PREVENTING CATASTROPHE

[INTERIM REPORT]

ROUND TWO

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GUIDE TO THE INTERIM REPORT—ROUND TWO

The **Interim Report - Round Two** summarizes the responses to the second of three rounds of questions addressed to the participants in Fall Line System's research on Preventing Catastrophe in Organizations.

It is the intent of the authors of the Interim Report to accurately reflect the input of our research participants-our Expert Group-without adding the author's ideas or theories. We have used the words of the participants where possible, and these phrases are in quotes. All other text is a paraphrase of the Expert Group's answers.

The Interim Report begins with an overview of the research process and a summary of the findings from the seven questions asked in Round Two. Detailed answers to each question, grouped into sections as indicated in the Table of contents, make up the bulk of the Interim Report. The full text of the questions is included on pages 10-11.

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Interim Report - Round Two, May 2011.

OVERVIEW OF THE RESEARCH—ROUND TWO

The objective of the research project is 'to identify barriers to and best practices for Preventing Catastrophe in Organizations.' The research commenced in January 2011. We are using a three part Delphi Study in which 22 participants (the Expert Group) will respond to a series of three questionnaires.

Round One was completed in March 2011. The Round One Interim Report can be viewed at http://www.fall-line.ca/preventing-catastrophe/research-project.

Round Two explores issues raised during Round One. The Expert Group submitted their responses in March - April 2011 with a 100% response rate.

Expert Group

The 22 participants in the Expert Group were selected because they had each built a reputation for working successfully in industry sectors where the risk of catastrophe is fairly significant. These are people who are known for their ability to manage complex, high risk projects and operations without producing dramatic problems.

Titles

Members of the Expert Group have a long history in their industry-their current titles are listed below:

Business Leader, Operations; CEO; Chief Reservoir Engineer; Corporate Director; Director of Engineering, Major Projects; Drilling Manager, Gulf of Mexico; Emergency Management Advisor; General Manager SAGD Major Projects; General Manager Refining; Manager Emergency Preparedness; Manager Process Safety; Partner; President; Principal Structural Engineer; Project Manager; Visiting Professor; VP Midstream; VP Operations and Engineering; VP QHSET; VP SAGD; Well Engineering Manager.

Organizations

Members of the Expert Group work for a variety of organizations, listed below:

ALE Energy; Bantrel; Canadian Petroleum Engineering; CNRL; EM&I Alliance; Energy Resources Conservation Board; Husky Energy; Imperial College; Irving Oil; National Energy Board; Nexen; Provident Energy; Statoil; Suncor; TransCanada; Tricon Solutions; United Illuminating Company.

Industry Sectors and Locations Represented

Members of the Expert Group are located in Western Canada (primarily), New Brunswick, Connecticut, and the UK. They have experience in a broad range of industry sectors, including:

- Electrical distribution
- EPCM engineering
- High speed rail
- Industrial construction
- Information technology
- Offshore and onshore drilling
- Oil and gas production
- Oilsands SAGD
- Oilsands upgrading
- Pipelines
- Refining
- Regulators

Research Team

The research project is led by George Campbell of Fall Line Systems Inc.

Research Advisors

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SUMMARY OF FINDINGS

The Round Two questions were distributed to the Expert Group March 15, 2011. All returns were submitted by April 5, 2011.

In Round One of our three part research process, we asked 15 questions exploring barriers to and best practices for Preventing Catastrophe in Organizations. These questions and our Expert Group's responses cast a broad net over the issues involved in preventing catastrophe. Key findings in Round One included:

- It is difficult to perceive catastrophic risk in organizations
- Production pressure makes it difficult to implement and sustain preventive actions
- Organizational and team cultures can make people reluctant to speak up about catastrophic risk
- Leadership failure causes organizations to be blind to catastrophic risk
- Risk management systems are essential for preventing catastrophe, but they do not always work

In Round Two we asked seven questions designed to explore the issues uncovered in Round One in more depth, partly by eliciting the personal experiences of the Expert Group members. Our questions asked what the Expert has done or observed that was most effective in five areas:

- Reducing risk blindness
- Increasing the potency of risk management systems
- Reducing deafness to catastrophe signals
- Balancing production pressure and safe operations
- Evaluating organizational capability for preventing catastrophe and responding to emergencies

In this summary we capture the principle messages from the Round Two survey. The detailed answers to each question follow the summary, for those who want to look more in depth at a particular question.

Reduce Risk Blindness

Background

One of the key barriers to preventive action, identified in our Round One survey, was the failure to perceive risk in the organization. Clearly, preventive action makes no sense when the organization is blind to risk.

Round Two Survey Questions in this Area

1. ***What actions have you taken or observed that were most effective in getting other people to perceive catastrophic risk in their business or organization?***
    a. ***Actions that improved the perception of risk by Senior Management & Board Members. (List no more than 3 actions)***
    b. ***Actions that improved the perception of risk by Operations Leaders. (List no more than 3 actions)***
    c. ***Actions that improved the perception of risk by Operations Staff. (List no more than 3 actions)***

Use the Risk Management System Effectively

Prevention of catastrophic risk requires each of three different organizational levels to make distinct contributions to the Risk Management System. Failure to understand and manage risks appropriately at any one of these organizational levels increases the danger of catastrophe significantly. Different tools are used to improve the perception of risk at each organizational level, as outlined below.

Senior Management & Board	Operations Leaders	Operations Staff
Make risk management part of governance	Job Hazard Assessments	Discuss risks in a two way conversation at pre-job, tailgate and other meetings
Include risk assessment in Capital and Project Approvals	Ensure reasonable projected costs and schedules are presented	Review identified risks
	Update risk profiles, reporting to appointed Board member	Build culture by talking about risk at the start of every meeting
	Push to assess risks broadly: include public safety, financial, project management, etc.	Build culture of risk based decision making in day-to-day operations
	Skilled use of HazOp process	

Use Stories of Catastrophe, Incidents, and Near Misses

Risk blindness occurs, in part, because catastrophic events and near catastrophe happen so rarely. Stories of incidents and near misses are powerful tools for opening people's eyes to risk and to fight the tendency to think, "It can't happen here." These stories are most effective if they encompass personal experience or similar work but stories of more distant incidents can be powerful as well.

Our Expert Group points out that Board members "have or do hold senior executive positions in other companies, so there is a bank of experience that should be utilized" for examples of incidents and ideas for managing risk. This bank of experience also exists at other organizational levels.

Annual safety meetings, project kick off meetings, toolbox talks and many other opportunities to share stories of incidents are identified in the survey. Our Expert Group stresses the need to use these opportunities, with one person saying "Risk identification needs to be institutionalized - at the outset of EVERY briefing, risk profiles and safety considerations must be addressed."

Align Management Processes

Our Expert Group identified the need to make sure management systems such as "clear accountabilities for leadership," "safety / risk performance targets," and operating budget targets are aligned with process safety requirements. "Strong oversight programs" were also stressed. One participant had initiated a reorganization to increase oversight and found this reduced risk blindness.

Provide Effective Training

Two types of training are seen as important: broadening individuals' competency to understand the operations, particularly the implications of actions on other parts of the business; and analysing risk.

One Highlight Tool

Several tools and processes for reducing risk blindness were identified by the Expert Group. One that may warrant further discussion is called **Key Issue Management**. "This formal process involves identifying large impact risks six months to a year in the future and planning effective mitigation of those risks, usually by Operations Leaders."

Increase the Potency of Risk Management Systems

Background

Most large, complex organizations now have formal risk management systems. These are implemented with varying levels of rigor and enthusiasm. Highly developed risk management systems were in place at Enron, AIG, Countrywide Financial, BP and they did not prevent massive catastrophes.

Round Two Survey Question in this Area

2. ***What have you done, or observed, that has brought life and effectiveness to formal risk management systems? (No more than 3 actions)***

Sharpen the Risk Management System (RMS)

Risk Management Systems are just blunt bureaucratic shams until they are sharpened by organizational leaders at all levels. To sharpen the RMS:

1. **Make sure the RMS activities fit the practical realities of the organization**. Our Expert Group has done this by ensuring the RMS framework "will be applied throughout the organization," ensuring "front line staff have input," and looking for "common themes in the rollup of individual operations or project areas."
2. **Provide effective and comprehensive training on risk management and the RMS.** "Ensure that all involved are fully versed in the formal risk management plan and are following the plan, communicate with management and make adjustments when necessary."
3. **Conduct effective HazOp and other risk identification meetings.** Make sure "all of the right people are brought into meetings," and "someone is playing the devil and asking hard questions." Also, "limit hazard reviews to 3 hours at a time with a day or two in between" so that people don't get worn out and there is opportunity to think between meetings.

Lead by Example

Risk Management Systems are given life through visible support of senior leaders in the organization. This support has to go way beyond just saying the management of risk is important. Senior leaders must:

- **Walk the talk**. "Don't just talk about it and hope the risk event never happens, but act to identify, analyze, eliminate or mitigate with discipline, particularly act to mitigate." The Expert Group emphasized the need for Senior Executive and Board members to lead by example saying, "Safety & consideration of risks is not someone else's responsibility. It must have personal ownership from the CEO, through management and staff and must be consistently communicated as such."
- **Show visible leadership in the field operations**. Specifically, we need "senior people actually walking through the installations, making comments and suggestions and most importantly soliciting suggestions/concerns and listening to responses. Creating action lists (and acting on them!)"

Keys to Increasing the Potency of the RMS

- "The culture and values of the organization will always trump controls." Because of this, "build risk-based decision making into the organizational culture."
- "RMS can't be seen as being implemented only 'when it doesn't hurt.'" Commitment to the RMS will be tested during 'moments of truth' when action to manage risk hurts financial or project performance. If you fail here, you are back to a bureaucratic sham.

Reduce Deafness to Catastrophe Signals

Background

Research shows that major accidents are always preceded by warning signs that, for one reason or another, are not recognized as such[1]. Isolating and acting on these signals are an essential part of preventing catastrophe.

Round Two Survey Questions in this Area

3. ***What have you done, or observed, to make sure that people speak up vigorously when they perceive significant risk?***
4. ***What have you done, or observed, to help you sort out the real signals (where you have to act) from noise?***

[1] Turner, B. (1978). Man-Made Disaster, London, Wykeham.

Build an Open Culture so that People Speak Up

Oppressive organizational cultures make it less likely that people speak up loudly against conventional wisdom, even when that 'wisdom' appears to be leading to catastrophe. Our group emphasized the need to build an open culture where people "feel safe to offer opposing views openly" and "we don't only value the 'yes' men." To build an open culture:

1. **Follow up**. Thank people for their input personally and act on the input when appropriate. When you don't act on the input, let people know why. "Opened my door to listen. Acted publicly on an issue presented by my open door policy."
2. **Make it safe to speak up**. Encourage signals through good leadership practices. For example, "never shoot the messenger," even if you don't like the message. On top of this, establish channels separate from the normal supervision chain that are clearly safe—hot lines, independent safety reps, whistle blower channels.
3. **Empower staff**. Involve staff in early stage of planning and make sure they have the power to stop work when facing unsafe conditions. "Empower individuals to stop unsafe work without fear."
4. **Provide training**. Train management on how to engage in two way communication, staff in how to speak up effectively, and everyone in risk assessment.

Investigate Signals with Diligence

Participants reacted strongly to the implication in Question 4 that some signals should be ignored. 60% of our Expert Group says that all signals need investigation. Others point out that "there is always noise that needs to be sorted from the key signals." These positions are not as opposed as they may appear to be-everyone emphasizes the need to investigate signals with diligence.

- **Act on all signals**. Don't "prejudge it was noise-a little digging normally identifies if it is just noise. I have often failed to do this the first time due to pressures of the job and it has cost." Expert Group members pointed out in different ways that, "The fire department responds to all alarms even though they know that a large percentage are 'false alarms.'"
- **Filter the signals**. "Score and sort the risks from high to low," using priority models, evaluation of the source, competent assessors, etc. One Expert Group member points out, "To do this you need common definitions and method of scoring the risks. Also need to update this information as the situation and risk changes."

Actively Listen for Signals

The Expert Group identified a number of methods for increasing their listening power. Steps for active listening include:

- "View, first-hand, the systems in place to identify risk / safety considerations"
- "Review independent assessments of safety and risk programs"
- "Conduct annual employee feedback surveys with 90% engagement scores"
- "Respect your technical specialists who really understand the business and operations and value their views"
- "It's often best that the leader not attend all the meetings. A fresh set of eyes is key to seeing issues"

Balance Production Pressure and Safe Operations

Background

Research shows that major accidents are always preceded by warning signs that, for one reason or another, are not recognized as such[2]. Isolating and acting on these signals are an essential part of preventing catastrophe.

Round Two Survey Question in this Area

5. ***What have you done, or observed, that kept the balance between production pressure and safe operations at the appropriate level?***

Establish Constant Vigilance

Risk assessment must become part of day-to-day decision making and planning to keep safety balanced with production pressure. In order to do this:

- **Discuss operational and project risk**. Leaders must ask thought-provoking questions when reviewing projects and this must be reinforced by organizational systems such as quality reviews, health and safety reviews and third party cold eye reviews. “Always ask question of staff if we do "this" what are the new risks that we expose ourselves to or the identified risks that we increase.”
- **Use risk assessments**. Build risk assessments and hazard reviews into “part of the everyday culture.”
- **Stop work to review risks**. Use safety stand-downs and crew inductions to clarify risks and roles in managing risks. Ensure as part of this that people know they have the right to “halt the operation for risk / safety considerations.”

Demonstrate Commitment to Safe Production

- **Walk the talk**. Leaders must walk the talk by “supporting schedule delays and productivity interruptions in the name of safety regardless of production implications.” And they need to “Hire and retain great people - people who care AT LEAST if not MORE about their people than they do about the excel spreadsheet. And - then trust them.”

Key Messages

- “We have publicly declared to all our employees and contractors that safety is ‘not’ a priority, it is a ‘value’. Priorities change from time to time, but safety is a consistent effort that will not be compromised by any business priority.”
- “The operational commander in the field should never be trumped by someone in head office who is headed to his yatch or not standing on the platform.”
- You can maximize both production and safe operations “if you have the proper open culture with an accountable and trained team.”

[2] Turner, B. (1978). Man-Made Disaster, London, Wykeham.

Evaluate Capability to Prevent and Respond to Catastrophe

Background

Assume a colleague has asked you to assess her organization's exposure to catastrophic risk. In a company the same size and in the same business as where you work or normally consult.

Round Two Survey Questions in this Area

6. ***What would be the top five elements you would rate on your catastrophe prevention scorecard?***
7. ***What are the top five elements you would have on your scorecard to evaluate their incident / emergency response system?***

Draft Scorecards for Evaluating Organizations

The draft scorecards compiled from the responses to Questions 6 & 7 can be used as a starting point for evaluating an organization's capabilities to prevent or respond to catastrophic situations. These scorecards have to be highly customized to fit the organization, it's industry and technology in order to be relevant.

Catastrophe Prevention Scorecard

Understanding an organization's capability to prevent catastrophe requires assessment of a broad range of indicators. Assessment must include:

- Risk Management System
- Health, Safety and Environment Performance
- Operational Excellence
- Organizational Culture
- Emergency Response System

43 indicators are identified in this draft scorecard, demonstrating the complexity and multi-faceted nature of preventing catastrophe in organizations. The risk management system is clearly an important component of preventing catastrophe in a large organization—it is also clearly not adequate by itself to accomplish this task.

Incident / Emergency Management System Scorecard

Failure of the emergency management system can potentially turn a minor incident into a catastrophe and so readiness to manage 'unplanned events' is a key component of preventing catastrophe. Assessment of the emergency management system includes:

- Hazard Assessment
- Emergency Management System
- Readiness Testing
- Investigation
- Continuous Improvement

39 indicators are identified in this draft scorecard. The Emergency Management System affects a narrower slice of the organization than catastrophe prevention but it relies on people responding correctly at a moment's notice, often under extraordinary pressure and personal danger. It is exceptionally important to ensure the Emergency Management System is ready when needed.

DETAILED RESPONSES BY QUESTION

The Round Two questions, included here on Pages 10-11, were distributed to the Expert Group March 15, 2011. All returns were submitted by April 5, 2011.

Round Two Questionnaire

Blind to the Risk

One of the key barriers to preventive action, identified in our Round One survey, was the failure to perceive risk in the organization. Clearly, preventive action makes no sense when the organization is blind to risk.

1. **What actions have you taken or observed that were most effective in getting other people to perceive catastrophic risk in their business or organization?**
    a. **Actions that improved the perception of risk by Senior Management & Board Members. (List no more than 3 actions)**
    b. **Actions that improved the perception of risk by Operations Leaders. (List no more than 3 actions)**
    c. **Actions that improved the perception of risk by Operations Staff. (List no more than 3 actions)**

Impotence of Some Risk Management Systems

Most large, complex organizations now have formal risk management systems. These are implemented with varying levels of rigor and enthusiasm. Highly developed risk management systems were in place at Enron, AIG, Countrywide Financial, BP and they did not prevent massive catastrophes.

2. **What have you done, or observed, that has brought life and effectiveness to formal risk management systems? (No more than 3 actions)**

Deaf to the Signals of Potential Catastrophe

Research shows that major accidents are always preceded by warning signs that, for one reason or another, are not recognized as such[3]. Isolating and acting on these signals are an essential part of preventing catastrophe.

3. **What have you done, or observed, to make sure that people speak up vigorously when they perceive significant risk?**
4. **What have you done, or observed, to help you sort out the real signals (where you have to act) from noise?**

[3] Turner, B. (1978). Man-Made Disaster, London, Wykeham.

Balance Production, Efficiency and Prevention

In our Round One survey, one of the strongest barriers identified to preventive action is the pressure for production. High expectations of production are important, but when taken too far these pressures increase the risk of catastrophe.

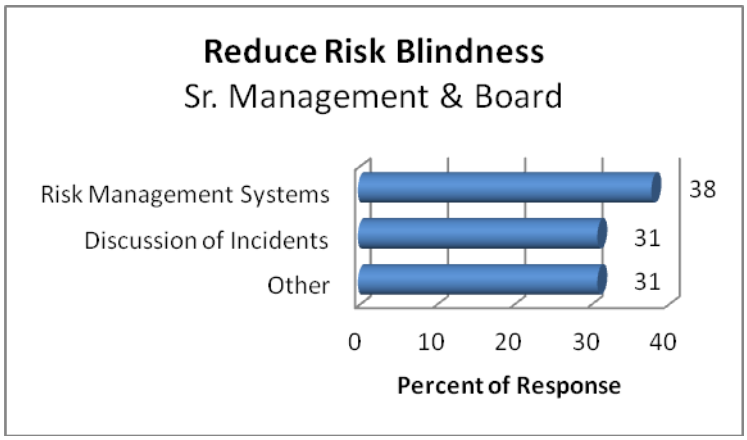
5. **What have you done, or observed, that kept the balance between production pressure and safe operations at the appropriate level?**

Catastrophe Prevention Scorecards

Assume a colleague has asked you to assess her organization's exposure to catastrophic risk. In a company the same size and in the same business as where you work or normally consult.

6. **What would be the top five elements you would rate on your catastrophe prevention scorecard?**
7. **What are the top five elements you would have on your scorecard to evaluate their incident / emergency response system?**

Question 1 (a): Actions that improved the perception of risk by Senior Management and Board Members.



Formal Risk Management Systems and Processes

Preventive action Use of enterprise risk management systems are seen as extremely useful in increasing awareness and understanding of risk by senior management and the Board.

- **Make Risk Management Part of Governance** (9). "An enterprise risk management program is identified as a strategic priority with expectations that it will be implemented throughout the organization." Guidance on making the Risk Management System effective includes:
    - "Develop an overall risk chart which highlights the individual or subsidiary accountabilities for all major risks in the organization; this is accompanied by a formal process of annual review of overall corporate risk by Senior Management & Board Members"
    - "Having an annual cycle of planning where risk areas are deliberately looked at and quarterly reviews done to determine whether anything has changed"
    - "Requirement for a member of the Board to be responsible for risk assessment and to report to the Board on the risk profile"
    - "Normalized trends must be tracked and setting targets at 'industry standards' is not acceptable"
- **Make Risk Assessment Part of Capital and Project Approval** (7). Several participants emphasized the need to "Assess overall risk in the appropriation and approval of capital budgets and projects." Examples used included:
    - "Ensure they are provided with reasonable projected costs and schedules, so they are not mislead into believing that the projects they are approving can be completed at a cost and schedule that is not reasonable to achieve."
    - "Including high level risk in project charter documents and then consistently communicating risk as projects progress and the residual risk that exists despite preventions, detections, controls and mitigations."
    - "Met with senior leaders to ensure they understood the risk of sour gas during planning phase of proposed sour gas exploration program that was close to an urban center. By ensuring that leaders knew the hazard and consequences, even though the likelihood was remote it helped the team to understand the need for rigorously following all of the steps recommended for industry in IRP1."

Discussion of Incidents

Many participants stressed the use of “examples of significant events that have happened internally or externally. Clearly define risk and list the top risks for the company” to raise awareness of risk.

- **Share Examples of External and Internal Incidents** (13). Suggestions for making these examples effective follow:
    - “Show examples from other similar industries/projects in areas normally perceived as low risk. People are more prepared to believe "it can happen here" if they see relevant examples that can be extrapolated to their situation.”
    - “Open discussion at the board level where directors can bring forth their experience in other companies/industries. Note that most directors have or do hold senior executive positions in other companies, so there is a bank of experience that should be utilized.”
    - “Selecting an industry example (it doesn't need to be analogous from the process point of view the undesired action that you're seeing just has to have played a part in the outcome) and walking them through a "this could be us if we cut manpower, cut maintenance initiatives, or skimp on redundancy in a capital project presentation."
    - “Emphasize the consequences experienced by that other entity, especially in business interruption, infrastructure damage, subsequent litigation, and the usual roster of both hard and soft costs. These seeds will probably fall upon fertile ground in these days of unprecedented calamity.”

Other Awareness Tools

- **Emphasize Personal Liability** (4). Legislation and legal precedent make “Senior Management and Board Members ultimately responsible for catastrophes.” “Ensure they know they have skin in the game;” and “personalise the potential for risk.”
- **3rd Party Assessment** (3). “3rd party independent reviews of safety and risk identification that are reported directly to the Board are invaluable.”
- **Regulatory** (3). “Reference to regulatory requirements” is useful for raising risk awareness.
- **Education (2).** Education of Senior Management and Board members is suggested for:
    - “Risk perception and analysis”
    - For those “unfamiliar with high level specifics of certain corporate operations or locales of operation. The better educated that decision makers are, the better prepared they are to understand risks.”
- **Culture** (1). “Encourage and inspire an open and communicative culture, within as flat an organization as practical with measurable targets and personal accountability.”

Advice on Presenting Risk Information to Senior Management & Board

Two people shared their strategies for communicating risk information to Senior Managers and Board members. Outlines of their approaches follow:

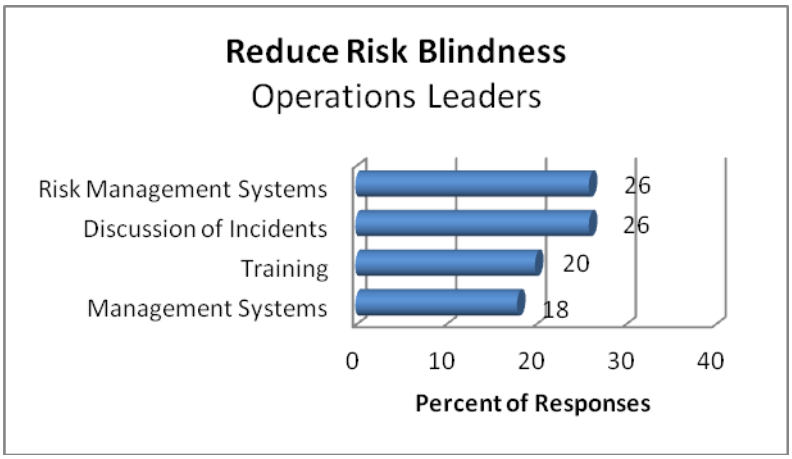
- **Communication Strategy 1**

  "Perhaps the single most telling factor is to develop CREDIBILITY with Senior Management. If they have a conviction that there is a foundation of experience, common-sense, complete honesty, and objectivity supporting the words that are spoken, it helps to dispel any idea that there is an "agenda" driving what they are listening to or reading. This impression is bolstered by an offer to meet and frankly discuss the perceived risks, the consequences, and the likelihood of occurrence in complete candour at a time and place of their own choosing.

  Senior Management is perhaps so isolated from the process details of their own industry that, once confronted by a "problem," they are unable in some cases to devise a solution. Offering several solution alternatives for further study would give them a way to authorize a go-ahead and, in doing so, feel that they had effectively dealt with the problem in the manner intrinsic to their roles as Senior Management."

- **Communication Strategy 2**
  1. "Clearly articulate the cause, probability and consequences
  2. Gain internal support of your view through a broader stakeholder consultation before raising the issue
  3. Make sure they truly understand the need for senior management to understand the business"

Question 1(b): Actions that improved the perception of risk by Operations Leaders.



Risk Management Systems & HazOp

Skilled use of risk management systems and HazOp processes are seen as critical for improving the perception of risk by Operations leaders.

- **Risk Assessment and HazOp** (10). Examples of the skilled use of these systems include:
  - "Operations Leaders must conduct a Job Hazard Assessment Review exercise of all of the major activities that will be required to complete the project."
  - "Involve the Operations Leaders in **Key Issue Management**. This formal process involves identifying large impact risks six months to a year in the future and planning effective mitigation of those risks. "
  - "Assess a wide spectrum of risks, e.g. public safety risks, financial risks, project management risks etc.
  - "Periodic updating of risk profiles and risk reporting to the appointed Board member."
  - "Hazard ID or risk assessment discussion but encourage them to think about worst case scenarios and get them all down on list - more portrayed as brainstorming in the first pass. Once have this list of possible but (in many peoples minds) highly unlikely events then start systematically working way through list. Who ever is facilitating the discussion has to be persistent in encouraging people to think of ways that this worst case scenario could happen. The discussion and thought process can lead people to realize the perceived highly unlikely is much more likely and hence require mitigation plans/actions."

Discussion of Incidents

The discussion of near catastrophe and real catastrophe examples is seen as an important risk awareness tool.

- **Discuss Internal and External Incidents** (10). Incidents internal to the organization and those from other organizations in the same and similar industries increase risk awareness. Examples of how to conduct these discussion include:
    - "Show examples from other similar industries/projects in areas normally perceived as low risk."
    - "Annual Safety Briefings - Ops Leaders must be front and centre to reinforce a culture of safety and risk identification / mitigation. Annually (perhaps bi-annually) halt operations and have a corporate-wide safety briefing that highlights the accidents, near misses and buffunary that has occured over the past operating year. Stress that each person (leader, manager, operator) has the accounability to halt the operation when they witness potential safety hazzards or risks. "

Training

- **Provide Training for Managing Risk** (8). "Process safety training for our leadership team" is seen as important:
    - "Having workshops that bring differing views on risk, potential broader consequence discussions, provide systems perspective, involvement in risk identification and mitigation planning."
    - "Preach one principle for risk management that is against the "common wisdom," i.e., "Don't fix it if it's not broken." "It has worked well so far" is not a guarantee the system is safe."
    - "Encouraging interdisciplinary forums amongst leaders to enhance their understanding of how the business works as a whole and thus appreciating how seemingly benign actions/processes taken by them can have a catastrophic impact when combined with other seemingly benign actions/processes."

Management Processes

- **Align Management Processes for Process Safety** (7). Tuning of management processes to reinforce process safety was emphasized. Each comment in this area is included here:
    - "Personal accountability, commitment, communication and frequent contact with staff on safety/risk matters."
    - "Implementation of strong oversight programs to confirm compliance and identify continuous improvement opportunities."
    - "An organizational reorganization was implemented with the primary purpose to increase oversight."
    - "Clear accountabilities for leadership setting expectations on compliance."
    - "Implementing aligned safety/risk performance targets for operating teams and measuring same."
    - "Each Leader is acutely aware, also, of his Operating budget and the costs associated with mitigation will perhaps be one of the foremost thoughts on his mind. It is useful to emphasize that the costs cannot be accurately estimated until a series of viable alternatives are formulated and that the costs can be minimized if one or more creative solutions can be devised by all Operating entities working together. As a footnote, the costs of mitigating a vulnerability to catastrophe should probably be borne by a special corporate budget item established for that purpose."

- "Risk identification needs to be institutionalized - at the outset of EVERY briefing, risk profiles and safety considerations must be addressed. If these considerations are set aside for expedience or cost, cynicism will immediately set in and undermine the programs. Treat safety and risk management personnel as professionals and reward them accordingly - the challenge and cost of readiness is vastly lower than the cost of clean-up or loss of life."

Other Awareness Tools

- **Personal Liability** (3). "Personalize the potential for risk."
  - "Personalise the potential for risk."
  - "Legislation that makes Senior Management and Board Members ultimately responsible for catastrophes responsibility gets pushed down."
  - "Ensure the operations leaders are trained and accountable to go to the homes of injured personnel to speak with the loved ones of injured / deceased personnel and to explain how / why the risks were somehow overlooked and the injuries / accidents sustained."
- **Change Management** (1). "Before proposed changes to programs or operations are implemented, risks are first identified and assessed prior to the changes taking place."
- **Involve in Planning** (1). "Operations Leaders must be involved in the planning phase of the project."
- **Communication** (1). "Operations Leaders must open communication and trust with both the Operations staff and their Senior Management; they must inform all, the identified concerns and /or potential problems and develop action plans on reducing these risks."
- **3rd Party** (1). "Use of Insurer and Underwriter reports and presentations."

Advice on Presenting Risk Information to Operations Leaders

"Operations Leaders often feel that they should know the industry processes intimately. In many cases their specific knowledge, derived from the days when they were Operations Staff, is dated. This can be used to good effect if the nature of the risk is characterized as arising out of process changes that were made to effect economies of production. In this way, they lose the defensiveness that might otherwise attend the announcement of vulnerabilities inherent in the process stream. It also places the burden of having created the vulnerability 'elsewhere.'

While a process vulnerability may fall largely or completely within the purview of only a few Operations Leaders, the potential impact of a force exploiting that vulnerability crosses all borders. In many cases, a solution effectively addressing the vulnerability will require the cooperation of nearly all the Operations Leaders of the affected industry group. For this reason, all must be vividly aware of the consequences to their Operating area should a catastrophe occur in another, remote area."

Question 1 (c): Actions that improved the perception of risk by Operations Staff.

Risk Management Systems

A mixture of three approaches is suggested to "encourage and instil a culture of risk based decision making in day-to-day operations."

- **Discuss Risks with Staff** (6). Use "toolbox talks and safety meetings / discussions to raise risk awareness."
    - "Use of hazardous identification, pre-jobs, and tailgate meetings are standard protocol. The output of these programs raises the awareness of potential events."
    - "A field/plant walk down prior to commissioning/start up or restart where discussion tracks startup sequence and at every action point (eg: open valve T201) identify what equipment/piping/instrumentation/valving now is in play and what risks does that present. Being right out in the operating plant can prove to be beneficial."
    - "Conduct Job Safety Assessment prior to beginning activities with all of the personnel that will be involved in the activities, also when changing crews or making changes to the crew structure."
    - Continually assessing the risks also ensures work is completed safely at the field level and identified hazards are quickly addressed. "
    - "The brainstorming let's get all possible risks on table no matter how unlikely you perceive them to be discussion/meeting then start the discussion on even though risk percieved to be low how could it happen. Facilitator has to keep pushing to explore the possibility that one of unlikely risks may actually be much more likely than popular perception."
- **Review Identified Risks** (4). Make sure that risks identified at other levels are clearly communicated.
    - "Fully review the identified and / or potential problems identified by Operations Leaders and developed plans on how to remove or reduce these risks to the lowest denominators." But "but don't take away the need for them to use common sense."
    - "Sharing risk mitigation strategies in programs and other published materials."
    - "Annual Safety Briefings"

- **Build the culture** (2).
    - "Risk identification needs to be institutionalized - at the outset of EVERY briefing"
    - "Encourage and instil a culture of risk based decision making in day-to-day operations."

Other Awareness Tools

- **Discussion of Incidents** (9).
    - "Following up on accidents/incidents both within and out of our jurisdiction."
    - "Personal knowledge of individual(s) involved in actual events." (2)
    - "Awareness of consequences - i.e. reviews of past catastrophes to illustrate that 'it could happen to you'"
- **Training** (8). Two types of training are seen as important: broadening individual's competency and risk analysis training."
    - "Educating employees how their job fits into the established procedures or systems;" "Increase their competency or skills to understand the operations and business."
    - "Creating awareness that their actions may have implications to the actions of others."
    - "Ensuring that the established procedures and systems are well understood and why they are important."
- **Management Systems** (6).
    - "An organizational reorganization was implemented with the primary purpose to increase oversight."
    - "Active monitoring and networking;" and "On-site safety supervision."
    - "Incentives and recognition"
    - "Personal accountability and performance measurement"
- **Personalize the Risk** (2).
- **Two Way Communication** (2).
- **Planning** (1). "Engage them in the planning phase of the operation."
- **3rd Party** (1).

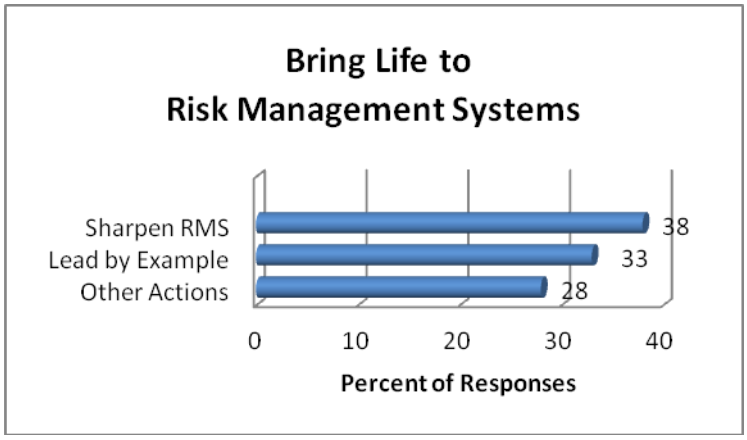
Advice on Presenting Risk Ideas to Operations Staff

"i. In my experience, this is a "soft sell." Those close enough to the process to understand it completely are not only able to quickly and affirmatively grasp process vulnerabilities, they have probably thought about this for years and formulated a few of their own. To that end, it is much easier to engage them in the solution formulation than with others at higher management levels. There is also, often, an innate sense of pride in having had a hand in improving what they are dealing with on a daily basis.

ii. The exception to "i." above is those individuals who see themselves as cogs in the machine or, worse, teeth on the cog. To these individuals, there is a need to emphasize the personal nature of a catastrophe in terms of lost wages, joblessness, personal injury, or death.

iii. Staff may feel distanced from the decisions being made by Senior Management. There is an opportunity to address this and, at the same time, engage their active participation by pointing out that Senior Management has authorized this mitigation project as a means of improving process reliability, safety, and business continuity all of which means that the Staff will be able to work safer and without calamitous interruption to their livelihood."

Question 2: What have you done, or observed, that has brought life and effectiveness to formal risk management systems?



Sharpen the Risk Management System (RMS)

- **Fit Implementation to Practical Realities** (8).
  - "A corporate risk management framework was implemented at the corporate level, with the expectation that it will be applied throughout the organization."
  - "Formal system, but it is risk based and a hybrid of industry complex systems, very practical."
  - "Focus on in the field controls and activities / expectations clear and linked to leading and lagging indicators."
  - "Carry out risk matrixes at operational/individual project level and ensure front line staff have input and discussion on the risks identified/ mitigation actions agreed upon."
  - "Look for common themes in the rollup of the individual operations or project areas. Often each group or area has one or two unique risks that get the major focus and airtime but everyone has some (at least in their perception) lower level risk but the fact it is common to many means its a significant risk for the corporation (especially if perception of likelihood of occurrence is too low)."
- **Ensure RMS Training is Thorough and Effective** (4).
  - "Engage the appropriate personnel from all levels of the organization so that the risk management system is understood and is applied."
  - "Ensure that all involved are fully versed in the formal risk management plan and are following the plan, communicate with management and make adjustments when necessary."
  - "Staff training in the procedures, together with sessions using examples of disasters which have occurred elsewhere when these were not followed."
  - "Regular training, updating and communication of any RMS are important at all levels in the organization. Time must be set aside on a regular basis to discuss and evaluate the RMS and its effectiveness."

- **Conduct Effective HazOp Meetings** (3).
    - "Make sure that all of the right people are brought into meetings where hazards are being discussed. Cancel meetings if all of the right people are not there."
    - "Ensure that someone is playing the devil and asking hard questions. Make sure that that person's concerns are heard."
    - "People get worn out when they talk about hazards all day. Limit Hazard reviews to 3 hours at a time with a day or 2 in between to think about what was discussed before returning to continue the process."

Lead by Example

- **Build the Culture by Walking the Talk** (10).
    - "Board and senior Executive team "walking the talk" about RMS all the time even if it costs more, reduces earnings, disappoints shareholders or analysts or results in dismissal of a senior executive. RMS can't be seen as being implemented only 'when it doesn't hurt.'"
    - "Culture is King - the culture and values of the organization will always trump controls. Ensure doing the 'right' thing is always rewarded over setting aside safety and risk for timeliness or the $."
    - "Not all systems are really "used" in these companies. Don't just talk about it and hope the risk event never happens, but act to identify, analyze, eliminate or mitigate with discipline, particularly act to mitigate."
    - "Develop a safety & risk awareness culture; safety & consideration of risks is not someone else's responsibility. It must have personal ownership from the CEO, through management and staff and must be consistently communicated as such. Insisting on an open, communicative culture without fear of reprisals is paramount as part of an effective risk management system."
    - "Refusal to sign off project plans which do not have a formal risk analysis."
- **Demonstrate Commitment through having Senior Leaders Visible in the Field** (3).
    - "Field visibility - senior people actually walking through the installations, making comments and suggestions and most importantly soliciting suggestions/concerns and listening to responses. Creating action lists (and acting on them!)"

Other Actions that Bring Life to Risk Management Systems

- **Discuss Incidents** (3).
    - "Review case histories and learn from others (e.g. company leadership & staff should review why RMS have not prevented massive catastrophes elsewhere and try and understand why many RMS are lifeless and ineffective)."
- **Personalize the Risk** (3).
    - "Risk management systems do not necessarily bring home the consequences of catastrophe to the senior management, nor do they always mitigate the risk - Senior management need to be made clearly aware of the personal consequences to themselves as well as others in case of a catastrophe occurring. The personal consequences should apply even after those responsible have left the job."
    - "Governments implement risk avoidance processes (e.g., SOX) and mandate them."
- **Enable Whistle Blowing** (2).
    - "Whistleblower programs and associated training"
    - "Being prepared to whistle blow when formal risk assessment has not been carried out and senior management has not been prepared to insist that it is."

- **Use 3rd Party Reviews** (2).
    - "Third party reviews that are independent of internal incentive programs."
    - "Utilize external experts to provide cold eyes oversight and gap assessments, focus on improvement rather than audit failure."
- **Establish Project Governance and Oversight** (1).
- **Insist on Sign-Offs** (1).
    - "When being requested to undertake activities considered hazardous or unsafe, have the request put into writing and signed by the requesting party, so they are aware that the activity is being conducted at their request and are responsible for the outcome."

Advice on Implementing Risk Management Systems

- **Steps to Successful Implementation**
    1. "Instituted conformance checks on actual risk levels to targets/policy.
    2. Perform governance reviews on risk elements.
    3. Provided visibility of performance against risk acceptance targets throughout the organization.
    4. Identifying employees' job functions directly to risk mitigation."
- **Managing Process and Maintenance Vulnerabilities**
    1. "Perhaps a process vulnerability is a little like a hole in a boat. If the hole is near a seam or near a rib and the boat is on dry land, one has to look very carefully to find it and, even then, there may be a host of others that will minimize its importance or do not see the hole at all. When the boat is put in the water, the hole is obvious and starts leaking. At this point, there is debate about whether or not to make port and repair it or just do what little bailing is necessary to keep the boat afloat. If the same hole is located in a nuclear submarine cruising for months on patrol below the polar ice cap, the hole is a major catastrophe. It is not the nature of the vulnerability that marks it as a potential source of catastrophe; it is the forces that exploit the vulnerability that create the catastrophe. We had an instance where a "Perfect Storm" triggered the coincidental simultaneous failure of two protection devices. Recognizing that such a coincidence was not statistically unique, a complete forensic examination was launched, the results of which will guide improvements in electromechanical design and will be shared across the entire industry.
    2. Often, the maintenance or upgrading of process machinery is guided by one of two alternatives: repair to restore original condition or replace in kind. The assessment of present adequacy is often solely visual and no detailed analysis is done to quantify the serviceability of the equipment. Seeking to get a better "handle" on how well elements of our infrastructure were holding up and to quantify an expected service life, we have recently added finite element modelling capability to the engineering department. Although, for its "stated" purpose, this may not constitute a risk management system, it will nevertheless be employed to that end. The greatest risk facing any industry with a large inventory of static, exposed infrastructure elements is the gradual weathering deterioration of those elements and the effect of that deterioration upon serviceability and system reliability. We have long collected data on the physical inspection of these elements. Adding this analysis tool will provide the ability to objectively quantify their present condition, forecast a likely service life, and schedule timely interventions to mitigate the catastrophic consequences of isolated or simultaneous failure."

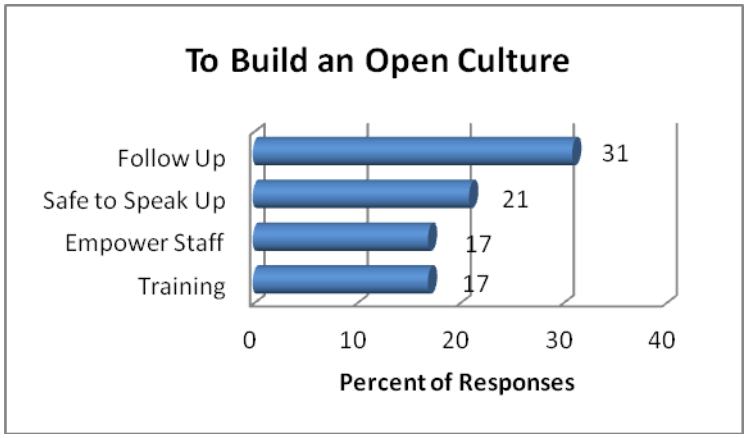
Question 3: What have you done, or observed, to make sure that people speak up vigorously when they perceive significant risk?

Build an Open Culture

Participants described the kind of organizational culture that encouraged people to speak up about risk. Characteristics of this culture included:

- "No-blame culture - encourage communication at all levels. Reward this type of behaviour."
- "Create a culture for people to feel safe to offer opposing views openly (feel free to blow the whistle)."
- "Creating an environment which does not penalize the messenger is important - and maybe even rewarding the messenger?"
- "Developed a culture where the onus and personal accountability is on everyone in the company to take responsibility for awareness and attention to risk warning signs WITHOUT fear of reprisal."

How to Build an Open Culture



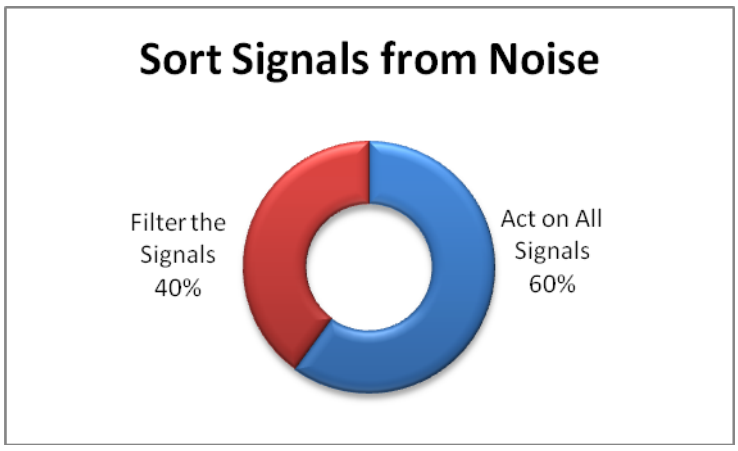
Participants outlined actions they had taken to build open communication cultures that encouraged people to vigorously speak up about perceived risk. Key actions were:

- **Follow Up** (9). When people do speak up they need to know that their concerns have been heard and considered. Examples of useful follow up include:
  - "Always follow-up with the person raising the concern - whether or not you decide to take action - so that the person has a sense that his or her concern was treated appropriately."
  - "Have personally approached individual and thanked them for bringing forward an issue."
  - "Provide positive feedback when people do speak up and make sure that they are aware that senior management are acting on the issues raised. "
  - "This takes constant reinforcement at project meetings, town hall meetings, new hire orientation and so on. Following up on people's smaller concerns will make them more comfortable that their thoughts and concerns are acted upon and it makes them more likely to bring future ideas forward."

    - "Making After-Action Reviews a part of everyday business where everyone feels comfortable admitting problems without fear of judgement is key. Ideally the leader shares his/ her own failures/ issues first to make it easier for folks to admit their faults."
    - "Opened my door to listen. Acted publicly on an issue presented by my open door policy."
    - "I have gotten calls from the field and have acted, as promised, immediately to investigate the condition, follow up with a Thank You call to the caller and updated him on what was being done."
- **Make it Safe to Speak Up** (6). Leaders must act appropriately when people speak up but there also has to be safe channels outside the supervision chain to enable some people to voice their concerns.
    - "Senior leaders visit sites, walk shop floors and have meetings with staff without front line management."
    - "Emphasize culture & ownership of outcomes at all levels. NEVER shoot the messenger."
    - "Ensure the safety boss has a direct reporting line to the CEO / Board and is not silenced by the reporting chain."
    - "We encourage people if they don't believe they are being listened too, to use our hot line."
    - "Provide for independent receipt of messages."
    - "There must be an independent person to whom the whistle blower can speak and the whistle blower must be told the outcome of the investigation, which may be that he or she was mistaken - but it must be transparent."
- **Empower Staff** (5). Staff members are more likely to speak up if they are involved in the early stages of planning and if they have the power to stop work when facing unsafe conditions.
    - "We use a broad cross section on employees in scenario planning around worst case scenarios. This gives everyone a chance to speak up."
    - "Know your people and trust those with a track record."
    - "We enforce a right to refuse work."
    - "Empower individuals to stop unsafe work without fear."
    - "Make explicit statements in unambiguous language –'You are empowered and expected to halt production at any time in response to a perceived risk or hazardous situation.'"
- **Provide Training** (5). Three types of training were identified: training management on how to engage in two way conversations about risk with staff, training staff to how to speak up, and training staff on risk assessment.
    - "We provided training to management on how to engage in the discussion and facilitate a mutual understanding of the actual risk."
    - "We have implemented a formal "finding your voice program" through our safety training with an at-work and at-home focus."
    - "'Crew induction' - a multi-day event hosted by line management, where contractor crews are made to feel "part of the team", where all are encouraged to speak up and 'stop the work' when they perceive that something is not right."
    - "We have embarked on a training program with front line to teach what risk is and how to quantify risk."

- **Others** (8).
    - "Promote such people to show the organization that we don't always value only the 'yes men'."
    - "Performance bonuses that are tied to safety performance - a simple lost time accident or environmental incident can cancel out any performance bonus otherwise earned."
    - "Required all incidents be documented, reported and addressed/resolved jointly by management & staff within a set timeframe."
    - "Our communicated operations culture is quantitative risk based which encourages alternatives and the use of facts which provides encouragement to speak out."
    - "Identify complacent behaviours or alarms that are no longer noticed as anything but nuisances."

Question 4: What have you done, or observed, to help you sort out the real signals (where you have to act) from noise?



Investigate Signals with Diligence

There was very strong reaction to the implication in the question that some signals should be ignored. 60 percent of responses said “All signals need to be treated as real until thoroughly investigated and found otherwise.” Others see the need to filter these signals to quickly identify those associated with real hazards.

- **Act on All Signals** (9).
  - “The fire department responds to all alarms even though they know that a large percentage are "false alarms" many rung in by folks with legitimate concerns/fears.”
  - “EVERY signal gets a close-quarters evaluation, regardless of the "apparent" seriousness of the condition. . . . Every "signal" is considered "real" until conclusively proven otherwise. To do less is to employ blind judgment as a catapult to folly.”
  - “Tried to react to all verbal or written signals – not to prejudge it was noise – a little digging normally soon identifies if it is just noise – often failed to do this the first time due to pressures of the job and it has cost.”
  - “Listened really hard and openly to a persistent employee – when the individual came the second time and near pleaded it really caught my attention.”
  - “I subscribe to the 'pyramid' or 'iceberg' theory of noise/minor incidents/serious accidents (i.e. there are numerous minor incidents or 'noise' which if not reported and considered, can lead to complacency and an ultimate fatality or serious accident). Thus I believe it is imperative to report and address all incidents (including what some would consider noise) in a deliberate process to avoid a significant occurrence, rather than to help sort out the real signals from noise.”
  - “Do not disregard "gut-feel" from experienced staff. Once the "gut-feel" is voiced, steer the people into fact-based evaluation of their "gut-feel" to determine if the threat is real.”

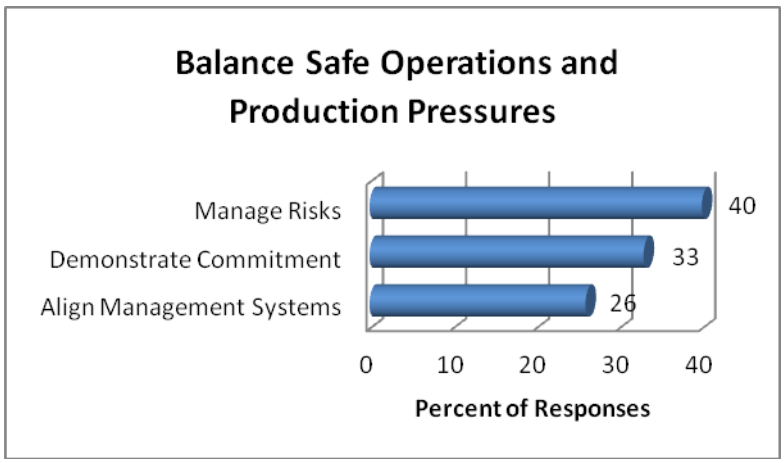
- **Filter Signals** (6).
    - "There is always "noise" that needs to be sorted out from the key signals. I am not an expert on this; however, it is an art and not a science. Judgement and actions are key in being able to do this well."
    - "(1) Once actual or agreed upon risk level is determined compare it to your known risk levels or your risk acceptance tables. (2) We use priority models to bring perspective to perceived risks."
    - "Score and sort the risks from high to low. To do this you need common definitions and method of scoring the risks. Also need to update this information as the situation and risk changes."
    - "Evaluate who or what is triggering the risk signal. Is it a reliable source? If it is a person and they constantly talk about many catastrophic imagined risks, then this may be less reliable than the knowledgeable person who raises this."
    - "Not sure about this, but perhaps having a separate risk and contingency planning team would provide an impartial view and evaluation of risk."
    - "Put in place a review and filtering system to identify 'real signals'. Assess the risks using competent assessors."

Improve Quality and Quantity of Signals

- **Leaders Act Appropriately** (4).
    - "Senior leaders must know the operation and be present to ensure they speak with operations staff to:
        1. validate the signals regarding pressure to deliver etc.
        2. view, first-hand, the systems in place to identify risk / safety considerations
        3. review independent assessments of safety and risk programs; and
        4. personally validate the effectiveness of the culture / behaviours in relation to the incentives and rewards."
    - "It's often best that the leader not attend all the meetings. A fresh set of eyes is key to seeing issues. If you are too close to the activity by being involved in all the decisions it is more difficult to see problems starting."
    - "Two steps - Build trust with at least a few front-line operators - individuals who are knowledgeable, experienced and not concerned with political correctness. Talk directly and informally with these front-line operators - at least quarterly if routine operations are involved - more frequently if a project or high risk activity is occurring. If the project is in planning stages then replace the "front-line operators" with front line design and operations representatives."
    - "Leadership visibility in the field for real feedback, observations etc. by all levels of leadership."

- **Assess and React to Data** (4).
    - “Enterprise data gathering systems must provide comprehensive and accurate information. Ensuring those collecting and entering data understand the value of trends. If data is 'noise' then it has no value.”
    - “The noise level is important as a measure of sloppy management. Injury and minor incident rates etc. are a symptom.”
    - “Conduct annual employee feedback surveys with 90% engagement scores.”
    - “Regular unannounced inspection by an independent internal inspector ("we are from HQ - we are here to help you") is needed to ensure that procedures are followed and that nothing untoward is happening. The manual should say when outside advice is mandatory.”
- **Improve Your Knowledge** (2).
    - “Get really strong on identifying the risks.”
    - “Need to learn the knowledge and develop the sense through experience focused training and on where a hazard can turn into a disaster.”
- **Respect Technical Specialists** (1).
    - “Respect your technical specialists who really understand the business and operations and value their views.”

Question 5: What have you done, or observed, that kept the balance between production pressure and safe operation at the appropriate level?



Not Always Mutually Exclusive

"In all cases safety of people and the environment need to be maintained even at the cost of productivity, when necessary shut down and re-evaluate; - my experience is that the two are not mutually exclusive if you have the proper open culture with an accountable and trained team. My objectives (aligned with those of a trained and motivated team through performance targets linked to incentive pay) are top quartile operational performance/productivity and similar top quartile safety performance. The balance is achieved through personal accountability of everyone on the team to keep the appropriate balance."

Establish Constant Vigilance

- **Discuss Project / Operations Risk** (5).
  - "Always ask question of staff if we do "this" what are the new risks that we expose ourselves to or the identified risks that we increase."
  - "One executive I worked for was very demanding but always asked (if you didn't point it out) "what's downside/risk and how can we manage it". Any issues brought up were thoughtfully discussed not summarily dismissed."
  - "Include health and safety issues in a project at an early stage and ensure that Clients are aware of the consequences of not investing adequate time and resources to avoiding incidents including catastrophic ones. Prioritise health and safety."
  - "Ensure that all deliverables are reviewed for quality (completeness, correctness, etc.). Establish a review board external to the project organization."
  - "Third party cold eye reviews."
- **Use Risk Assessments** (3).
  - "Make the carrying out of proper risk assessments and hazard analyses part of the everyday culture. Pass on the findings to the Client and the site team(s) and ensure that they buy in to the control and mitigation measures. Point out the consequences of a catastrophic event to the Client - including cost, public image etc."
  - "Clear standards of acceptable risk must be established and understood by all."
  - "Integrate production risks into an overall operational risk matrix, i.e. include various types of consequences in risk matrix."

- **Stop Work to Review Risks** (3).
    - -"crew induction" - a multi-day event hosted by line management, where contractor crews are made to feel "part of the team", where all are encouraged to speak up and "stop the work" when they perceive that something is not right."
    - "Every person whose life is on the line has the ability to halt the operation for risk / safety based considerations."
    - "It is not uncommon for Alberta construction sites to have "safety stand downs". The whole site is shut down for a day (or half day) to reinforce some specific issue (like vessel entry procedures, or slipping hazards at the onset of winter)."

Demonstrate Commitment to Safe Production

- **Walk the Talk** (8).
    - "Through continuous and consistent communications we have discussed the realities of competing objectives. We have publicly declared to all our employees and contractors that safety is "not" a priority, it is a "value". Priorities change from time to time, but safety is a consistent effort that will not be compromised by any business priority."
    - "It takes personal commitment and explicit direction that production is always secondary to safe conduct and operations. No record or budget achieved is as enduring as the fallout from an incident. Remind people of this."
    - "Ensure the understanding that the longevity of the operation and production is equal as, or even more important than, the short term production to the shareholder's value."
    - "Demonstrated support from leadership to communicate production targets are important, but safety parameters are not compromised to do so."
    - "Pressure to produce on a construction site is always high but particularly so during heavy lift programs. Everyone is under pressure to complete work that requires costly heavy lift cranes. Severe weather conditions (rain, wind, cold temperatures, etc.) can increase risks in heavy lift operations to a point where the operation should be curtailed. The people supervising these operations are encouraged to consider the risks and the ramifications if something were to happen during that temporary period of severe weather conditions. Is it better to stand-down for a two-day period to let the severe weather to pass or risk a two-week shut-down for an accident investigation?"
    - "Hire and retain great people - people who care AT LEAST if not MORE about their people than they do about the excel spreadsheet. And - then trust them. The operational commander in the field should never be trumped by someone in head office who is headed to his yatch or not standing on the platform."
    - "Actively demonstrate the above through supporting schedule delays and productivity interruptions in the name of safety regardless of production implications. We have a rankless protocol that enables any employee to intervene."
    - "It's important to set a good example. Bosses that make production the first and last thing that are talked about make the inadvertent message that production is most important. Starting meetings with Safety Moments or a discussion about safe work practices/ initiatives being run and ending with a discussion about the safety impacts of activities sends the message that we are about doing things safely."

Align Management Systems

- **Align the Reward System** (3).
  - "Performance bonuses that are tied to safety performance - a simple lost time accident or environmental incident can cancel out any performance bonus otherwise earned."
  - "Compensation incentives are tied to long term performance of the operations and production, particularly for the management."
  - "Have equal weighting of safety and production in KPI's."
- **Align the Structure** (2).
  - "Our organization has split P&L (production) from actual plant operations. This forces the conversation to balance risk/reward. Once tolerance levels in the plant are set they cannot be exceeded by local management. Escalation and variance approval are required by senior leadership."
  - "Conversations between P&L and Operations senior leadership occur frequently to ensure proper balanced risk/rewards are set"
- **Build Solid Operational Procedures** (2).
  - "Other checks and balances as appropriate to the project. E.g., are the people trained? Has the team had safety training before implementation on site? Etc."
  - "Proper manuals which are adhered to. Inquiries if they are not. Like they will now carry out at the Japanese Nuclear Plants where inspection documents have been routinely falsified."

Potential Causes of a Risk / Production Imbalance

"There is no doubt that production pressures have overridden safety and caused many serious accidents/catastrophes. In my view though, some of the underlying causes do not necessarily result from an improper balance, but rather from: poor training; poor or lacking operating procedures; accountabilities which do not rest with each individual (but someone else); non-communicative leadership or a 'fear of reprisal' culture to name just a few."

"Perhaps many processes were originally designed holistically "back in the day" by engineers dedicated to the anally retentive investigation of process reliability. Such processes may have operated in their original configuration for many decades and, in doing so, provided a high level of comfort regarding their reliability.

At least two types of actions since the original design have been at work:

1. Environmental and operational degradation and
2. Process "improvements" implemented to increase productivity, reduce costs, or both.

It is, perhaps, useful to point out that the process has yielded a higher rate of production in response to (2) in spite of degradations occurring as a result of (1). Furthermore, it is sometimes the case that measures implemented under (2) have actually introduced vulnerabilities that would have been caught had the same anally retentive effort been exerted that produced the original configuration.

In continuous supply-line production industries such as ours, it is essential to devise means whereby sections of the production machinery may be studied in detail and, when necessary upgrades for mitigation have been identified, take this portion of the system out of service to implement the upgrades. If, in other industries, this cannot be done, an overarching vulnerability has been automatically identified! Redundancy is now commonly recognized as an essential feature of catastrophic event mitigation."

Question 6: What would be the top five elements you would rate on your catastrophe prevention scorecard?

Risk Management System

- **Comprehensive Risk Management System**
  - A comprehensive risk management system is in place, encompassing risks throughout the enterprise. Process Safety and Health, Safety and Environment risks are included.
  - Risk analysis is conducted as part of project and capital approval
- **Detailed and Diverse Input to Risk Analysis**
  - Knowledgeable people from a multitude of disciplines provide input to risk assessments
  - Internal worksite and project inspections are conducted and reported regularly
  - Incident investigation processes identify and communicate root causes
- **Third Party Review**
  - Independent inspections and / or audits are used to assess key risks
- **Systems in Place to Ensure Reliable Data**
  - Frontline employees are empowered to stop work in unsafe conditions
  - Whistle blower protection is in place and used

Health, Safety and Environment Performance

- **Compliance and Incident Performance**
  - The organization meets or exceeds government regulations
  - The organization tracks and reports all safety statistics, including near misses
  - Five year trends of incidents are at or above industry norms

Operational Excellence

- **Operational Performance Measures**
  - Performance on operational measures, specific to the industry. Examples: Plant reliability, operational costs, project delivery, production volume, etc.
  - Performance on equipment integrity and preventive maintenance, including completion rates, work order backlog, etc.
  - Attrition - are good people bailing and what are they saying on the way out the door?
  - Continuous Improvement is demonstrated through improved deliverables over time
- **Staff and Leadership Competence**
  - Frontline staff and operations leaders know their roles and how to do their jobs.
  - Senior leaders really understand the business and operations, including the technical details.
- **Procedures**
  - Procedures and systems are established and regularly tested. Results of these tests are made widely available and discussed openly.
- **Management of Change**
  - Management of Change processes are implemented, well understood and used with diligence. Audits of management of change are conducted regularly.
- **Operational Discipline**
  - Leadership is visible and active, accountabilities and roles are unambiguous, operations controls are in place.
  - Operating limits are clarified, compliance measured, and exceptions reported.
- **Process Redundancy**
  - Critical processes are identified and redundancy established where appropriate

Organizational Culture

- **Risk Management Culture**
  - There is a culture in the organization that empowers risk identification and actively evaluates and effectively mitigates real risks. People are not complacent about risk.
  - People speak truthfully about the safety & risk mitigation programs
  - Senior management and the Board demonstrate visible commitment to risk management. Indicators of risk are actively monitored.
- **Governance**
  - Active governance of risk is correctly established and widely understood
  - Board committees are in place for audit, safety and operations. Committees are comprised of qualified individuals having access to multiple levels of personnel in the organization.
  - Sound decision making processes are established at the executive and board levels.
  - Regular systems are established for reporting, measurement and follow up risk issues. Audits and gap assessments are conducted.
- **Engagement and Open Communication**
  - Senior Management, Operations Leaders and Frontline Staff are all engaged appropriately in assessing and managing risk.
  - There is an atmosphere of openness and empowerment to bring up safety and risk issues at the front line as well as in middle management
  - There is active sharing of ideas in meetings. One person does not make all of the decisions. All concerns are respected and time taken to understand differing points of view.
- **Preventive Actions Taken When Appropriate**
  - Preventive actions have been taken recently as a result of a risk/safety issue being identified
  - Risks are re-evaluated as environmental changes occur. Mitigation is implemented.
- **Organizational Strategy and Systems Aligned with Risk Management**
  - Risks associated with organizational stability are managed. Rapid growth, financial stress and other corporate sources of risk are mitigated appropriately
  - Competitive salary and benefits packages are in place
  - People are rewarded appropriately for managing risk, KPI's include some preventive measures
- **Organization Structure and Vision**
  - There is a visible statement about the corporation's beliefs and some proof that they are practiced.
  - Organization charts are well documented

Emergency Response System

- **Emergency Management / Business Continuity**
  - The organization's emergency response and business continuity capability is detailed, comprehensive and regularly tested

Question 7: What are the top five elements you would have on your scorecard to evaluate their incident / emergency response system?

Hazard Assessment

- **Potential Hazards Understood**
  - All hazards are identified, root causes are identified and common themes addressed
  - Worst case scenarios are included
  - Residual Risk (those risks remain after risk assessment and mitigation actions are completed) are considered in the Risk Identification.
- **Tiers of Hazard Type and Different Locations Encompassed in Risk Analysis**
  - Provides for tiered response to differing levels of emergency. There is a clear distinction between incidents, emergencies and crisis management.
  - Includes provision for geographic distance, time zones, local conditions, etc.

Emergency Management System Overview

- **Procedures are Well Documented**
  - Manual includes full details of immediate emergency action (e.g. dumping product, shutting down power systems etc.) to be undertaken.
  - Manuals and notices show details of emergency contacts for medical, safety and public reporting systems in serious emergencies. Instructions included for what parties to contact in what circumstances.
  - Manuals, procedures, contact protocols and contact phone numbers are tested and updated regularly.
- **Command and Control Clearly Defined**
  - Decision making accountability is delegated to the appropriate level in the organization. Accountabilities are clearly defined.
  - Incident command and control is clearly defined in the Incident Command System.
- **Crisis Communication Plan Part of the Emergency Response System**
  - ERP includes a detailed Crisis Communications Plan which outlines communication roles and responsibilities, communication chain of command and contact tree for external communications and communication with employees
  - Trusted communications channels and protocols established with employees and external groups before the crisis
  - The Communication Plan includes strategies for controlling the message in a Web 2.0 environment
- **Required Resources Identified and Available**
  - Material resources required for managing incidents are identified
  - Procedures for moving resources to location are tested under challenging circumstances
- **Mutual Aid Agreements Established**
  - Processes for sharing of people and equipment with peer companies or industry associations are agreed and tested.
  - Mutual aid agreements are completed with local and provincial emergency response organizations and private companies as appropriate
  - Command systems and processes for collaborative work are agreed and tested.
- **Performance on Previous Incidents at or Above Standard**
  - Performance on previous incidents and exercises is at or above standard
  - Feedback from regulators and local communities on past responses is positive

Readiness Testing

- **Training is Proven to be Effective**
  - Roles and responsibilities are clearly understood and tested.
    1. Operations personnel and senior leaders can describe the incident / emergency response system and explain their roles without referring to documentation
    2. Required third party responders and stakeholders are included in the training and testing
  - Leadership continuity is assured as staff members can assume different roles during an incident response.
  - First responders and the Incident Management Team have demonstrated competence
  - Required certifications are complete
- **Exercises Conducted Regularly**
  - Regular drills and table-top exercises are conducted.
  - Third party responders, agencies, landowners and other stakeholders involved as appropriate
  - Action items identified as part of each exercise and are implemented in a timely manner.
- **3rd Party Assessments / Audits Completed on the Emergency Response System**
  - Independent assessments of emergency response system conducted regularly (minimum annually)
  - Assessments include review of potential risks, readiness to respond to risk and regulatory compliance.
  - Action items from assessments are implemented in a timely manner.

Investigation

- **Procedures Established for Serious Incident Root Cause Analysis**
  - Internal investigation team leaders identified for each tier of incident seriousness
  - Protocols for coordinating with regulatory investigators established
  - Fact finding teams trained to gather data, including eyewitness interviews, as soon as scene is secured
  - Analysis team trained to uncover both the immediate cause and underlying root cause(s)
  - Findings and recommendations distributed widely and action items implemented
  - Follow up occurs after every serious incident to ensure recommended actions are implemented

Continuous Improvement

- **Learning from Incidents and Exercises is Demonstrated**
  - An incident / lessons learned data base is in place and being used
  - Debriefings occur after every incident and emergency exercise. Action items are implemented in a timely manner
  - Learnings from exercises and incidents are made widely available and discussed openly.

NEXT STEPS IN THE RESEARCH

1. Round Three Questions will be developed from the data contained in this report. The Round Three Questions will be sent to participants during the week of June 13, 2011.
2. The Round Three Interim Report will be completed by June 30.
3. The Final Report will be distributed by July 30.

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