



RECOMMENDATIONS FOR ESTABLISHING PROCESS SAFETY INVESTIGATION BOARDS

November 14, 2014

Executive Summary

Global population growth and the associated growth in the production of goods and services provided by high-hazard process industries require increasingly stronger safety systems that reduce the potential for catastrophic failures. One contribution toward enhancing safety is to expand the number of national Process Safety Investigation Boards (PSIBs). As recent experience has shown, PSIBs can: investigate catastrophic events resulting in severe damages; identify their circumstances and causes; recommend specific ways to prevent their recurrence; communicate with audiences vulnerable to experiencing similar incidents; and coordinate with other relevant governmental agencies and the private sector to strengthen the policies and practice of process safety. A knowledgeable, skilled, diverse board selected by high-level, public officials and subject to limited terms, can help ensure performance and accountability for the PSIB and its more permanent, hired expert staff who establish and maintain the core technical competencies needed to fulfill the PSIB's functions.

Key factors critical to the success of a PSIB include:

- Create a high performance organization
 - Create a board with a sufficient number of qualified members with diverse backgrounds. Board members should have the necessary technical skills, knowledge and experience. Ideally select an odd number of members to avoid deadlocks on voting matters. Appoint a chair, and assign other responsibilities clearly to Board members.
 - Support legitimacy of the Board by appointing members through a high government official. Establish term limits that encourage periodic turnover, with the term limit not coinciding with the term of the appointing official
 - Ensure Board member performance through a transparent evaluation process
 - Provide the Board with a skilled staff representing the necessary technical, political, and administrative skills needed to support investigations, communications, organizational funding, and management oversight.

Technical skills include a deep knowledge of process safety and the process of root cause investigation.

- Define clear scope of investigations
 - Identify reliable methods to learn the occurrence of incidents and means to track incident statistics
 - Establish clear criteria to define which incidents to investigate, and mechanisms to choose between incidents when resources are constrained
 - Define a clear scope of investigations
- Ensure high-quality investigations
 - Conduct in-depth investigation to identify root causes and contributing causes, either of individual incidents or groups of similar incidents
 - Be timely in completing investigations and reporting findings
 - Issue recommendations that are supported by evidence to the parties best placed to respond, and track recommendations to resolution. Such recommendations may address regulations, enforcement, consensus standards, industry guidelines, practices at the company whose incident is being investigated, and others relevant to improvements to process safety
- Operate effectively and efficiently
 - Create trust among government, industry, labor, public, and other stakeholders
 - Increase efficiency by partnering with other national and local agencies and with industry to maximize the accumulation and communication of lessons learned
 - Streamline investigations by pre-establishing mechanisms with other national and local agencies to provide investigators with access to the site as soon as feasible
- Share lessons learned
 - Issue communications which inform stakeholders of lessons learned and maintain continued awareness

- Support the mission of the Board with policies that encourage cooperation of the investigated company, such as protecting the company from private torts related to information revealed uniquely through the Board investigation.

I. Introduction

Process industries support essential economic and social development. They have vast impacts that are felt locally, nationally and globally. However, businesses dependent on highly hazardous materials and processes operate with the daunting challenge of preventing catastrophic incidents. While incidents are relatively rare, a single catastrophic event, like that experienced by the Union Carbide pesticide facility in Bhopal, India, in 1984; the Phillips plastics facility along the Houston Ship Channel in Texas in 1989; and the AZF fertilizer factory in Toulouse, France, in 2001 can have extraordinarily high consequences: loss of life, extensive on-site and off-site structural damage, environmental contamination, and significant interruption of important supply chains. Single monumental incidents can also precipitate changes in law and regulation, thereby impacting entire industries. In aggregate, the global impact of rare but catastrophic process incidents is large.¹ Without a stronger safety infrastructure, the global pattern of incidents can be projected to grow as larger populations demand greater productivity from process industries over the next several decades.

Managing these risks requires instituting specialized systems of process safety. The adequacy of these systems depends upon continuously high levels of vigilance and preparedness. When incidents do occur, responsible organizations should pursue a high-quality investigation that gathers evidence which illuminates root and contributing causes and, thereby, inspires better policies, practices and strategies to prevent their recurrence. However, because catastrophic incidents are so rare and their consequences so severe, organizations are likely to be poorly equipped to self investigate. Simultaneously, severe incidents may precipitate investigations by regulatory agencies interested in the process facility's fidelity to governmental regulations, standards and practices which distract organizations from also pursuing broader incident investigations.

¹ See for example, The 100 Largest Losses 1974-2013: Large property damage losses in the hydrocarbon industry, 23rd edition, Marsh and McLennan.
<https://uk.marsh.com/Portals/18/Documents/100%20Largest%20Losses%2023rd%20Edition%202014.pdf>

Unfortunately, lessons from these investigations frequently stay within the specific organization and location that experienced the high-consequence incident. Concerns about liability may reduce the willingness of companies to publish their investigative findings and conclusions. Even when company investigations are made public, access may be time-limited. Without a better system of communication, self investigations can become histories hidden from many other vulnerable businesses and communities. In the absence of knowledge about weaknesses in equipment and practices that precipitated a catastrophic incident elsewhere, similar facilities may await their own rare catastrophic event before pursuing much-needed preventive improvements.

Recognizing these systemic problems, some nations with high-hazard process industries have implemented national policies that have created special process safety investigation boards (PSIBs). These organizations maintain expertise to investigate high consequence incidents, and keep current in the better practices, staffing and technologies needed for incident investigations and the development of recommendations to prevent their recurrence. When such agencies are freed from regulatory enforcement responsibilities, PSIBs have more permanent resources, responsibilities and skills to communicate the lessons broadly and recommend preventive actions that reach far beyond the single facility subject to a catastrophic incident.

PSIBs can become important elements for improving process safety in several ways. First and foremost, PSIBs can communicate the lessons learned from incidents to the broadest community of process industry members within their national boundaries. National PSIBs can enhance the process safety efforts of their private sector trade associations and trade unions by assessing the effectiveness of, and adherence to, private standards, training and best practices in light of incidents. Furthermore, national PSIBs can serve their public sectors by understanding the efficacy of governmental policies, regulations, guidelines and enforcement practices in light of incidents.

As PSIBs grow to serve each nation with significant process industries, more investigative results and recommendations will be accessible across national borders via modern electronic communications. Partnerships among national PSIBs hold the potential to promote better coordination on the best global investigative practices, and may enhance understanding of better standards, practices and policies to ensure process safety. Multiple national PSIBs will also foster better benchmarking of PSIB performance.

II. Past History and Experience with Process Safety Investigation Boards

Several nations have implemented policy options to fulfill the functions of Process Safety Investigation Boards.

In the United Kingdom (UK), the Health and Safety Executive oversees the Control of Industrial Major Accident Hazards Regulations that apply mainly to the chemical industry, but also to some storage activities, explosives and nuclear sites, and other higher-hazard industries that manage dangerous substances in excess of threshold quantities. On rare occasions following major catastrophic incidents, the UK Health and Safety Commission can establish an independently chaired Major Incident Investigation Board (MIIB) given a wide-ranging set of objectives to examine the circumstances, root and contributing causes, and to issue recommendations for prevention, including those uncovered by an assessment of the adequacy of existing regulations and their enforcement.²

For nearly five decades in the United States (US), the National Transportation Safety Board (NTSB) has investigated accidents in the aviation, highway, marine, pipeline, and railroad industries, as well as incidents involving the transportation of hazardous materials.³ Ultimately Congress re-established NTSB as completely independent from the Department of Transportation regulatory agency to ensure that NTSB investigations

² See: <http://www.hse.gov.uk/foi/internalops/og/ogprocedures/majorincident/miib.htm>

³ See: www.nts.gov

also encompassed the adequacy of DOT regulations and the performance of regulators and all other aspects of the system of transportation safety. NTSB has no authority to regulate, fund, or be directly involved in the operation of any mode of transportation.

NTSB has investigated more than 100,000 aviation accidents and thousands of surface transportation accidents and has issued more than 10,000 safety recommendations to more than 2,500 recipients. NTSB's effectiveness depends on its reputation for conducting thorough, accurate, unbiased and independent investigations and for producing timely, well-considered recommendations to enhance transportation safety.

Building on the NTSB model, in a 1990 environmental statute, the United States Congress established the Chemical Safety and Hazard Investigation Board (CSB), with a primary role of investigating significant incidents at industrial facilities managing high-hazard chemical processes.⁴ CSB's investigative function is independent of the major agencies responsible for ensuring compliance of chemical process industries with national regulations: the Environmental Protection Agency (EPA) and the Department of Labor's Occupational Safety and Health Administration (OSHA). CSB investigations seek to identify root and contributing causes of the incident whether or not those causes were in violation of any current and enforceable requirement, and to identify hazards not addressed by current regulations.

Also in the US, the Department of Energy (DOE) oversees the special operations of high-hazard facilities involved with nuclear weapons production and research. As such, policies have been developed to foster more independent incident investigations whose results become available to the public.⁵ In addition, since 1989, the Defense Nuclear Facilities Safety Board (DNFSB), an independent organization within the Executive Branch, is empowered to investigate, audit and recommend actions to the President and the Secretary of Energy regarding public health and safety issues at DOE defense nuclear facilities. DNFSB reviews and evaluates the content and implementation of

⁴ See: <http://www.csb.gov/>

⁵ See: the policy <https://www.directives.doe.gov/directives-documents/0225.1-BOrder-b> and results <http://energy.gov/ehss/listings/federally-led-accident-investigation-reports>

health and safety standards, as well as other requirements, relating to the design, construction, operation, and decommissioning of nuclear facilities.⁶

In India, the Oil Industry Safety Directorate, a technical directorate under the Ministry of Petroleum and Natural Gas, formulates and coordinates the implementation of a series of self-regulatory measures aimed at enhancing process safety in the oil and gas industries.⁷ OISD is staffed by a small core group of technical experts of diverse disciplines on deputation from industry, and has the responsibility to analyze incidents in the oil and gas industries to identify root causes and formulate remedial action plans.

Finally, corporations can also impanel and provide independent experts to investigate catastrophic incidents and broadly communicate their results. After the 2005 explosion and fire at its Texas City refinery that claimed the lives of 15 workers and injured more than 170 more, British Petroleum (BP) commissioned former U.S. Secretary of State James A. Baker, III, to chair an independent panel that reviewed and made recommendations for improving safety management systems and the corporate safety culture at BP Products North America, Inc., the subsidiary responsible for the company's US refining operations.⁸ Such efforts can impact the system of safety far beyond the nation where an incident occurred.⁹

III. Functions of PSIBs

Several key functions have been identified as core to Process Safety Investigation Boards serving nations with robust process industries.

First and foremost is the responsibility to investigate catastrophic events resulting in severe damages (fatalities, serious injuries, significant property damage). By establishing the circumstances of the incident and assessing the role of safety systems

⁶ See: <http://www.dnfsb.gov/>

⁷ See <http://www.oisd.nic.in/>

⁸ See: <http://www.propublica.org/documents/item/the-bp-us-refineries-independent-safety-review-panel-report>

⁹ See: <http://www.hse.gov.uk/leadership/bakerreport.pdf>

(equipment, people, policies, practices and culture), PSIBs assemble compelling evidence to identify root and contributing causes. PSIBs also establish criteria to define the scope of investigations, balancing thoroughness with a competing need to report findings and issue recommendations quickly. Throughout an investigation, effective PSIBs establish a trustworthy presence in the community where the incident occurred and exercise particular communication responsibilities regarding the PSIB purpose and the status of its investigative efforts with the individuals, families, businesses and government authorities most impacted by the incident. Due to the unpredictable pattern of incidents and their complexity, PSIBs must make difficult choices among competing incidents. Often with stakeholder assistance, PSIBs set and reset incident selection criteria that guide the application of limited staff and financial resources.

Following investigations, PSIBs recommend actions designed to correct specific safety deficiencies uncovered after an incident. Developing recommendations and tracking their implementation become an important way to assess the value of PSIBs to the larger system of safety. Recommendations can be issued to:

1. Managers, workers or contractors at an individual facility at a single locality
2. Managers of larger businesses where recommended actions would be applied at many facilities in multiple locations
3. The broader business community in the same process sector
4. Trade or professional associations that set standards or guidance for their members
5. Governmental inspectorates/regulatory bodies and policy makers charged with setting and enforcing adherence to public guidelines, standards and regulations.

The PSIB's weight of evidence, justification in support of--and the level of effort to gain acceptance of its--recommended actions grows larger as its recommendations impact greater numbers of businesses, organizations and governmental agencies. PSIBs, generally lacking enforcement authority except in the conduct of its investigations, must persuade these recipients to accept recommendations or to propose alternatives that would achieve similar safety improvements. Whenever recommendations are not accepted, PSIBs develop and employ additional strategies to achieve needed safety improvements.

Where an incident, pattern of incidents or other analyses identify a significant gap in safety information, PSIBs may conduct, commission or stimulate special research into the sources of systemic weakness and identify ways to reduce their potential role in process-related catastrophic events. Safety studies can evaluate topics such as the effectiveness of, or need for, actions by a government agency in reducing losses from process incidents, technical aspects of particular processes, or analysis of incident data. Safety studies also lend themselves to gathering broader input from a wider number of stakeholders than might occur with a single incident investigation. The study results in the issuance of a narrative report on the facts, conclusions and any applicable recommendations.

PSIB's investigative function depends upon being notified quickly through an effective incident reporting system that is designed to serve many public needs, such as emergency response, and ensuring compliance with governmental standards and regulations administered through inspectorates/regulatory agencies. Consequently, PSIBs have a special need to ascertain and assure the adequacy of the system of reporting for process incidents subject to its immediate investigative efforts. PSIBs also rely upon effective reporting systems to discern which process sectors are most prone to failure and which incident types more commonly occur in many different process industries. Where needed and as communication systems evolve, PSIBs have a role in proposing systemic improvements in the reporting of incidents, refining the pace and sufficiency of information content and quality to facilitate effective emergency response, compliance with regulation, as well as the PSIBs' abilities to fulfill their own investigative function. Building stronger reporting systems may be particularly important in geographical regions with newly emerging process industries, weaker systems of communications and less governmental oversight.

While PSIBs can directly improve site safety through analyses of a specific incident's causes, their larger social value is achieved when they effectively communicate investigation findings and recommendations to every relevant audience engaged in

process safety and inspire each to higher safety performance. Confidence in the PSIB's investigation ultimately relies upon a lengthy report that supplies the evidence and provides detailed analyses in compelling technical documents. However, few will be inclined to delve into those extensive details. For some, a distillation of the investigation into a short synopsis will best suffice as motivation toward improvements in safety. For many, a video's recapitulation of the incident and its major findings will have broader impact on prevention and may vastly increase the audience for the PSIB's analysis. Increasingly, PSIBs will have important roles in ascertaining and implementing the most effective means for communicating findings, recommendations and research, especially in an increasingly complex web of on-line communication platforms and rapidly evolving communication preferences among key audiences for PSIB work products. As the global network of PSIBs grow, each will have a further vested interest in translating and communicating investigations and safety recommendations from other parts of the world for domestic audiences.

Finally, PSIBs, while an important component, are only parts of a much larger system of process safety. As such, many PSIB functions can only be achieved if PSIBs effectively coordinate with other organizations and governmental bodies, so each understands, communicates and honors their various roles and responsibilities. For example, at the start of an investigation in the immediate aftermath of a catastrophic event, PSIBs will interact on scene with:

1. Health, safety and process engineering experts from the facility and, perhaps, from a larger business unit
2. Local emergency responders and fire departments
3. Staff from governmental inspectorates/regulatory agencies
4. Local, regional and national security/law enforcement agencies.

Effective mitigation and emergency response must proceed while simultaneously preserving evidence important to the many investigators. Subsequent phases of investigations require similar collaboration, transparency and coordination with the same organizations and many others if the investigation's findings, conclusions and recommendations are to be ultimately accepted and safety improvements pursued.

IV. Structure of Boards

How should board membership be structured to best accomplish the high purposes of a PSIB?

Avoiding catastrophic incidents in high-hazard process industries involves a complexity of skills, knowledge and commitments that range from conducting process hazard assessments; to understanding mechanical integrity and reliability; to awareness of safety instrumentation and process controls; to recognizing and managing changes in people, equipment and culture in a dynamic industrial environment, to name a few.¹⁰ Since no single individual possesses sufficient knowledge, skills and experience to strengthen the system of process safety, PSIBs adopt a board structure with a sufficient numbers of members to oversee and approve investigations, develop and pursue safety recommendations and communicate findings to the growing number of stakeholders. Five or more members are better able to bring the full complexity of process safety knowledge to guide investigations and recommendations initiated through the efforts of expert staff and odd numbers avoid deadlocks in decision making. After receiving comment from relevant stakeholders, PSIB work products are completed in public through open deliberations and voting by the full board.

Populating board member seats on PSIBs is best accomplished by a transparent high-level appointment process in which each member's experience and competencies are first fully assessed by an executive authority and become the justification for public nomination. If the nominating executive commands a very high level of public authority, such as holding high public office, then the nominee and, ultimately the PSIB as a whole, will also accrue higher regard. When each nominee's qualifications and competencies are subsequently confirmed through approval by a separate, independent

¹⁰ For a fuller appreciation of the diverse knowledge and skills needed to ensure commitment to process safety see: <https://www.aische.org/ccps/topics/elements-process-safety/commitment-process-safety>

governmental body, such as a legislative branch, then new board members begin executing their PSIB responsibilities with very high public confidence.

PSIBs are best populated when their authorizing policies define the technical skills, knowledge and experience needed by members to render decisions about investigations and recommendations. Board member competencies for nomination and confirmation rely on a balance of specified mandatory and desirable skills: formal education, experience, professional standing, and demonstrated knowledge in the fields of catastrophic incident reconstruction, chemical engineering, safety engineering, human factors science or process safety regulation.

While individual board members may be well qualified to serve as members, the success of the institution requires that nominating and approving authorities also ensure board membership diversity. The Board's ability to produce high quality investigations and recommendations depends upon the board as a whole commanding a wider range of knowledge, expertise and relationships with key stakeholders. PSIBs will be weak if, collectively, the board members reflect a narrow range of technical sub-disciplines. Further weakness will ensue if, collectively, the board interprets evidence through the more parochial interests of a single stakeholder community. Finally, if board members are drawn from duplicative disciplines or from similar institutions and from a single geographical region, then the board's authority and respect will be undermined, especially in its interactions with diverse staff experts and, more broadly, in its interactions with under-represented disciplines, stakeholder groups and geographic regions.

Review and renewal of board members through defined member tenure and renewal policies is one key way to ensure sustained PSIB commitment to improving process safety practice. The high level of effort to nominate and approve competent board members argues for a commensurate tenure of service. Several PSIBs operate with five-year terms -- a time duration that allows a new board member sufficient time to absorb the history the PSIB's investigative efforts and to pursue implementation of

safety recommendations generated before their arrival, as well as to assist with and complete new investigations. Since term renewal is subject to the same formal, transparent nomination and approval process, candidates seeking renewal allow many others to evaluate performance of the individual and of the board as a whole during their tenure. Furthermore, since the five-year term may exceed the tenure of the nominating executive and many others involved in the approval process, renewal will bring broader, new perspective to the roles and responsibilities of the PSIB. Staggering the terms of individual board members also creates the opportunity for measured renewal of leadership without threatening organizational continuity.

Beyond regular turnover of board membership to improve diversity and performance, board performance and accountability require the establishment of policies to promote productivity and ethical behavior and to remove board members when their inefficiency, neglect, or malfeasance becomes so egregious as to threaten the reputation and trustworthiness of the institution. Prior to joining the Board, members must fully grasp and commit to effective PSIB governance and be willing to support transparent accountability for the performance of individual board members and for the board as a whole. Nominating executives and the approving authorities often will be granted:

1. The authority and means to assess the performance of PSIB members and the board as a whole
2. Where evidence supports, to remove incompetent board members before their tenure is complete.

Better PSIBs generate information about the performance of board members and boards as a whole through annual self assessments subject to public input, especially from those with whom the PSIB collaborates in investigations and recommendations. Such assessments need to recognize the importance of board member independence in decision-making over technical work products, as well as the importance of each member demonstrating responsibility for building effective relationships with all private stakeholders groups, their associations and with public sector inspectorates/regulators and policymakers who oversee, fund and have responsibilities to improve process safety. Finally, given the intimate, day-to-day interactions by staff with board members

and senior staff executives, whistle-blower protections can enable hired staff to present evidence of inefficiency, neglect, or malfeasance within PSIB leadership.

While multiple board members with great expertise can help ensure the quality of investigations and recommendations and grow public trust in the PSIB, defining the chair's responsibility improves the efficiency of essential technical, legal, administrative and communication functions by staff. PSIBs generally are guided by policies that authorize one board member to serve as board chair, often with assignment of that title through a separate nomination and approval process. Chairs have two very important responsibilities. First, the chair leads the independent board members, building the consensus from the board as a whole to set and approve its budget, approve policies that allow effective and efficient board oversight and accountability, select incidents for investigations, issue and declare status of recommendations, schedule regular public meetings, select and approve research studies, oversee communication effectiveness, and hire and evaluate the most senior staff. Secondly, but equally important, the chair oversees the day-to-day administration of the PSIB and its hired staff, working with and through senior staff. Among other duties, the chair ensures the timely production of draft investigations and recommendations for board approval; develops a draft budget for board approval and updates the board on the execution of the budget; ascertains efficient and effective use of resources; identifies and informs the full board of internal staffing and resource constraints; ascertains and resolves problems in technical, administrative, financial and legal work while keeping the board informed; and oversees the communication of the board with stakeholders and authorizing committees. Should the PSIB engender a crisis in public confidence with an inability to complete its technical work in a timely and competent manner, the PSIB's role will be significantly diminished.

V. Structure/Staffing/Operations of the Organization

The board members and chair have high responsibilities and possess the leadership and visibility to oversee and direct PSIBs. However, the reputation of the institution

ultimately is determined by the hired technical staff and is measured by the quality and timeliness of their detailed investigative work, insightful safety recommendations, and effective collaboration with key stakeholders. They and other essential staff who provide legal, fiscal, administrative and communication support, sustain the organization.

What key aspects should be considered in forming the PSIB organization?

Similar to the competencies for filling board positions, PSIBs must be staffed in ways that maintain and grow technical investigative and safety expertise. Investigation and safety recommendation staff need to be technically expert in relevant fields and collectively even more diverse than the board members in experience and knowledge of process safety. Strategic hiring ensures that the staff possesses professional standing and demonstrated knowledge in preventing catastrophic process safety incidents. Staff should have special skills, such as catastrophic incident reconstruction, chemical engineering training with operational and safety experience, as well as expertise in human factors, mechanical integrity and reliability, process hazards analysis and process safety regulations, standards and best practices. Effective annual training of technical staff can maintain and grow expertise.

Since board members will be limited by their terms of appointment and unassured of success in reappointment, hired staff can have much longer tenures within the PSIB. Over time they can become stronger in the expertise to conduct investigations, in issuing recommendations, and in understanding the complexities of the larger system of process safety. Furthermore, expert staff will have a greater role in creating a PSIB culture that embraces continuous learning and seeks to cultivate process safety excellence in a variety of settings. If deployed well, technical staff also can broker more effective relationships with key stakeholder groups and collectively monitor the public perception of the PSIB's technical authority and its value to process safety.

First and foremost, PSIB staff demonstrates the willingness and capability to expertly gather evidence from which to identify root and contributing causes that justify safety

recommendations. PSIBs conduct expert interviews of those involved in an incident and those with special knowledge germane to the incident. Authorizing policy usually enables the staff to compel reports and testimony, using subpoena power where needed. Staff also masters the process of holding public hearings to gather additional information while being informed by, and informing the public about the status of the ongoing investigation. Staff is skilled in gaining access to information gathered by occupational health and environmental protection and security regulatory agencies/inspectories, emergency responders, the company and others after an incident. Staff knows how to gather and analyze physical evidence, as well as the data outputs from process and safety instrumentation. It masters incident reconstruction techniques and technologies. Staff establishes the internal system to document, store and retrieve evidence.

PSIB staff knows the effectiveness of the layers of protection surrounding hazardous processes and the sources of weaknesses that can undermine that system of safety. Based upon the evidence and findings and specific knowledge of an organization's capability, staff proposes and pursues meaningful safety recommendations, seeking the most aggressive and achievable actions to improve process safety and prevent the recurrence of an incident. Staff becomes expert in knowing the capacities and constraints that surround an organization receiving a recommendation, and cultivates relationships with those who can make a difference in its implementation.

In most nations with significant process industries, governmental inspectorates/regulatory agencies are delegated important public roles in preventing catastrophic incidents. PSIBs know and evaluate policies, regulations and standards set by occupational health, environmental protection and process security inspectorates/regulatory agencies to prevent catastrophic incidents. PSIB staff understands the resources and practices that define public compliance assurance programs. Such knowledge extends to professional engineering organizations,¹¹ trade

¹¹ For example, see: <https://www.asme.org/shop/standards/new-releases/boiler-pressure-vessel-code-2013>

associations¹² and other private sector organizations that might set domestic or international standards for equipment, operations and best practices relevant to process safety. PSIB staff collaborates and coordinates with standard-setting organizations to better understand their current and long-term capacity to strengthen process safety through improvements in standards, best practice guidelines, regulations and compliance enforcement.

PSIB staff establishes administrative procedures to conduct business, such as hiring processes, staff evaluations, setting salaries and bonuses, ensuring compliance with broad governmental policies, proposing and administering contracts, leases, etc. Staff develops the legal framework that enables board members, chair and the board as a whole to work effectively. Possessing more intimate knowledge of, and interactions with, other relevant governmental agencies, PSIB staff also will plan, implement and update memoranda of understanding (MOUs) with others who can assist PSIBs in fulfilling technical and administrative roles. Particularly during its early development, a PSIB may need to draw upon resources from occupational safety and health and environmental protection inspectorates/regulatory agencies, professional engineering and safety organizations, industrial process safety experts, etc., to initiate investigative activities until more permanent staff and resources become available. Staff brings awareness of the expertise needed to augment its capabilities, where such contract talent is located, and how to engage it in ways that ensure the integrity of contracted work. Further, PSIB senior staff knows what expertise to maintain and nurture as in-house staff and which should remain contracted resources.

Finally, PSIBs have urgent needs to benchmark infrastructure and performance with the highest performing safety investigation boards. Such comparisons include regular assessments of staff expertise, experience and training, as well as the competency and timeliness of core products, the effectiveness of the institution's relationships with key stakeholders, and the quality and competency of legal, administrative, financial and communication efforts.

¹² For example, see: <http://www.api.org/publications-standards-and-statistics>

VI. Other Key Concepts Relevant to Forming Process Safety Investigation Boards

What other issues should be considered in forming Process Safety Investigation Boards?

PSIBs are best established when public officials create PSIBs through legislation. Proposing specific authorizing policies, seeking broad public input, weighing alternative policy options and, ultimately, approving a PSIB through law, enhances the visibility, support for and accountability of the institution. Statutes specify the PSIB structure, define roles and responsibilities of board members and chair, articulate key board functions and define the PSIB's relationship with other governmentally sanctioned safety organizations, such as inspectorates/regulatory agencies. Some nations start the process of forming PSIBs by first commissioning special *ad hoc* expert panels when a major catastrophic incident occurs in a hazardous process sector.¹³ Successful experiences with specially chartered independent investigations can build national confidence and demonstrate the need for—and ability to-- establish a permanent PSIB.

The breadth and scope of process industries can be so large that new PSIBs might be unable to meet the technical and economic challenges of investigating many major catastrophic incidents, especially during their early years. Policymakers assist when they clearly define the scope of responsibilities, for example, precluding investigation of highly specialized sectors, such as offshore oil exploration, or by making investigations only mandatory for certain incidents with specific severe consequences and leaving optional the investigations of other incidents within the constraints of resources and regularly appropriated public funds.

¹³ For example, on May 22, 2010, President Barack Obama created the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling as an independent, nonpartisan, limited tenure entity, directed to provide a thorough analysis and impartial judgment to determine the causes of the disaster, and to improve the country's ability to respond to spills, and to recommend reforms to make offshore energy production safer. <http://www.gpo.gov/fdsys/pkg/GPO-OILCOMMISSION/pdf/GPO-OILCOMMISSION.pdf>

PSIBs have the important, but limited, purpose of investigating incidents, identifying root and contributing causes, and recommending actions that prevent recurrence. One potential source of weakness contributing to an incident may be the inadequacy of current regulations and/or the level of effort to ensure compliance. Therefore PSIBs are best supported by policies that ensure independence from the direction of any government inspectorate, regulatory agency or ministry. Usually this includes independence in the development of investigations and technical reports, recommendations, budgets, provision of testimony to public officials, etc. Where a PSIB makes use of private sector expertise and resources, such as shared analyses of the integrity of equipment involved in an incident, potential conflicts of interest can be identified and managed in ways that will not compromise the actual or perceived integrity of the analyses.

While recognizing the importance of ensuring its independence, PSIBs also have urgent needs to promote governmental and private coordination and cooperation.

Catastrophic incidents require many other governmental inspectorates and agencies to respond and others to investigate, often for different but allied purposes. Each governmental organization has a legally defined purpose designed to serve the greater public good. National security and law enforcement officials have an urgent need to understand if criminal activity caused the incident and, if so determined, the PSIB will then have a much lesser role in investigating. National environmental, health and safety inspectorates/regulatory agencies will investigate to ascertain the pattern of compliance with their regulations. Regional and local authorities may also investigate to ascertain compliance with regional and local regulations. Orderly and efficient approaches to witness interviews and access to equipment, procedures and safety data systems require coordination and cooperation. Prior to any incident, PSIBs often develop MOUs with other national authorities that allow each governmental agency to achieve its mission while promoting efficient working relationships, such as defining approaches to gathering and sharing evidence and communicating information about on-going investigations to the public. MOUs with regional and local authorities often are

developed after the first regionally relevant incident occurs, because these agencies are too numerous and operate under policies too diverse to merit the use of limited resources for preplanning efforts. MOUs are regularly reviewed and revised as needed. All other governmental agencies should support future actions that prevent the recurrence of catastrophic incidents.

Similarly, companies, professional societies, trade associations, trade unions and institutes of higher education may have responsibilities, interests and competencies to gather and analyze evidence, ascertain systemic weaknesses and strengths, and inform pathways toward improving the system of catastrophic risk reduction. PSIBs can exert a positive influence on diminishing the barriers toward, and promoting the opportunities for, greater cooperation and coordination.

In many nations, a catastrophic incident will precipitate claims of wrongful injuries to individuals and to businesses -- matters that ultimately will be decided before judges. While PSIBs may gather evidence that could support or refute those claims, PSIBs' purpose is limited to evaluating the evidence, presenting findings that identify root and contributing causes and issuing recommendations that would prevent the incident from recurring. Authorizing legislation often ensures exclusion from private torts and other legal procedures. The small number of PSIB staff charged with conducting expert investigations into catastrophic events could be overwhelmed with unrelated obligations to courts, litigants and defendants if the PSIB's findings, conclusions and recommendations become part of legal deliberations either in assigning blame in private suits or in the enforcement of regulations.

Finally, PSIBs can be assisted by policies and actions that promote efficiency and collaboration with stakeholders whose technical expertise can advance investigations and the development of recommendations. An incident may require access to very specialized technical knowledge and expertise, ones so unique that the PSIB would be unlikely to require them again in subsequent incidents. Hiring permanent staff with this expertise would be inefficient. Contract organizations might also be unlikely to have

such special expert staff. However, other governmental agencies, national laboratories, other PSIBs, universities and private entities involved with process safety may retain the special expertise relevant to the conduct of a specific investigation, needed research and pursuit of process safety recommendations. Authorizing policies to encourage MOUs with these organizations and funding to enable short-term collaborative assignments of their staff, strengthens the PSIB capability to investigate. Such collaborations need to be guided by integrity assurance and confidentiality policies.

VII. Path Forward

“By the year 2020, leaders in process safety will value and demonstrate actionable commitment to the competencies, communication, awareness and risk preparedness that prevent, minimize and mitigate all process safety incidents.”

AICHe, CCPS (2012)¹⁴

Corporate leaders and many others on the forefront of high-hazard process industries have embraced AICHe’s vision to strengthen the global system of process safety over the next decade. Process Safety Investigation Boards can become an essential underpinning toward achieving a central vision tenet: “Enhanced Application and Sharing of Lessons Learned.” Expertly staffed PSIBs uncover the detailed evidence surrounding catastrophic incidents, identify root and contributing causes, recommend actions to prevent their recurrence, and broadly communicate their findings in ways that meet the complex needs of many stakeholders. Their widely accessible products can enhance learning, inform a safety culture, provide a basis for benchmarking, and stimulate procedural or mechanical improvements across companies and industries that seek to reduce near misses and prevent incidents.

¹⁴ For more information about AICHe CCPS’s Vision 2020 see: <https://www.aiche.org/ccps/about/vision-2020>

PSIBs also serve to support two key societal themes that form part of the 2020 vision. First, well managed and effectively staffed PSIBs become centers of responsible collaboration among government regulatory authorities, labor organizations, communities, research institutions, universities and industries -- encouraging all to work together to remove legal barriers to reporting incidents, develop reporting databases and promote mutual understanding of risks and effective process safety systems.

Secondly, PSIBs, primarily through the strategic communication of their results, celebrate the importance of science, technology, engineering and mathematics. This communication can expand stakeholder knowledge and the motivation to learn, including that of the general public. When combined with the compelling narratives of catastrophe, a PSIB's investigative methods, supporting research and data can provide middle, high school and college students with opportunities to develop critical thinking skills and absorb technical and foundational concepts of business and engineering.

How can the creation of PSIBs be advanced in many more nations with vibrant process industries?

1. Encourage the creation of PSIBs where none exist in regions where high-hazard process industries are located or are being planned. Work with global partners to support these new PSIBs.
2. Communicate the key functions and value of PSIBs to important stakeholders, including business leaders, emergency response organizations, labor leaders, environmental and community organizations and, especially, policymakers who can propose and build support legislation that creates PSIBs.
3. Communicate the value, as advocated in AIChE's 2020 Vision, of the ways that PSIBs can help "Enhance the Application and Sharing of Lessons Learned."