Communicating & Managing Risk

The Key Result of Risk Assessment

By Bruce K. Lyon and Georgi Popov

Uncertainty is uncomfortable. Within an organization, it can be debilitating when it comes to making decisions and pursuing objectives. The challenge for OSH professionals is not only to adequately identify, and assess operational risks of a targeted uncertainty, but to effectively communicate its potential risk to decision makers. As stated in ANSI/ASSE Z690.2-2011, Risk Management Principles and Guidelines, "Organizations of all types and sizes face internal and external factors and influences that make it uncertain whether and when they will achieve their objectives. The effect this uncertainty has on the organization's objectives is 'risk'" (ANSI/ASSE, 2011). The standard further describes risk as "the effect of uncertainty on objectives."

Successful business leaders realize that to conduct operations and achieve objectives, management must understand and manage the risks associated with the operation. OSH risk professionals who can facilitate risk assessments and effectively communicate risks to management, in essence, reducing uncertainty, will increase their value to the organization.

The Objectives of Risk Assessment

ANSI/ASSE Z690.2 defines risk assessment as the "overall process of risk identification, risk analysis and risk evaluation" (ANSI/ASSE, 2011, p. 12). As shown in Figure 1 (p. 36), risk assessment is at the heart of the risk management process.

ANSI/ASSE Z590.3, Prevention through Design: Guidelines for Addressing Occupational Hazards and Risks in Design and Redesign Processes defines risk assessment as "a process that commences with hazard identification and analysis, through which the probable severity of harm or damage is established, followed by an estimate of probability of the incident or exposure occurring, and concluding with a statement of risk" (ANSI/ASSE, 2016, p. 13). As these definitions indicate, without risk assessment, risk cannot be managed.

To examine this more closely, risk assessment serves several purposes, all of which should be considered by risk assessors. The objectives of risk assessment are to:

- identify hazards and their risks that threaten the organization and its objectives;

IN BRIEF
- **By itself, risk assessment does not achieve its objectives. Risk communication is required to reduce uncertainty and manage operational risks. Assessing risks within an organization enables decision makers to properly manage risks and make plausible decisions.**
- **Safety professionals must be able to effectively communicate the risk to top decision makers. This requires understanding the nature of the decision to be made, and the specific information needed to help make an informed decision.**
- **OSH professionals should select and design risk assessment methods to identify, assess and communicate not only operational risks and their controls, but also the resulting business consequences and downstream effects.**
- **A sequence of modified and cascading risk assessment methods can effectively communicate risk to decision makers by presenting the linkage between operational risk, OSH risk and business risk.**

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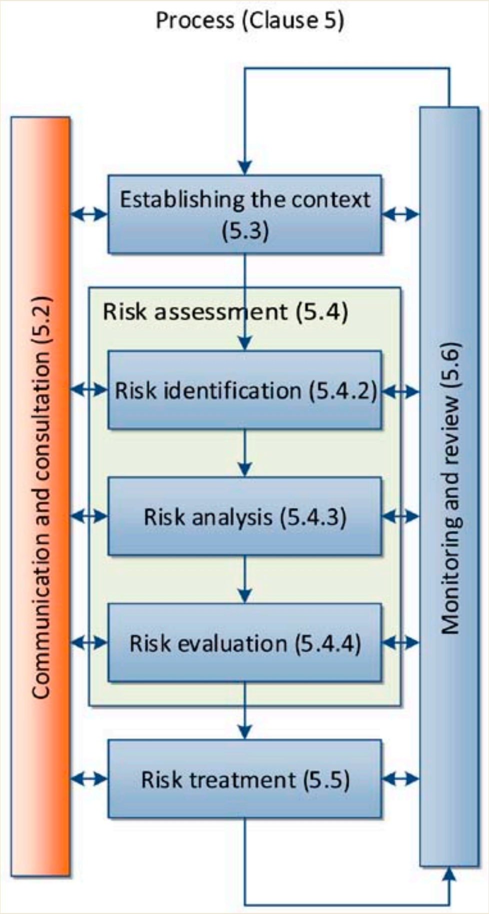
FIGURE 1

Communication & Consultation Throughout the Risk Management Process



Note. *From ANSI/ASSE Z690.2-2011, Risk Management Principles and Guidelines, by ANSI/ASSE, 2011, Des Plaines, IL: ASSE. Reprinted with permission.*

•analyze, evaluate and determine risk levels;

•recommend risk reduction measures according to the hierarchy of controls;

•reduce and maintain residual risk to an acceptable level to the organization;

•communicate risk effectively to decision makers to enable informed risk-based decisions;

•reduce uncertainty;

•help the organization achieve its objectives.

The ability to conduct a successful risk assessment is a critical skill for OSH professionals. However, if the risks identified are not communicated effectively to decision makers, they are of little value to the organization.

Risk Communication

Effective communication is essential to successfully managing operational risk or, for that matter, almost any other aspect of an organization. In Section 5.2, ANSI/ASSE Z690.2 establishes communication and consultation as a major component of the risk management process, and defines requirements for communication with internal and external stakeholders throughout the process. The standard defines communication and consultation as "continual and iterative processes that an organization conducts to provide, share or obtain information, and to engage in dialogue with stakeholders regarding the management of risk" (ANSI/ASSE, 2011, p. 10). It further notes that "consultation is a two-way process of informed communication between an organization and its stakeholders on an issue prior to making a decision or determining a direction on that issue."

As illustrated in Figure 1, communication and consultation are linked to each of the other process elements, signifying the importance of effective risk dialogue with stakeholders, from the beginning stages of establishing the scope, to performing the assessment and risk treatment, to final monitoring and review. The takeaway message from the definition and diagram is that effective communication must be designed and embedded into and throughout the risk management process.

Where communication is ineffective or inconsistent, problems are likely. Most OSH professionals can recount events and experiences where inadequate communication led to unwanted and sometimes severe consequences. Outside of personal experiences, communication breakdowns are cited in many catastrophic events. A quick Internet search for "disasters and serious incidents resulting from communication failures" will return many results. For example:

•Texas City Refinery explosion;

•Toyota Worldwide vehicle recall;

•Hurricane Katrina;

•Three Mile Island incident;

•multiple medical malpractice deaths;

•*Deepwater Horizon* oil spill;

•aircraft disasters;

•Bhopal pesticide plant explosion;

•space shuttle *Challenger* and *Columbia* explosions.

As Abkowitz (2008) states, all disasters, whether accidental, intentional or natural, share common risk factors. In *Operational Risk Management: A Case Study Approach to Effective Planning and Response,* Abkowitz asks the following questions: "Why do these disasters happen? With all our knowledge, skill and technology, why can't we do something to prevent them or at least keep them from causing such devastation?"

Abkowitz's (2008) research indicates that all disasters, although different, when closely analyzed have remarkable similarities in how they were caused or allowed to develop (p. 1-8). These common risk factors include:

1) flaws in design and construction;

2) failure in communication;

3) lack of planning and preparedness;

4) deviation from set procedures;

5) economic pressure and lack of resources;

6) convergence of multiple risk factors overwhelming control measures;

7) political agendas;

8) individual and organizational arrogance;

9) lack of uniform safety standards;

10) not taken seriously by decision makers until a disaster occurs;

11) risk level is unknown and, thus, unmanaged.

In reviewing these risk factors, Abkowitz (2008) posits that humans cause or contribute to the impact of disasters through their actions or inactions and, therefore, can/should control and influence these risk factors.

Key Risk Assessment Practices

Abkowitz's (2008) list of risk factors correlates with another list examining why risk assessments are often inadequate (Lyon & Hollcroft, 2012; Popov, Lyon & Hollcroft, 2016). These issues include the failure to:

1) perform a formal assessment;
2) define the context and objective of the assessment;
3) understand the organization's acceptable risk level;
4) assemble the best team to perform the assessment;
5) use the best assessment techniques;
6) be objective and unemotional in the assessment process;
7) identify hazards that create risks and consider combined whole-system risk;
8) consider the hierarchy of controls and failure to prioritize based on risk;
9) perform assessment during the design/redesign phase;
10) communicate before, during and after the assessment.

These lists identify factors or failures that can be linked to key principles found in the ANSI/ASSE Z690 (2011) and ANSI/ASSE Z590.3 (2016). The authors believe organizations can improve their management of risk by consistently practicing these principles:

1) Perform a formal risk assessment when risk sources/triggers are present.
2) Define the context and objectives of each assessment.
3) Understand and account for the organization's acceptable risk level when defining risk criteria.
4) Assemble a qualified risk assessment team necessary to accomplish the objectives.
5) Select, modify, combine and use the most effective method(s) to accomplish the objectives.
6) Remain objective and unemotional.
7) Anticipate and identify hidden hazards and potential combined or synergistic effects.
8) Use the hierarchy of controls model and higher-level control measures.
9) Perform risk assessments in the design/redesign phase.
10) Effectively communicate risk throughout the process.

When designing and implementing an organization's risk management process, OSH professionals should consider Abkowitz's (2008) risk factors and the fundamental risk assessment practices compiled by Lyon and Hollcroft (2012) and Popov, et al. (2016). Those involved should understand how risk-based information is communicated to decision makers, and emphasize that risk assessments are conducted with the organization's objectives in mind.

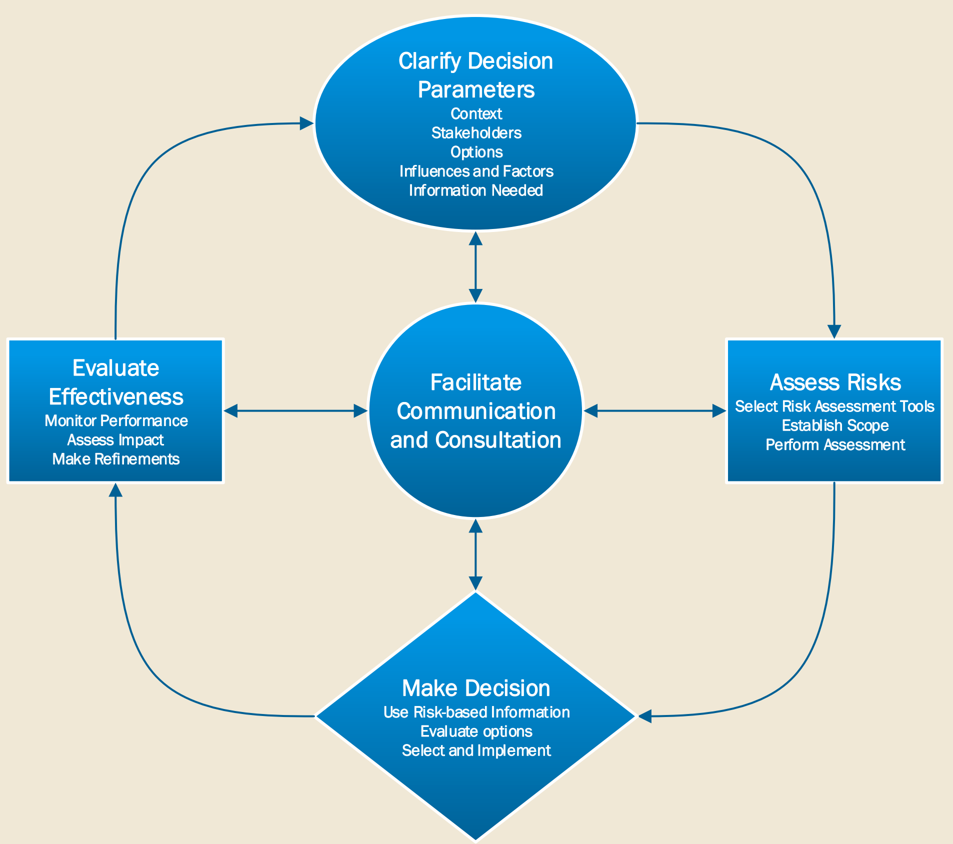
Risk-Based Information & Decision Making

With emerging technologies, limited resources and increasing demands, most organizations cannot continue business as they have in the past. The need for continuous improvement drives change within most organizations, therefore requiring decision makers to consider the risks in their decision-making process. U.S. Coast Guard (USCG) has established a process called risk-based decision making (RBDM), which is described in a four-volume set of downloadable guidelines posted at **www.uscg.mil/hq/cg5/cg5211/risk.asp**.

USCG defines RBDM as "a process that organizes information about the possibility for one or more unwanted outcomes into a broad, orderly

FIGURE 2

Risk-Based Decision Making Process Model



structure that helps decision makers make more informed management choices." In essences, it is the practice of risk management in the decision-making process. The model provides a structured, consistent and systematic way of making informed decisions using risk-related information that considers 1) what can go wrong; 2) the severity of the potential outcome; 3) how likely it is to occur; 4) whether the risk is acceptable or unacceptable; and 5) whether risk reduction is required. Figure 2 (p. 37) shows the authors' interpretation of the process steps and their sequence.

Five Steps of RBDM

The five RBDM steps, briefly described here, require effective communication and consultation.

Step 1: Identify & Clarify Decision Parameters

Referred to as "establishing the decision structure," stakeholders determine and define the context of the decision and its parameters during this step. This encompasses defining the type of decision (e.g., accept or reject a request; determine what to act upon; or determine what action is best); the target or focus of the decision; stakeholders and decision makers; potential options or choices; uncertainty surrounding the decision; and any influential factors to consider. Information is gathered and analyzed to prepare for the next step.

Step 2: Assess the Risk

Based on the information gathered about the pending decision, those involved determine what specific data are necessary to satisfy the decision, and identify sources and methods for obtaining these data. The team reviews available risk assessment tools and selects those most effective for the needed information. Various sources include ANSI/ASSE Z690.3, Risk Assessment Techniques, ANSI/ASSE Z590.3, Prevention Through Design and USCG Volume 3, as well as other risk assessment text books. The selected methods are performed by competent risk assessors to generate the risk-based information.

Step 3: Make the Decision

Decision makers evaluate the risk-based information generated from the risk assessment in the context of the decision to be made. Available options are presented, discussed and assessed in terms of risk-reduction potential and other benefits as well as costs. The hierarchy of controls, higher-level controls and the as low as reasonably practicable (ALARP) principle are applied to the selection process. Decision makers select the option with the lowest risk level and greatest benefits, then implement.

Step 4: Monitor Effectiveness

The implemented decision is monitored, and its effects are documented. Analyses such as business impact analysis or other methods are used to determine impact and unintended consequences. Monitoring and analysis results are compared to the expected outcomes to determine whether the decision was successful, or whether modifications or adjustments are required.

Step 5: Facilitate Communication & Consultation

Throughout the RBDM process, ample input, feedback and exchange of information with and from stakeholders is required for success. Risk-based information is provided and explained in terms clear to the decision makers. Furthermore, communication of decisions and their results, as well as any further actions are provided to stakeholders.

Decision makers want to avoid unacceptable risk and be safe. The problem is that many executives and nonsafety professionals do not have a fundamental understanding of what safe truly means. Some may believe that having a low incident rate or no OSHA violations indicates there are no significant risks in their workplace. As Walline (2015) says, "defining what safe looks like" is crucial to better decision making in organizations. This requires the use of risk assessment and the communication of risk-based information to help decision makers understand the nature of the risk and whether it is considered acceptable.

Using Risk Assessment to Communicate Risk

OSH professionals can use many risk assessment methods to obtain risk-based information. More than 30 methods are listed in the annex of ANSI/ASSE Z690.3-2011. Often, selected methods require some modification and combination to adequately meet the needs and objectives of the risk assessment effort. The art of risk assessment lies partially in the ability to modify appropriate methods and express information in a way that effectively communicates risk (Popov, et al., 2016).

In this article, a sequence of several modified techniques used in combination are applied to demonstrate how OSH professionals can determine risk pathways and their cascading effects and communicate that information to decision makers.

The methods used after establishing the team and context for the assessment include, in order; 1) HAZID and RISKID; 2) risk assessment matrix (RAM) and heat map; 3) preliminary hazard analysis (PHA) of current state and future state; 4) layers of protection analysis (LOPA); 5) striped bow tie risk Assessments of current state and future state; and 6) a cascading bow tie diagram connecting operational risks to OSH risks and resulting business consequences (which are tied to an organization's objectives). Figure 3 displays the sequence of methods presented.

Case Study

Biodiesel is considered a sustainable energy source and its production has increased over the past 10 years. The need to add methanol during the production process introduces safety and health hazards and risks that require assessment (Medina, 2014). Methanol for biodiesel production is usually stored on-site in aboveground storage tanks. Many production plants are located near coastal areas where the potential for hurricanes and tropical storms exists as do higher levels of chloride salts in the air that accelerate corrosion. Some may be located near seismic activity.

Based on the industry's incident history and concerns of the operation, a team assessed the risk of the methanol storage process. Following is a discussion of the steps taken.

Identify Hazards

To begin, hazard identification is performed using any number of methods available. One common method is hazard identification (HAZID) study. This qualitative, structured technique uses guide words and/or checklists to identify potential hazards, their causes and consequences. The method is generally conducted by a team using documents, diagrams, checklists and brainstorming to identify hazards, causes, consequences and controls.

The technique can also include a qualitative analysis to determine the potential severity and likelihood of occurrence, which is sometimes referred to as a risk identification study or RISKID. Once hazards and their consequences have been identified, a hazard register is compiled and used to prioritize

FIGURE 3

Example of a Risk Assessment & Management Sequence for Methanol Release

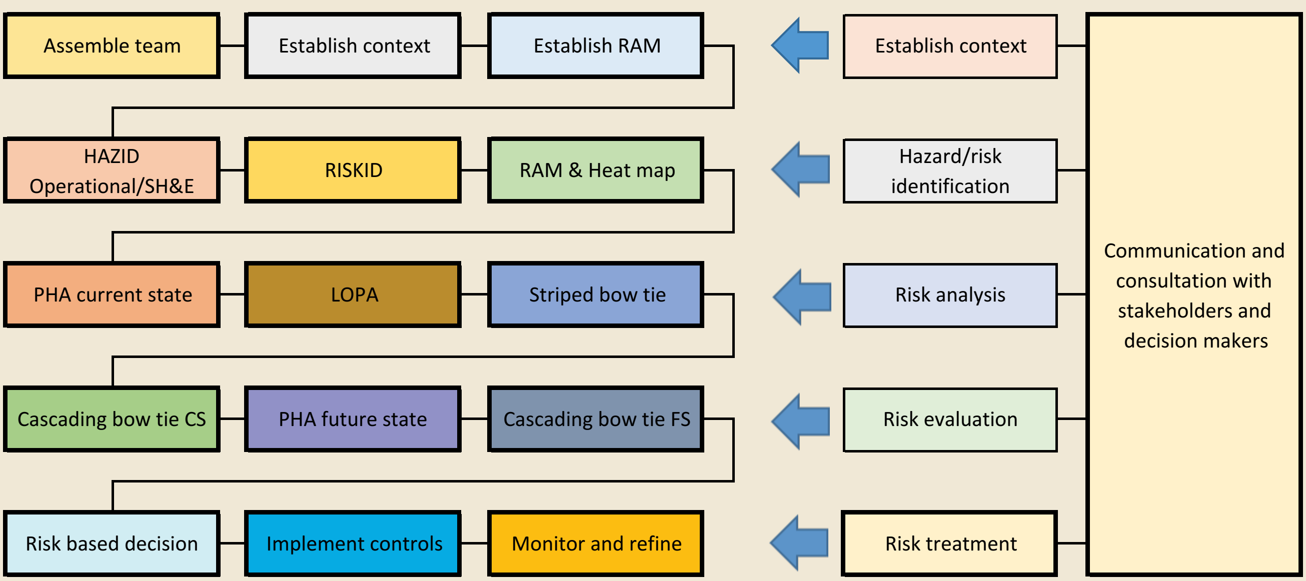


FIGURE 4

HAZID for Biodiesel – Methanol Storage

HAZID - Operational				HAZID - SH&E	
Biodiesel Manufacturing - Methanol Tank Storage					
HAZ ID#	Hazard	Cause	Consequences	Hazard	Consequences
1	**Thermal** Expansion - Methanol - Vapor generation	Faulty/blocked vent - Excessive in-tank vapor generation	Overpressurization - Loss of containment. Property and tank damage	**Physical** - Vapor generation and ignition	Explosion. Property loss. Workers exposed.
2	**Corrosion** - Methanol tanks, trim and piping	Incompatible tank and trim materials	Loss of containment. Methanol product loss.	**Chemical** - Methanol workers exposure	Blindness. Headache. Nausea. Weakness.
3	**Human factors/errors** - Methonal tanks - overfilling	Distraction, miscalculation	Methanol product loss.	**Physical/Chemical** - Vapor generation and ignition	Explosion. Local population exposure.
4	**Environmental conditions** - carbon steel tanks - corrosion	Proximity to ocean and salts	Methanol product loss.	**Physical/Chemical** - Vapor generation and ignition	Explosion. Local population exposure.
5	**Natural disasters** - methanol tanks/piping - earthquake	Storage system not designed for siesmic activity	Methanol product loss.	**Physical/Chemical** - Vapor generation and ignition	Explosion. Local population exposure.
6	**Ignition sources** - bonding and grounding - static discharge	inadequate conductivity in bonding and grounding	Damage to equipment from fire and explosion	**Physical/Chemical** - Vapor generation and ignition	Explosion. Property Loss. Workers exposed.

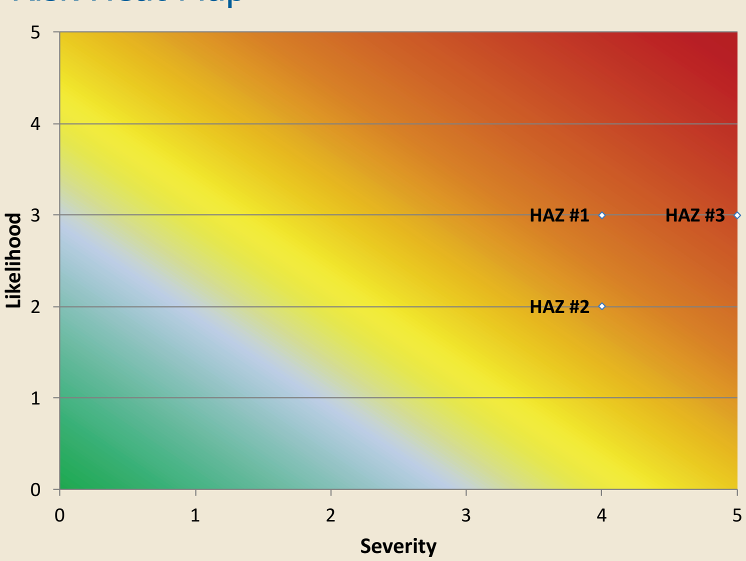
FIGURE 5
Risk Assessment Matrix

Incident outcomes				Likelihood of occurrence				
Severity rating	Health effects (people)	Property damage	Environment impact	1 Very unlikely	2 Unlikely	3 Possible	4 Likely	5 Very likely
5	Death or permanent total disability	Catastrophic damage	Significant impact	5	10	15	20	25
4	Permanent partial disability; hospitalizations of three people or more	Severe damage	Significant, but reversible impact	4	8	12	16	20
3	Injury or occupational illness resulting in one or more days away from work	Significant damage	Moderate reversible impact	3	6	9	12	15
2	Injury or occupational illness not resulting in a lost work day	Moderate damage	Minimal impact	2	4	6	8	10
1	First aid only or no injuries or illnesses	Light damage	No impact	1	2	3	4	5
Very high risk: **15 or greater** High risk: **9-14** Moderate risk: **5-8** Low risk: **1-4**								

FIGURE 6
Risk ID

RISK ID					
HAZID	SH&E hazards	SH&E consequences	RL	Severity	Likelihood
HAZ #1	Physical - Vapor generation and ignition	Explosion. Property loss. Workers exposed.	12	4	3
HAZ #2	Chemical - Methanol workers exposure	Blindness. Headache. Nausea. Weakness.	8	4	2
HAZ #3	Physical/Chemical - Vapor generation and ignition	Explosion. Local population exposure.	15	5	3

FIGURE 7
Risk Heat Map



and select hazardous event scenarios to further analyze. Figure 4 (p. 39) presents some operational and OSH hazards summarized in the HAZID form.

Risk assessment matrices (RAM) and heat maps provide a graphical representation of how risks compare. These methods can be qualitative, semiquantitative or quantitative visual measures of risk using scales, scoring and color-coded matrixes or mapping diagrams. Individual risks are placed in the matrix or map according to the defined risk criteria levels for likelihood and severity. RAM and heat maps are used for comparisons and allow decision makers to recognize and select the highest-level risks to address. Hazards selected from the HAZID (Figure 4) are compared to the criteria in the RAM (Figure 5) with the results placed into the RISKID (Figure 6) and heat map (Figure 7) for further analysis.

Risk Analysis

Select hazard scenarios are analyzed. Preliminary hazard analysis (PHA; Figure 8) can be used for several applications to help identify hazards and existing controls, analyze risk levels and prioritize actions. PHA allows the assessor to analyze the

FIGURE 8

Preliminary Hazard Analysis: Current State & Future State

Biodiesel Production - Methanol Vapor Release											
	Current state							Future state			
Haz ID #	Hazard description	Exposure description	Exposed assets	Existing controls	Sev	Lik	RL	Proposed controls	Sev	Lik	RL
#3	**Human Factor/Error** - Explosion resulting from overfill/spill methanol tank and ignition source	Operator fills tank from tanker truck using float gauge to determine fill level. Requires visual attention on gauge. Manual shutoff. Tanker truck running during filling.	Employees, third-party delivery personal, process, facility, local community	SOP	5	3	15	**Engineering** - Overfill protection design; auto alcohol-resistent fire exting. system; auto overfill shutoff; spil containment **Warning** - Fill alarm **Admin** - Mechanical integrity program; SOPs; training **PPE**	5	1	5
#1	**Thermal Expansion** - Methanol vapor release from vent blockage and tank rupture	Methanol tanks in sun causing internal pressure buildup. Expansion vent on top of tank.	Employees, contractors, product loss, process, local community, environment	Tank vents	4	3	12	**Engineering** - Shade protection over tanks **Warning** - Internal pressure alarm **Admin** - Mechanical integrity program **PPE**	4	1	4
#2	**Corrosion** - Methanol vapor release from tank, trim and piping	Carbon steel tanks, alloy fittings and flame arrestor and PVC piping. Proximity to ocean and salts in atmosphere.	Employees, contractors, local community, environment	Inert gas blanket in tanks	4	2	8	**Engineering** - Stainless steel tanks; cathodic protection; compatible valves, trim and piping material **Admin** - Mechanical integrity program	4	1	4

FIGURE 9

Layers of Protection Analysis: Current State & Future State

Event	Cause	Independent protection layers (IPLs)		Current state (CS) - Existing IPLs			Proposed additional independent protection layers (IPLs)					Future state (FS) - After additional IPLs		
		1	2	Severity	Likelihood	Risk level	3	4	5	6	7	Severity	Likelihood	Risk level
Thermal expansion - Methanol - Vapor generation	Sun/vent failure	Tank vents		5	3	15	Shade protection for tanks	Explosion-proof equipment	Internal pressure alarm	Spill contain-ment	Auto fire exting. system	5	1	5
Corrosion - Methanol tanks, trim and piping	Moisture/ oxidation	Nitrogen blanket		4	3	12	Corrosion inhibiting materials	Cathodic protection	Auto fire exting. system	Spill contain-ment		4	1	4
Human factors/errors - Methonal tanks - overfilling	Distraction/ deviation	Visual - floating device		4	2	8	Overfill tank design	Automatic shutoff	Overfill alarm	Auto fire exting. system	Spill contain-ment	4	1	4

current state with existing controls and future state with proposed additional controls. PHA results can then be transferred to a more in-depth method such as a modified bow-tie risk assessment diagram to further evaluate and communicate risk to decision makers.

Layers of protection analysis (LOPA) is a barrier analysis used to study existing or proposed barriers and determine whether acceptable risk levels are achieved. As described in ANSI/ASSE Z690.3 Annex B, hazards and consequences are selected, and independent protection layers (IPLs) are identified for each hazard/consequence pair.

IPLs are considered physical barriers or devices that prevent the initiating cause from proceeding to the unwanted consequence. IPLs include only physical barriers such as alarm/warning devices, engineering controls, design changes and other higher-level controls. Administrative controls such as inspections, training and standard operating procedures as well as PPE are not considered barriers and not included in the LOPA. Figure 9 illustrates a qualitative LOPA with semi-quantitative risk level scoring of existing IPLs and proposed IPLs.

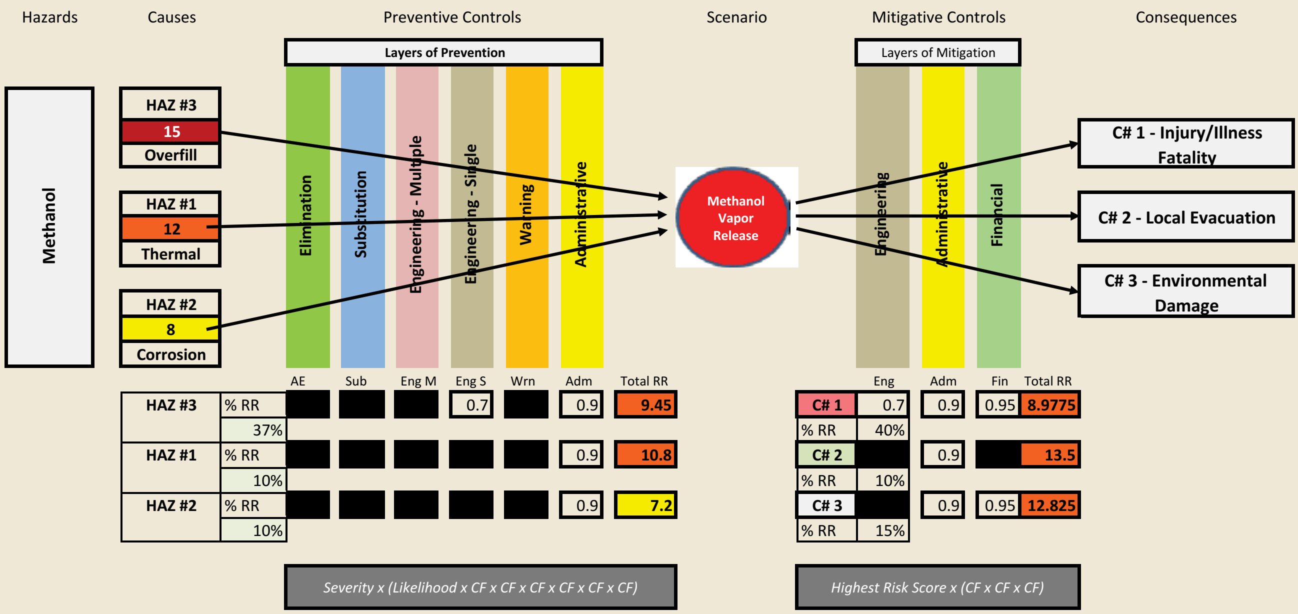
Risk Evaluation

One method receiving greater attention is bow-tie analysis; this is partially due to its ability to show the whole picture of a specific hazardous event. A conventional bow-tie analysis is a combination of a simplified fault tree analysis (left side of bow-tie) and event tree analysis (right side) used to illustrate the risk pathways and control measures in place for situations that do not require a full quantitative fault tree analysis.

Two shortcomings of the bow-tie analysis are that it typically lacks a risk scoring mechanism, and that the effectiveness of controls is not reflected in

FIGURE 10

Striped Bow-Tie Risk Assessment: Current State



the analysis (i.e., higher-level controls such as elimination, substitution and engineering are not distinguished from lower-level controls such as warnings and administrative measures).

To address these shortfalls, the authors have modified the method to include a risk scoring system that incorporates the hierarchy of controls as well as LOPA; this method is known as a striped bow-tie risk assessment (Figures 10 and 12). PPE is not included in the analysis since it is considered the least effective method of protection and is not preventive in nature. On occasions where an analysis is performed for chronic exposure events such as welding or spray applications for which PPE (e.g., respiratory protection) would act as a preventive measure and be included in the analysis.

FIGURE 11

Control Factor Risk Formulas & Multipliers

Control Factor (CF) Risk Formulas		
S x (L x CF x CF x CF x CF x CF)		Highest risk score x (CF x CF x CF)
Preventive controls left side of bow tie	**Multiplier**	**Mitigating controls right side of bow tie**
Elimination	0.1	
Substitution	0.4	
Engineering - multiple	0.6	
Engineering - single	0.7	Engineering
Warning	0.8	
Administrative	0.9	Administrative/warning
	0.95	Financial
No controls	1	No controls

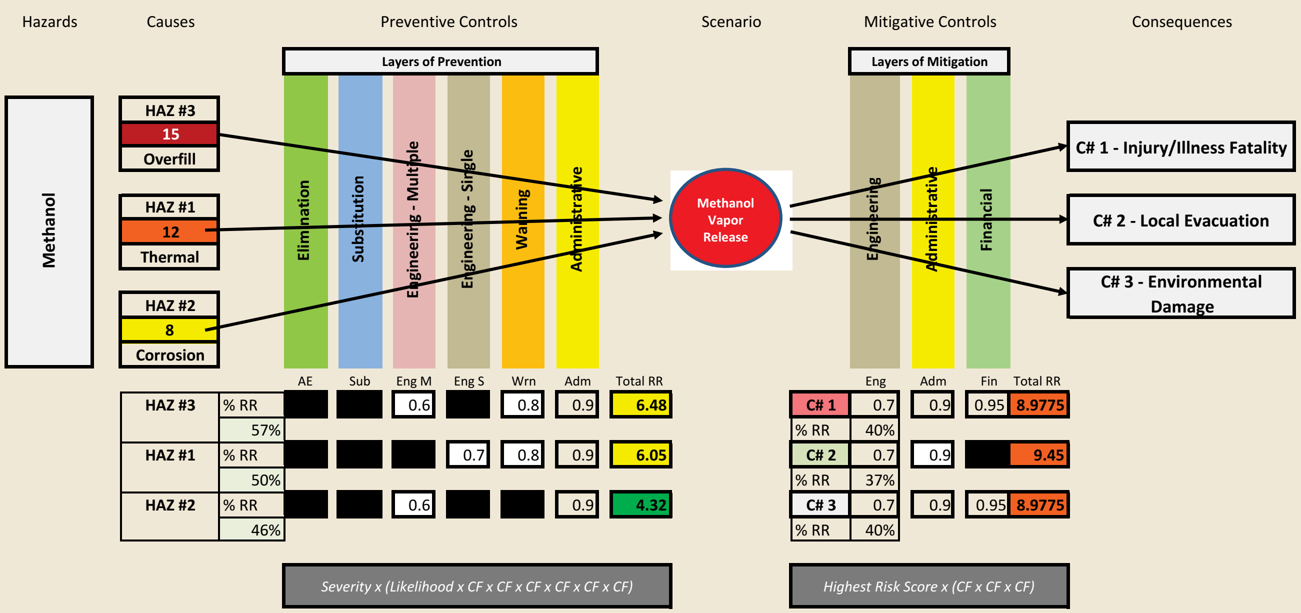
For striped bow-tie analysis, the team uses the formula, severity x (likelihood x control factor) = Risk (Figure 11). Risk scores are derived by entering the control factor (CF) multipliers for preventive controls on the left side of the bow-tie. On the right side of the bow-tie, risk scores with existing mitigating controls are derived from the formula, highest risk score x (CF x CF x CF).

To calculate the prevention controls risk score, on the left side of the bow-tie, each identified hazard-cause and existing preventive controls are analyzed individually and scored according to the CF multipliers (Figure 10) providing a CF risk score. The percent of risk reduction achieved (% RR) is derived by using the formula (original risk score-CF risk score)/original risk score = % RR.

To calculate the mitigating controls risk score, for each of the three consequences identified (C#1, C#2, C#3) in the methanol release scenario, existing mitigating controls are analyzed and scored using the risk formula shown in Figure 11. Fewer control options are available to reduce impact from events after they occur and are grouped into three categories (engineering, administrative/warning, financial/insurance). To calculate percent of risk reduction, the hazard-cause with the highest risk level (HAZ #3 with a risk level of 15) is used for all three resulting consequences.

FIGURE 12

Striped Bow-Tie Risk Assessment: Future State



The mitigating control risk reduction formula used is (highest original risk score-CF risk score)/highest original risk score = % RR. Figure 12 shows the future state with proposed risk reduction from preventive controls and mitigating measures. The case study shows that preventive controls have a greater degree of risk reduction potential while mitigating controls have limited reduction potential.

For complex situations, the team can use a cascading bow-tie where the consequences of one event may trigger a secondary event. In addition, business consequences caused by OSH-related incidents can be integrated into the cascading bow-tie methodology. Figure 13 (p. 44) presents a cascading bow-tie example using the biodiesel production operation; this example demonstrates the linkage between operational risk and business risk.

Conclusion

The role of the OSH professional is evolving. Hazard-based efforts and compliance-focused programs are transitioning to risk-based management systems, both abroad and within the U.S. Risk assessment and prevention through design concepts are certainly at the heart of this transition.

The process of identifying, analyzing and evaluating risk provides those responsible for making business decisions an understanding of the risk and the options so that the best decision can be made and the risk reduced. OSH professionals should challenge themselves to go beyond traditional practices and continue to develop more advanced risk assessment and management methods. Perhaps, in future years, those working to manage OSH risks, currently known as safety professionals, will be viewed by their organizations as occupational risk professionals. **PS**

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FIGURE 13

Cascading Bow Tie: Operational Risk to OSH Risks to Enterprise Risk Management