Safety Management Systems for Safety Sensitive Industries

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Executive Summary

Safety Management Systems (SMS) are successfully deployed across a wide range of safety sensitive industries. They obtain positive results and outcomes that successfully address the potential of organizational loss and risks. They protect an organization's reputation and support their social license to operate. Simply put, they are good for business.

SMS and a culture of safety are not self-regulation. They are a self-directed and independent approach to integrate sound business management practices. These practices attain positive outcomes and goals in conjunction with a robust and achievable regulatory regime.

SMS guides and helps companies identify and adopt best practices that exceed regulatory requirements. Built into the SMS is an ongoing continuous improvement process in which organizations constantly learn and adapt to improve their safety performance. As organizations are constantly in flux, ever changing and morphing to demands and external forces, the SMS is changing, morphing and adapting, and is a continuous "work in progress" for many companies. SMS are foundational for safety sensitive industries, which by nature have operations that require a high reliability factor in order to achieve positive outcomes associated with production, quality, and safety. SMS coupled with a strong culture that proactively addresses safety and builds in resilience to survive the vast array of challenges and barriers that need to be overcome in a safety-sensitive business environment, is essential to success.

This report includes an examination of SMS applied in safety sensitive industries. It presents a number of findings and qualities about SMS:

- definitions and approaches vary, however they embrace foundational principles that assist to identify, select and implement to meet their unique business requirements;
- hazard assessment, risk and mitigation strategies and continuous improvement as important elements;
- are interdependent and inter-related throughout an organization;
- require consistency of application, effective communication and sharing approaches with an adaptable system promoting a continuous learning philosophy;
- are scalable for company size, complexity and applicable for all organizations;
- are formalized and transparent programs with regular verification reviews and evaluations aligned to established standards, guidelines and best practices;
- are embraced as continuous opportunities for improvement, making the business successful, profitable, safe and a valued member of the community[1], and
- some industry and regulators accept the principle of performing better than the minimum compliance standards, relying on shared best practices and solid partnerships to build the best and safest systems in North America.

[1] (Haight, Yorio, Rost, & Willmer, 2014)

Context

This paper supports the present review of the Railway Safety Act (RSA) 2017-2018 and the understanding that SMS are integral to the success of industry. Safety sensitive industries depend on SMS to realize significant performance and business outcomes.

This paper centres on SMS in safety sensitive industries, to provide context and other successful approaches that may be considered by the RSA Review Panel. SMS and a culture of safety are of significant importance and positively recognized by the government, the regulator, and the railway industry. The successful integration of an SMS helps companies to proactively develop and implement the appropriate systems that are necessary to identify hazards, implement controls and mitigate risks in the industry, working towards the ultimate goal of zero loss events.

Safety sensitive companies understand the importance and risk to their industry that a few or even one non-compliant company, with a minimalist mindset, negatively impacts their company and industry in the area of safety. It has been demonstrated that through non-compliant behaviours, one poor performer is a significant weak link that can negatively impact an entire industry diminishing the efforts of other companies who act responsibly within the sector. The "weakest link" concept encourages safety sensitive industries to partner and work collaboratively to share information and best practices and drive accountability across a sector.

This paper describes how safety sensitive industries:

- evolve, continually use and implement a SMS with a culture of safety;
- attain improved safety benefits through SMS when supported by effective and realistic regulations;
- look beyond a "regulatory and compliance only" approach, since safety sensitive industries without an effective SMS significantly limit their ability to realize optimal safety, business and sustainable outcomes;
- understand and accept that an effective SMS drive improvements in safety culture, technology and other investments to improve safety at a company-specific, sector and industry level;
- integrate SMS to promote success for companies and governments;
- recognize the role of government in an effective SMS regime and how they work and partner with the government; and
- recognize that moving in the direction of SMS is easy, however sustaining improvement is hard work.

Safety Management System Definitions

Definitions of SMS differ by organization, purpose and the perspective of the user. Perhaps the most comprehensive and easy to understand definition of SMS has been provided by the US Department of Energy:

> *"a formal, organized process based on key guiding principles and core functions for ensuring the integration of safety, health, and environmental considerations into all types of work, at all DOE sites and facilities, for all types of potential hazards.* [2]

The above definition has been foundational in the success of safety sensitive industries (nuclear & energy) that it is based on "key guiding principles and core functions" that extend beyond the formal and organized process. These principles are highlighted in their policy statement. It recognizes the importance of processes, competence, accountability and effectiveness. Their success is highlighted in the following:

[2] Department of Energy, Integrated Safety Management system Guide DOE G 451.4-1B Source: https://www.directives.doe.gov/directives-documents/400-series/0450.4-EGuide-1bv1/@@images/file p. 5

> *To complement these systems and mechanisms, the Department expects all organizations to* ***embrace a strong safety culture*** *where safe performance of work and involvement of workers in all aspects of work performance* ***are core values*** *that are deeply, strongly, and consistently held by managers and workers. The Department encourages* ***a questioning attitude*** *by all employees and a work environment that fosters such attitude.*[3]

Missing from most systems is the strong safety culture and the questioning attitude by all to realize success in performance and outcomes. The challenge is to move beyond just a formal process to engage and build a culture of safety that drives success.

A short list of various definitions is contained in Appendix 1.

The 2007 RSA Review Panel describes SMS as:

> *"a formal framework for integrating safety into day-to-day railway operations; it includes safety goals and performance targets, risk assessment, responsibilities and authorities, rules and procedures, and monitoring and evaluation processes."*

More formally Transport Canada defines SMS under the Railway Safety Management System Regulations as a process.

The Safety Management System term is not defined in the rail regulations and is positioned as a process in section 5 of the regulation. It states,

> *5. A railway company must develop and implement a safety management system that includes:*
>
> - *a process for accountability;*
> - *a process with respect to a safety policy;*
> - *a process for ensuring compliance with regulations, rules and other instruments;*
> - *a process for managing railway occurrences;*
> - *a process for identifying safety concerns;*
> - *a risk assessment process;*
> - *a process for implementing and evaluating remedial action;*
> - *a process for establishing targets and developing initiatives;*
> - *a process for reporting contraventions and safety hazards;*
> - *a process for managing knowledge;*
> - *a process with respect to scheduling; and*
> - *a process for continual improvement of the safety management system.*

This process provides a framework list and identifies required key areas. The "how to" aspect is for the company to identify, develop and implement. A risk arises in that without templates or collaboration in principles and processes, each company independently develops a SMS that becomes unwieldy to garner a consistent approach throughout an industry. Successful safety sensitive industries work together on core principles and processes for the industry, and then modify the policies and procedures to meet the particular needs of their operation. It is much easier to collectively identify successful best practices and evaluate these best practices and their effectiveness of the SMS.

The Alberta Safety Management System guideline document aligns with the federal Railway Safety Act and states that it "is to provide a systematic way to control risk and to provide assurance that the system is effective and provides for a high level of safety".[4]

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[3] (Energy, 2011)

[4] Government of Alberta, Alberta Safety management System, Safety Management Guidelines for Alberta Railways,

This guideline provides a comprehensive template to assist rail operators in the development of their safety management system. This is an example of step-by-step assistance to address the requirements for all organizations building their management system. The company will then modify, enhance and tweak the generic program templates to their specific company needs. This prompted the provinces of British Columbia (BC Safety Authority) and Saskatchewan (Railway Safety Act – Saskatchewan) to adopt a similar approach.

Accident versus Incident Term:

Within the context of this report we refer to "incidents or events rather than "accidents" principally because references to accidents imply that an event could not have been prevented. Rather, the new CSA Z1005 Incident Investigation[5] standard has a simple definition of incident as:

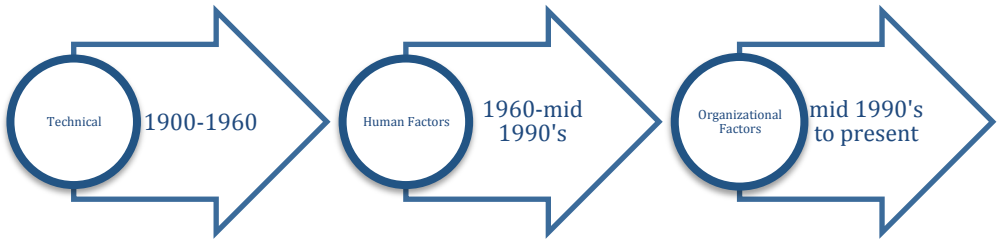
> *"Incident — an occurrence, condition, or situation arising in the course of work that resulted in, or could have resulted, in injuries, illnesses, damage to health, or fatalities."*

Taking the various definitions, the purpose of a safety management system and a culture of safety, simply is to:

> *"identify, develop and implement a combination of interrelated and/or interdependent components or factors working in concert to attain an organization's performance objectives and goals and prevent a negative outcome or incident".*

For many safety sensitive organizations, the prevention of a negative outcome or incident ensures their social license to operate is recognized by stakeholders and the community. This demonstrates the organization's commitment to strive to be the best that they can be in their industry.

Evolution of SMS



SMS in safety industries originated as early as the 1940's according to the safety profession and management literature. It evolves and incorporates all three of the above levels of technical, human and organizational factors. It has been a long-term journey to realize safety and business performance success. The Technical aspect looks at established practices, procedures and best in class approaches. The Human Factors approach integrates the "people" piece in that businesses function and rely on people for success. These individuals add value and work with the established technical aspects of the job. The inclusion of Organizational Factors brings together the specific cultural aspects that exist in an organization.

It has been observed in workplaces that you can have two similar business units that follow the same technical standards, apply the same human factor tools and have different safety performance outcomes. One unit will perform better than the other using the same tools. The organizational plus site-specific factors bring the technical, human and organizational factors together to achieve the best results and success at the work site. Even within the same

[5] (Canadian Standards Assocation, 2017)

organization, you will have multiple sites managing their hazards and risks, and one site will have a catastrophic event. We have learned from events such as the shuttle disasters, major environmental spills and rail derailments that "culture" within an organization can play a significant role in an event. When catastrophic events occur, the literature often highlights that while an organization may have a tool and or management system in place, it is often misaligned leadership decisions or level of risk tolerance, that led to the catastrophic event.

In many instances regulators assess SMS by looking exclusively at the technical and procedural aspects of a company's SMS. Missing are the human and organizational factors that bring together the safety management system and the building of a culture that supports the organization. It is more difficult to assess human and organizational factors when probing, inspecting or completing an investigation. It is easier to measure compliance to a procedure at a point in time by confirming a procedure's existence during a site inspection. The benefit is seeing a procedure or process in action, knowing it works and it is consistently applied at a site or process. This becomes increasingly difficult for remote projects or in the transportation industry when activities occur in the field or at an off-site activity or facility.

Most importantly, an organization that focuses on just a written binder of procedures and keeping up with the paperwork, pulls valuable resources and attention away from focusing action on areas such as the human and organizational factors.

When regulators are prescriptive in technical requirements indicating the need for written policies, procedures or standards, an organization can comply by creating extensive paper binders and procedures. Success happens when an organization goes beyond the technical requirements contained in the binders and procedures on the bookshelf. It integrates the human element, effective leadership and the organization's commitment to include a safety culture.

We will discuss the integration of the "*DuPont Bradley*" and "*Safety+Sustainability*" models where organizations move from simple minimum compliance over to management systems to then working to be the best in class, including safety and industry performance. Many companies use a stepping-stone or evolutionary process that grows with maturity and building of a system. Having a visionary leader makes it possible to drive an organization to a Sustainable+Safety focus or a level of "interdependence" as highlighted in the DuPont Bradley model.

Established SMS

The business and safety worlds align with established standards created by organizations designed to assist business. In safety sensitive industries, companies have established SMS relevant to their specific sector. Many are similar in structure and content and may be applicable to other sectors. There is a move globally to integrate all of the various safety management system standards into one global standard titled ISO 45001 Occupational Health and Safety.

Presently the following standards are in place, and any one of them will assist an organization to attain their desired outcome and goals. The standards are:

- CAN/CSA Z 1000-14 Occupational Health and Safety Management System;
- US - ANSI Z 10 Occupational Health and Safety System Management;
- BS OHSAS18001 Occupational Health and Safety Management; and
- New ISO 45001 Occupational Health and Safety (development stage).

There are also industry standards such as:

- Responsible Care Management System (RCMS)

There are also governmental and trade association standards, such as:

- US VPP Voluntary Protection Program (OHSHA)
- Certificates of Recognition (COR) and SECOR (small employer) for the construction & oil and gas industry

There are specific process safety standards such as:

- CSA Z767-17 Process Safety standard

Most standards are developed involving industry, government, regulatory, labour and at times public input, to create a standard for safety and its management.

Standards can be useful in their ability to assist a company to develop a system in accordance with the specifics of their organization while creating an alignment for business units and their employees to work towards common goals and outcomes. Even more importantly, when an outside regulator or evaluator assesses an organization, the company system is easily aligned with the accepted standard. It also quickly and easily addresses regulators' concerns and eliminates personal biases, opinions or perceptions of everyone, when referenced against a standard.

The formal standards are tools to help us improve through these proven approaches to build a program. The "plan, do, check and act" model is usually the framework of the standards and aligns with the quality programs of most organizations.

SMS and Culture

Safety sensitive industries accept that SMS and safety culture are linked, inter-related and must work in tandem to achieve the best results. The UK Health and Safety defines safety culture as:

> *"The safety culture of an organization is the product of individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of, an organization's health and safety management. Organizations with a positive safety culture are characterized by communications founded on mutual trust, by shared perceptions of the importance of safety and by confidence in the efficacy of preventive measures."*[6]

The work of Hudson [7] on the safety culture continuum provides the stepping-stone approach in the development of a safety culture, this is aligned well with the safety management models. The integration of safety systems and a culture of safety are important and he simply states: "What costs money is not safety, but bad safety management."

The integration of safety systems and culture are further reinforced by his comments:

> *"What is needed is a safety culture that supports the management system and allows it to flourish. The bad news is that creating a healthy safety culture and keeping it alive requires effort."*[8]

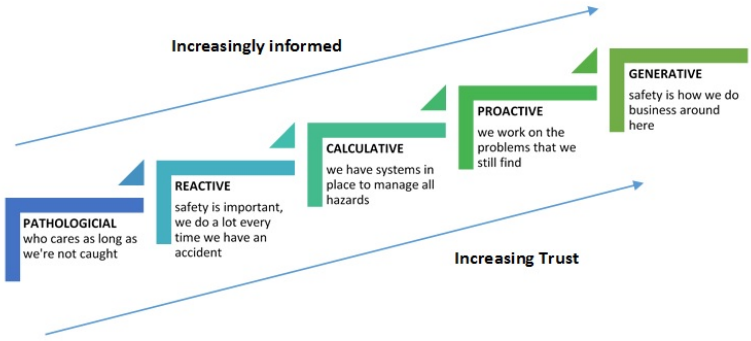
His model of safety culture maturity fits well with the established safety management system maturity models.[9]

[6] (Health and Safety Executive, 2008) ACSNI Human Factors Study Group: Third report - Organizing for safety HSE Books 1993

[7] (Hudson P. , 2001)

[8] (Hudson P. , 2001)

[9] Source: http://riskcollective.com.au/safety-side-hustle/



The following chart highlights the areas of importance competence / competency (safety management system) and commitment (culture of safety) that work together to realize the desired performance outcomes and organizational goals.

Competence / Competency	Commitment
▪ Policies ▪ Procedures, rules, standards, regulations ▪ Processes ▪ Goals and performance targets ▪ Hazard and risk assessment ▪ Responsibilities and accountability ▪ Monitoring and evaluation	▪ Beliefs ▪ Values ▪ Attitudes ▪ Behaviours ▪ Shared perceptions ▪ Accountability
Resulting **Safety Management System + Safety Culture**	

SMS in Safety Sensitive Industries

Chemical Process Safety 1980's

Since the 1980's, the chemistry industry in Canada, along with over 70 countries around the world, has integrated safety management and a culture of safety into their business and corporate responsibility initiatives. Their open and transparent display of responsibility and commitment is through effective process safety methodologies. This allows the chemistry industry to have greater freedom and self-determination in their communities and in their management of hazards and risks.

As a result of the Bhopal chemical disaster in the 1984, the Canadian chemistry industry proactively worked collectively between 1985 and 1988 to develop and create the successful Responsible Care program.

The Chemistry Industry Association of Canada (CIAC)[10] through Responsible Care is an example of industry leading in safety management and sustainability, including a culture of safety and caring. It goes beyond regulation and compliance, with industry leading in their community and taking proactive responsibility for safety and sustainability.

The premise of the chemistry industry is that they "do the right thing and be seen to do the right thing." This approach is both within the confines of the company gate and outside and beyond the facility and into the neighbouring community.

[10] http://www.canadianchemistry.ca/

According to the CIAC, the principles of Responsible Care are key to their business success, and compel them to:

- work for the improvement of peoples' lives and the environment, while striving to do no harm;
- be accountable and responsive to the public, especially their local communities, who have the right to understand the risks and benefits of what they do;
- take preventative action to protect health and the environment;
- innovate for safer products and processes that conserve resources and provide enhanced value;
- engage with business partners to ensure the stewardship and security of their products, services and raw materials throughout their life-cycles;
- understand and meet expectations for social responsibility;
- work with all stakeholders for public policy and standards that enhance sustainability, act to advance legal requirements and meet or exceed their letter and spirit;
- promote awareness of Responsible Care, and inspire others to commit to these principles.

This approach extends beyond legislative compliance and regulations, with defined processes and removes the compliance language of "must" found in regulations. The strength of Responsible Care is that "it is a culture that focuses on doing the right thing and demonstrating its commitment to public verification.[11]" Very strong industry principles are supported by observed action to ensure that companies are doing the "right thing". Sharing of information and best practices within the industry and the public is confirmed through ongoing verification and validation of their commitment to their employees, the environment and community in the public domain. This allows the opportunity for further discussions on how to integrate and apply these principles for all industries, including the railway industry.

The Canadian rail industry, through the Railway Association of Canada (RAC) and the chemistry industry, through the Chemistry Industry Association of Canada (CIAC) have partnered through the TRANSCAER program. This partnership continues with communities "along transportation routes, to make sure they are informed about the products being moved through their area, and are prepared to respond to potential incidents involving dangerous goods."

Nuclear Industry 1990's

In the early 1990's the nuclear industry formalized SMS for their safety sensitive industry. Their approach looks at hazards and risks. Their philosophy is based on the understanding that with their particular hazards, they do not have a second or multiple opportunities to respond when their risk assessment, prevention and mitigation strategies are not effective.

In a 1991 report, the International Atomic Energy Agency (IAEA) and their International Nuclear Safety Advisory Group stated that "…the establishment of a safety culture within an organization is one of the fundamental management principles necessary for the safe operation of a nuclear facility". The definition recognized that safety culture is both structural and attitudinal in nature. It relates to the organization and its style, as well as to attitudes, approaches and the commitment of individuals at all levels in the organization. It was formalized in the IAEA-TECDOC-860, ASCOT Guidelines, issued in 1996[12]

Aviation Safety: 2000's

The US Federal Aviation Administration (FAA) defines SMS as the "formal, top-down, organization-wide approach to managing safety risk and assuring the effectiveness of safety risk controls. It includes systematic procedures, practices, and policies for the management of safety risk. (FAA Order 8000.369)"[13]

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[11] (Belanger, Topalovic, Krantzberg, & West, 2009)
[12] Safety Culture in Nuclear Installations, Guidance for use in the enhancement of safety culture, IAEA December 2002
[13] (Organization, Safety Management Manual (SSM), 2013) US Federal Aviation Administration, Source: https://www.faa.gov/about/initiatives/sms/ Downloaded July 24, 2017

By recognizing the organization's role in incident prevention, SMS's provide to both aviation companies and FAA:

- a structured means of safety risk management decision making
- a means of demonstrating safety management capability before system failures occur
- increased confidence in risk controls though structured safety assurance processes
- an effective interface for knowledge sharing between regulator and certificate holder (companies)
- a safety promotion framework to support a sound safety culture

They define safety management system as "a systematic approach to managing safety, including the necessary organizational structures, accountabilities, policies and procedures."[14]

According to the FAA, SMS are based on four critical pillars: safety policy, safety assurance, safety and risk management and safety promotion.[15]

Recurring approaches are identified in all safety sensitive industries, with very strong similarities in concept and approach. *(See Appendix 2 for more details on the FAA four critical pillars)*

SMS success for companies, regulators and governments

It is important to recognize that SMS and a culture of safety provide a definite success opportunity and a win-win setting for companies, regulators and governments.

There is an expressed and implied desire in the literature and research material for the regulator and industry to work together to support all industries. This includes the transportation industry, so that they are recognized as "best in class" and a global safety leader. An opportunity exists through the review to bring the various approaches together and work to get the desired mutual outcome.

Value of SMS

SMS support company success, since they rely on the continuous improvement of an organization. Research and reports highlight the success factors of safety management. It must be stated that safety management for companies that "get it" is a natural and integral part of the day-to-day management of the company or organization.

The literature supports the importance for a company's safety management system to have a culture of safety and desire for long term sustained business success.

The UK Health and Safety Executive is one organization whose extensive research states:

> *"Organizations that are successful at managing health and safety recognize the business case for health and safety and meet the different, and sometimes competing demands and expectations of their stakeholders in a balanced way".*
>
> *"Successful organizations can establish and maintain a culture which supports health and safety.*[16]

The Railway Association of Canada (RAC) supports and proactively helps railways in their journey to develop and implement a safety management system that supports the railway industry safety culture initiatives. They state:

[14] ICAO p 14
[15] (Stolzer, Halford, & Goglia, 2016)
[16] (Health and Safety Executive, 2008) HSE

> *"The SMS approach requires railways to move beyond minimum compliance with regulations, to a corporate culture which proactively identifies and mitigates risks from all sources, whether or not they are covered by Act, rule, or regulation."*[17]

Safety sensitive industries understand, accept and promote the approach that effective SMS with a safety culture result in technology and other investment improvements for safety at a company-specific and industry sector level. These companies and industries cannot afford a major ruinous event resulting in loss of production, injury to employees, damages to the environment or to the public. The safety sensitive companies in aviation, mining, chemical, oil and gas and nuclear industries understand hazards, risk and loss. They live it on a daily basis and understand that usually there are no second chances. They believe in the importance to understand the issue or problem, identify the best solution or approaches and implement them as soon as possible. Their success is that they constantly review and enhance all levels of business operations since the company environment is constantly evolving.

To observe highly safety sensitive industries or companies in action, the list of the RW Campbell award winners is an excellent resource. These leading companies integrate SMS and safety culture in their operations. Since 2004, they have identified 14 major companies that demonstrate that safety management is integral to the success of their companies and industry.

The winners represent oil and gas (Noble, DynMcDermott Petroleum, Bahrain Petroleum, Gulf Petrochemicals); engineering & construction (Fluor); medical and pharmaceutical (Johnson & Johnson); energy management and automation (Schneider Electric); manufacturing (Alcan, UTC Fire and Security, Firmenich, Cummins, Honeywell Aerospace; and chemical (Dow Chemical, DuPont).

These examples of safety sensitive business ventures demonstrate where SMS are coupled with a culture of safety. These are effective drivers for their companies and support their competitive advantage as an industry in the business world.

For a senior leadership perspective of SMS and a culture of safety, a documented example is Paul O'Neil of Alcoa. His story is highlighted in the book by Charles Duhigg titled *The Power of Habit, Why we do what we do in life and business.* Paul O'Neill as the CEO of Alcoa focused on safety systems and safety performance metrics and outcomes to measure the success of a company.

Paul O'Neill of Alcoa at a shareholder meeting stated:

> *"Our safety record is better than the general American workforce, especially considering that our employees work with metals that are 1500 degrees and machines that can rip a man's arm off. But it's not good enough. I intend to make Alcoa the safest company in America. I intend to go for zero injuries."*
>
> *"I'm not certain you heard me," O'Neill continued. "If you want to understand how Alcoa is doing, you need to look at our workplace safety figures."*

After 13 years, annual net income and shareholder return on investment was five times higher compared to when O'Neil started with the company.[18]

Another example of leadership in safety is the CEO of Cementation, Roy Slack. This mining contractor company is in a safety sensitive industry in that their dangerous work is to prepare a site for a mine operation. It requires workers to perform tasks that, for many companies, are considered too dangerous. This Northern Ontario company has a management system and safety culture that has resulted in multiple recognition awards and more importantly a leadership

[17] (Railway Association of Canada (RAC), 2015)
[18] (Business Insider, 2014)

role in the mining industry. They assisted and helped the rescue efforts to recover the trapped miners during the Chilean mine disaster in August 2010.

As a Canadian mining contractor, Cementation has won multiple awards for safety. Their vision states:

> *"Our vision as a company is to change the way mine contracting is carried out in our industry for the benefit of all stakeholders. The first change we want to make is to eliminate harm within our industry and the stakeholders who benefit from this most are the ones with the greatest personal stake in our company, our employees."*[19]

Companies in traditional and high hazard industries understand the importance to identify the hazards, address the risks and put in place the controls and an effective safety management system. These two individuals are examples of how to build a culture of safety in very high hazard industries.

Regulation Enabling Improved Safety Performance

Transport Canada assesses the industry compliance through "risk-based oversight that includes SMS audits and on-site inspections."[20] Rail events in the 1990s, prompted the development of the Railway Safety Management System in 1999. In the years prior to the establishment of the rail SMS, there were several global events that highlighted the importance for all industries to adopt an approach to proactively and with a prevention focus manage their business to prevent so called "accidents."

Transport Canada clearly states their position on SMS is that it is not self-regulation by a company. Their website states:

> *"No, SMS are not self-regulation. Railway safety management system regulations do not eliminate or replace any other regulatory requirements. Transport Canada conducts inspections to verify industry compliance with the Railway Safety Act and rules, regulations and engineering standards made under the Railway Safety Act, in addition to conducting audits to verify compliance with the railway safety management system regulatory requirements.*
>
> *SMS increase safety by having companies put formal processes in place to proactively identify and address safety concerns before Transport Canada's intervention, and before concerns become major safety issues."* [21]

When an industry or company adopts a safety management system and it is built in conjunction with a culture of safety, the safety system and culture inevitably go beyond the regulations and more often than not exceed these minimum requirements.

While the RSA includes the additional Railway Safety Management System Regulations 2015, these regulations create a safety management approach framed around a prescriptive regulatory lens. Conversely SMS work best when aligned with business management systems that are different in approach and application.

Under the existing approach, federal regulations use "must" or "is to" to denote that there is an obligation for an individual or company to complete some activity or documentation to meet the regulatory requirement. Interestingly, the safety management system outlined in the Rail Safety Management System Regulation is very prescriptive in nature with a total of 156 "must" requirements and 105 "company must" references in the regulation. There is no mention of

[19] http://en.cementation.com/site/index.php?p=2&s=0
[20] Canada, G. o. (2017, April 26). *Railway Safety Act Review 2017 – 2018*. (G. o. Canada, Producer) Retrieved July 5, 2017, from Railway Safety Act Review 2017 – 2018: http://www.letstalktransportation.ca/3725/documents/6802 p.8
[21] (Transport Canada, 2017)

"culture" or "safety culture" in the regulation. In safety sensitive industries, safety culture is an integral component of success in the safety management system.

The number of prescriptive requirements positions the company safety management system as a compliance or check box approach rather than a building of safety systems and a culture that supports a system.

There are limitations around the "regulatory and compliance only" approach, especially without an effective safety management system. The lack of an SMS significantly limits safety sensitive industries in their ability to produce maximum safety, business and sustainable outcomes.

A potential result of this approach is that companies will expend vast amounts of effort and resources to meet regulatory requirements that may or may not result in safety improvements. At times, companies use valuable resources to address regulatory compliance issues that may be immaterial to the safety performance of a company. This limits a company's resources to focus on risk and building their safety culture.

Collaboration is critical for effective regulatory development

The importance of collaboration between regulators and the industries required to implement the regulations is key in order for the systems to be:

a) designed appropriately, attainable and reflective of industry experience, and
b) overseen and enforced by the regulator in way that generates business value by focusing on risk and performance rather than one-size fits all or a check the box approach.

At times, strict regulatory and compliance requirements are based on a "one size – fits all" approach. For many companies new regulations becomes onerous, expensive and at times difficult to implement confusing and overarching regulatory and compliance requirements. Without the collaboration of industry, the individuals creating a requirement or regulation lack the understanding, specific intricacies and nuances of a particular business process or a particular industry culture.

Interestingly, on many occasions the regulator or policy maker has limited or minimal industry-based experience or the knowledge on how to address a particular industry challenge or problem. Occasionally, the new regulation or rule is of a lower standard of care than what the industry has been historically practicing before a major event. So the regulation or compliance requirements could provide less protection for the workplace and the community.

In safety sensitive industries such as aviation, mining, chemical and nuclear, through collaboration the industry and regulatory representatives share solutions and consult amongst themselves on an ongoing basis. These high performing companies usually share best practices, select a higher standard and welcome an increased level of scrutiny and questioning amongst themselves. The safety sensitive industries proactively invite and are open to educating the regulators and policy makers, since they have the industry breadth, knowledge and understanding of the best-known standards and specific requirements for their particular industry.

The adage is, if you want to find out the safest, easiest and most efficient way to complete a task, ask the individual who does it on a daily basis. These individuals and companies understand the hazards, risks and processes and can usually provide the safest solution. The same applies for safety sensitive industries. Ask the industry for their specific solution, and you will find amongst the industry partners the best risk response, the safest processes and most effective and efficient way to get the job done.

Collaboration between the regulator and railway industry has occurred in the past and is stated on the Transport Canada site:

> *The SMS Working Group, with representatives of the rail industry, unions and Transport Canada, was established to address recommendations of the Railway Safety Act review with respect to SMS. Recommendation 18 was specific to safety culture:*
>
> *Transport Canada, Rail Safety Directorate and the railway industry must take specific measures to attain an effective safety culture.*[22]

It supports the ongoing and continuing collaboration and partnership between regulators and industry to find the best solution that meets the regulatory requirements and is easily and effectively implemented by the entire industry.

Government's role in an effective SMS regime and safety sensitive industries

The success of SMS occurs when industry and government work together for the same outcomes and goals. It is through partnership and collaboration that performance metrics and successful outcomes are realized. The challenge is to develop the best industry standards that are effective and most efficient to prevent a loss or event. The government policy makers and regulators are important partners for safety sensitive companies. The relationships are ongoing and collaboration is in the forefront to achieve goals that meet the needs of government, the regulator and the safety sensitive industries.

Emerging Safety Management Models

This is a very brief introduction to two emerging models in the literature that are aligned with the Hudson Evolutionary Model of Safety culture [23]. They are presented as important context for the Review Panel to consider regarding evolution of SMS in safety sensitive industries, including the rail sector and the limitations to SMS improvement on a strict regulatory compliance approach.

DuPont Bradley Curve Model

A model in the safety management literature gaining momentum is the DuPont Bradley curve, which is based on the Stephen Covey – 7 Habits of Effective People. It helps us understand the different levels of where companies are in the safety continuum. [24]

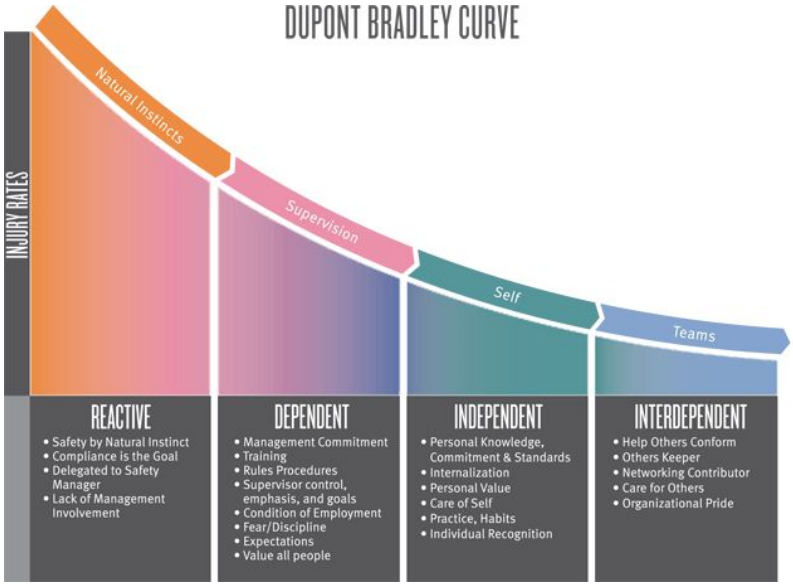
Many organizations live in a "Reactive" business environment. Their attributes are compliance-only focused, with limited management involvement and are experiencing injuries, losses and inefficient operations.

An organization in the maturity continuum can evolve from being reactive to the "Dependent" level. Here there is some management involvement with multiple policies, procedures and rules. This promotes a workplace in which individuals will experience negative consequences for not following the edicts and rules.

The next level moves from a workplace where individuals are dependent on everyone telling them what to do to a level of independence. In the "Independent" level, the individual is provided with and has the knowledge, skills, and a personal commitment to standards to address their individual issues. It is a person-focused approach, where we give everyone the tools, approaches and responsibility to make the best decisions. This may even include the ability for anyone in the organization being able to stop work if they "feel or believe" that someone can get hurt or the company may experience a loss.

The final level is when an organization moves from independent personal action to "Interdependent". At the interdependent level, individuals care for others, there is a culture of

[22] (Canada G. o., Rail Safety in Canada, Achieving and Effective Safety Culture, 2010)
[23] (Hudson P. , 2001)
[24] (DuPont)



doing the right thing and "looking out" for your colleagues. This is visible in the successful CIAC Responsible Care approach of "do the right thing and be seen to do the right thing."

This evolutionary approach makes sense in the hierarchy of evolving from a compliance and rule based approach to a culture of "working together" for common goals and outcomes. It seems simple, however it does get to results in which "DuPont has achieved an 83% better safety performance level when compared to other US industry manufacturers."[25]

Future Sustainability Continuum

A new area in the sustainability continuum gaining significant momentum is the "Human Capital" discussion. The sustainability movement's "Triple Bottom Line" put forward by John Elkington in 1992 involves the three basic bottom lines. They are the "3 P's" of "people, planet and profit." This covers the three important business areas of financial, social and environmental issues.

The safety discipline looks at the "people" and social aspect of sustainability and creates the term "Human Capital". It mirrors some of the same principles in the DuPont Bradley model and Hudson's SMS Maturity Model.

Sustainability + Safety			
At Risk	**Compliance Focus**	**Safety Management System**	**Sustainable+Safe**
▪ oblivious to obligations (legal) ▪ "…this cannot happen to us" ▪ …do not know how?	▪ tragically experienced an event ▪ … just minimum legal compliance	▪ …. strive to be the best ▪ understand, improve productivity, effectiveness & manage risks and hazard	▪ …it's the "right thing to do" ▪ global leadership focus ▪ meeting the needs of community, employees & investors
Observed Behaviours			
…assume that an incident will not happen to them, do not feel they are legally obligated or simply do not know.	….defensive attitude and focus on minimum compliance aspects with a focus to develop policies, procedures and rules to avoid prosecution	….formalized and working management system for health and safety ….strive to exceed legislative compliance and are seen as good employers in their community	Companies care for their employees as the "right thing to do." ….robust management systems and safety culture; …understand that makes good business sense, engaged with and share with stakeholders, investors, community, and employees

*adapted from SOS International model

[25] (EVS Translations)

Conclusion: Return on investment of safety

We have discussed how safety sensitive industries instinctively appreciate, support and live the value of SMS and a culture of safety. The success for companies and the entire industry are realized, when a concerted effort exceeds the requirements of compliance and evolves to a position of interdependence, continuous improvement, effective communication and on going building of a culture where safety is a core element that supports profitability and quality.

Now, the difficult question is how to do it, and more importantly the role of each of the players. There are definitely roles for all sides. Safety sensitive organizations have collectively, through collaboration or their trade associations, channeled their efforts to bring together the parties. This approach of collective partnerships works in safety sensitive industries with resounding success. Highlighted is the fact that Canadian ingenuity created a grass roots solution, for example Responsible Care, then shared it with others around the world for everyone to be successful.

It must be understood that fiercely competitive companies realize that safety is a priority in their industries. In actual fact, it enhances the competitive advantage of all companies on the national and global stage.

In closing, the SMS research supports the premise that companies realize positive outcomes, better safety and operational performance and the business case for everyone to be part of this important work.

Companies that build a culture of safety by focusing on the well-being and safety of their workforce yield greater value for their investors. Results consistently suggest that companies focusing on the health and safety of their workforce are yielding as well greater value for their investors.[26]

A team of researchers state:

> *"…. the growing evidence that a healthy and safe workforce correlates with a company's performance and its ability to provide positive returns to shareholders.*[27]

These positive returns go beyond the financial returns to investor stakeholders. It provides value for employee stakeholders in a safe and productive environment. It provides a safe and productive community. It protects the environment and supports a company's social license to operate a safe and profitable organization bringing value to all.

SMS are successfully deployed across a wide range of safety sensitive industries. It is possible to obtain superior performance results and outcomes that successfully address the potential of organizational loss and risks. It protects an organization's reputation and supports the hard earned social license to operate effectively and simply, it is just good business.

This is not self-regulation, it is a self-directed and an interdependent approach to integrate sound business management practices to attain good business outcomes and goals in conjunction with a robust and achievable regulatory regime.

An SMS is a guide to help companies identify and adopt best practices that exceed regulatory requirements. Built into the SMS is an ongoing continuous improvement process in which organizations learn and adapt to improve safety performance. As organizations are in constant flux, ever changing and morphing to demands and external forces, the SMS is changing, morphing and adapting. It is accepted by companies as a continuous "work in progress".

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[26] (Fabius R. e.)
[27] (Fabius R. e., 2015)

SMS with safety sensitive industries, drives in the right direction, the type of operations that require a high reliability factor. They have a strong culture that addresses safety and builds in resilience to survive the vast array of tribulations and challenges of business life. These same principles are adaptable for any industry and any size.

Several themes arise in the examination of safety sensitive industries and their successful business outcomes:

- definitions and approaches vary, companies who embrace the principle to “do good and do right” through an organizational specific safety management system and supporting safety culture are able to meet their unique business requirements and performance objectives
- processes for hazard assessment, risk and mitigation strategies and continuous improvement are foundational to meet the ever changing workplace or business
- an interdependent and inter-related SMS lives throughout an organization and supports other business systems such as finance, human resources, etc.
- consistency of application, effective communication and collaboration with other related company performance results
- it is achievable and scalable based on company size and complexity
- a formalized system includes documentation, implementation and verification with transparent reviews/evaluations/audits adhering to established standards, guidelines and best practices
- business results are achievable through continuous improvement opportunities making the business successful, profitable, safe and a valued member of the community.

The world of SMS and safety culture are foundational for the sustainability and the best in class performance of all businesses and industry. The lessons learned from safety sensitive industries identify that practices, principles and approaches apply to all companies. They help all organizations, regardless of size or complexity to attain the expected performance outcomes of stakeholders, shareholders and regulators.

Appendix

Appendix 1: Safety Management Definitions

US Federal Transit Administration of the Department of Transportation definition states:

"SMS is a formal, top-down, organization-wide approach to managing safety risks and assuring the effectiveness of safety risk mitigations"[28]

ANSI:

A set of interrelated elements that establish or support occupational health and safety policy, and objectives and mechanisms to achieve those objectives, in order to improve occupational health and safety. [ILO uses similar definition]

BSI:

Part of an organization's management system used to develop and implement its OH&S policy and manage its OH&S risks.

CSA Z1000:

Occupational Health & SMS - part of the overall management of the organization that addresses OHS hazards and risk associated with its activities

Safety management system.

A systematic approach to managing safety, including the necessary organizational structures, accountabilities, policies and procedures. An SMS is scalable so it can be tailored to the size and complexity of your organisation [29]

ISO 45001 Working group discussions

"management system is a set of interrelated or interacting elements of an organization to establish policies and objectives, and process to achieve those objectives"

[28] US Department of Transportation, Federal Transit Administration, SMS August 2015 p 2.

[29] ((ICAO), 2013)

Appendix 2: Federal Transit Authority: Four pillars of SMS

Federal Transit Authority

What are the four pillars of SMS?

SMS is composed of four functional components:

- Safety Policy
- Safety Risk Management
- Safety Assurance
- Safety Promotion

Safety Policy is the foundation of the organization's safety management system. It clearly states the organization's safety objectives and sets forth the policies, procedures, and organizational structures necessary to accomplish the safety objectives. The safety policy clearly defines management and employee responsibilities for safety throughout the organization. It also ensures that management is actively engaged in the oversight of the system's safety performance by requiring regular review of the safety policy, budget and program by a designated accountable executive.

The second component, Safety Risk Management, requires development of processes and procedures to provide an understanding of the public transportation system's operations and maintenance to allow individuals to identify hazards associated with those systems. Once hazards are identified, other procedures must be developed under safety risk management to analyze and assess the risk resulting from these hazards, as well as to institute controls to reduce or eliminate the risks from these hazards.

The third component, Safety Assurance, ensures the performance and effectiveness of safety risk controls established under safety risk management. Safety assurance is also designed to ensure that the organization meets or exceeds its safety objectives through the collection, analysis, and assessment of data regarding the organization's performance. Safety assurance also includes inspection activities to support oversight and performance monitoring.

The fourth component of an SMS is Safety Promotion. Safety promotion requires a combination of training and communication of safety information to employees to enhance the organization's safety performance. How an organization seeks to comply with this component depends on the size and scope of the organization. It may include formal safety training for employees, a formal means of communicating safety information, and a means for employees to raise safety concerns without fear of retribution.

Appendix #2: ICAO Safety Manual

ICAO safety manual:

Within the context of aviation, safety is:

> *the state in which the possibility of harm to persons or of property damage is reduced to, and maintained at or below, an acceptable level through a continuing process of hazard identification and safety risk management.*

While the elimination of aircraft accidents and/or serious incidents remains the ultimate goal, it is recognized that the aviation system cannot be completely free of hazards and associated risks. Human activities or human-built systems cannot be guaranteed to be absolutely free from operational errors and their consequences.

Therefore, safety is a dynamic characteristic of the aviation system, whereby safety risks must be continuously mitigated.

It is important to note that the acceptability of safety performance is often influenced by domestic and international norms and culture. As long as safety risks are kept under an appropriate level of control, a system as open and dynamic as aviation can still be managed to maintain the appropriate balance between production and protection. [30]

Appendix #3 Safety Culture IAEA

Safety culture IAEA

2.6. Reference [1] states in para. 2.5 that:

"The management system shall be used to promote and support a strong safety culture by:

- Ensuring a common understanding of the key aspects of safety culture within the organization;
- Providing the means by which the organization supports individuals and teams in carrying out their tasks safely and successfully, taking into account the interaction between individuals, technology and the organization;
- Reinforcing a learning and questioning attitude at all levels of the organization;
- Providing the means by which the organization continually seeks to develop and improve its safety culture."[31]

[30] Organization, I. C. (2013). *ICAO Safety Management Manual (SMM) 3rd edition.* Retrieved July 12, 2017, from https://www.icao.int/safety/SafetyManagement/Documents/Doc.9859.3rd%20Edition.alltext.en.pdf p. 2-1

[31] Source: http://www-pub.iaea.org/MTCD/publications/PDF/Pub1392_web.pdf (Agency, 2009) page 6

Appendix #4: ALoSP and ALARP

The literature discusses the concepts of ALoSP that risk is "reduced as far as reasonably practicable and ALARP "as low as reasonably practicable"." Understanding these two concepts are important in the real world, incidents or events may occur in at a company with a robust system or program. These concepts are challenging in the real world of prevention and a difficult issues management concept.

Workers, the public, regulators and government view catastrophic and tragic events as the responsibility of managers and companies expect them to prevent events at all costs. For the purposes of this review, the end goal of zero loss is the desired outcome. There are however many challenges and new ways required to realize a world of work free from critical or catastrophic negative events. The focus is to continue to work towards the highest level of performance, recognizing and addressing the challenges along the way.

Also, it has been proven that a company and industry that is seen by the community or stakeholders of proactively communicating their good work and goal of being the best, usually receive benefit of doubt and some latitude should a catastrophic or significant event occur. This is well documented in the business literature, a few successful examples are: the Tylenol event in the 1982; Responsible Care 1985 chemical industry response to the Bhopal event in 1984; Maple Leaf Foods listeria event in 2008.

Examples of less than favourable response by the community is the Westray Mine Disaster (1992) Deepwater Horizon (2010), and Lac Magantic (2013).

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