. They like to gamify learning with points, rewards and badges. Microlearning is key—one topic in less than five minutes built out in various digital formats (i.e., blogs, videos).

ATTENTION SPANS ARE CHANGING



Conscious Vibe

She provided an example of an effective campaign —practicesafework.ca— and observed that existing WPAC safety materials can be improved. They are text-heavy, visuals don't relate to the subject and videos are often too long. She challenged participants to consider the communication and learning styles of workers today and incorporate them into safety culture practices.

LEARNING STYLES FOR YOUNG PEOPLE

SOCIAL COLLABORATIVE
Engage via technology

SIMULATIONS
Mirror life but in virtual environment

GAMIFICATION
Positive feedback, points, rewards, badges

BRANCHING SCENARIOS
Consequences of choices—rewards/ punishments

MICROLEARNING
>5min, 1 topic, various digital formats

INFORMAL
Unstructured—self-study, chat rooms

AGILE/MOBILE
Accessed anywhere quickly

INTERACTIVE
Quizzes, simulations, branching scenarios

SAFETY CULTURE PARTICIPANT OBSERVATIONS

"Your safety culture is only as good as the worst behaviour that you tolerate."

CREATE A SAFE SPACE

"People may be worried about being blamed. We need to feel safe to ask why."

COMPLACENCY

"Do we become complacent because we over-communicate on safety?"

"We only focus on what we prioritize."

RECOGNITION

"Be rewarded for speaking up."

SHARE SAFETY RESPONSIBILITY

"Give people authority. Management needs to take the time to share the ownership and provide employees with an opportunity to provide the solution; can involve coaching."

WorkSafeBC PROCESS SAFETY INITIATIVE

Jose Barranco spoke to WorkSafeBC's Process Safety Initiative. The purpose of the initiative is to eliminate catastrophic incidences in workplaces across BC. WorkSafeBC engages with industries with major hazards and focus on risk management and the management of critical controls. Their next steps are to focus on human factors and the reliance on procedures and add-on controls.

Credit: WorkSafeBC (2023)

RECOMMENDATIONS

- **WPAC to engage with CEOs and decision-makers** to achieve buy-in for PSM.
- **Encourage participation** in monthly safety meetings.
- **Hold a Process Safety in Wood Products Manufacturing**
- **Wood Pellet & Bioenergy Safety Summit agenda to include:**
  - › Avoiding complacency.
  - › Effective communications.
  - › Train-the-trainer program and knowledge transfer.

KEY RESOURCES

Wood Pellet Association of Canada
pellet.org/safety
wpaclearning.com

BC Forest Safety Council
bcforestsafe.org

WorkSafeBC
worksafebc.com