

## Fatality Prevention/Risk Management



**The persistence of high severity events suggests a new approach—rooted in safety management systems—is needed in order to have different mine safety outcomes.** The backbone of this effort is the risk management process, which identifies risks associated with specific mining activities and ways to proactively mitigate those risks to prevent injuries and fatalities. The risk management process has been used

by other industries and mining in other countries to successfully improve safety and health performance.

### **Risk management is the process of:**

- Identifying safety and health hazards
- Evaluating the associated risk and consequences
- Developing controls to eliminate or minimize negative outcomes to an acceptable level
- The goal: Eliminate the risk or reduce it to the lowest practical level

The **CORE**Safety Safety and Health Management System (SHMS) is a systematic approach to risk management that calls for:

- Reviewing all safety and health hazards
- Assessing and prioritizing risk
- Applying controls systematically
- Verifying that controls remain effective over time

The term “risk” is often confused with hazard, so it is important to recognize they are not interchangeable. Hazard is defined as a source of potential harm, injury or detriment. Risk is defined as exposure to the consequences of uncertainty. It has two dimensions: the likelihood of something happening, and the consequences if it were to happen.



## How it Works

Risk management starts with operation planning; it is conducted on an ongoing basis and is carried through to closure. Risk assessment can involve technical staff (engineers) managers and workers with appropriate knowledge and experience.

There are several steps to the risk assessment process. Each step is critical to the success of the effort, and management teams should assure adequate resources and time to give credibility to the outcomes. Risk management can be used at four levels: the entire operation, a specific process or installation, a task or set of job tasks, and the last level—personal risk assessment, e.g., SLAM, Take 5, etc.

Acceptable risk should be defined by management; however, risk-based decisions can and should be made by workers when they have the knowledge, training, and experience.

The risk assessment process:

- Sets clear direction to solve specific at-risk problems
- Focuses on priority concerns(hazards and risks)
- Gains commitment from a cross-section of the facility's work force through their active participation in the process
- Decreases potential losses for operations
- Helps build teams to solve major problems and improve the safety culture
- Goes beyond simply complying with existing standards and regulations

## Flow of the Process

### Establish context & scope

The risk assessment design or scope is best defined prior to the exercise. Hazards to be discussed, decisions on risk assessment team membership, and time allotment for the activity are best addressed with a scoping document. This document provides an opportunity to break down the process into reviewable parts and define goals.

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A fundamental element of risk management is the risk assessment team. For major hazards, e.g., new mine, new development in an existing mine, new equipment, new mine process, etc. that tend to be complex, a full team of people is justified. However, for the small operator, the risk management process must be scalable. When a team is formed, it must include an appropriate cross-section of knowledgeable persons familiar with the hazards to be investigated. The team must be capable of identifying all relevant hazards, unwanted events and possible controls.

The facilitator is responsible for following a quality risk assessment process designed to meet the risk assessment scope and is responsible for making sure the team and the process remain focused on a quality output. The facilitator can be internal or external to the company, but must be someone with the appropriate qualifications, knowledge and experience. It is also important to consider non-management/labor entities for team participation. Miners responsible for performing tasks that are part of the work processes under review can validate information and provide insight, perspective and ideas that are invaluable to a quality output. These team members are also helpful in communicating adherence to existing prevention controls and recovery measures and in embracing changes brought about by the application of new ideas.

**Understand the hazard**

The first step is to identify all relevant hazards or possible problems that could lead to a potential event. If the list is incomplete, the risk assessment will be inadequate. There are many tools to help compile the list, including input from workers and managers, injury records, worker's compensation records, near miss reports, process flow diagrams, brainstorming and hazard identification. Risk assessment processes such as hazard and operability studies (HAZOP), fault tree analysis (FTA) and bow tie analysis (BTA) can also be effective.

The types of hazard that should be identified are best thought of as uncontrolled releases of energy that have the potential to cause significant harm. Energy that is not completely controlled leads to some level of risk, depending on the likelihood of release and the consequences should the energy be released. When the unwanted release occurs, it can cause serious injuries.

**Identify the risk - Analyze & Evaluate risks**

After a comprehensive list of hazards is identified and characterized, a broad-brush risk assessment tool is used to rank the potential unwanted events. Depending on the topic, the individual hazards should be broken down using a process mapping technique or by the geographic location within the operation. For each step in the work process or for each geographic location within the operation, a likelihood of occurrence and a consequence for each potential hazard are determined. Below is a generalized risk ranking matrix.

Likelihood	Consequence				
	1 Catastrophic	2 Major	3 Moderate	4 Minor	5 Insignificant
<b>A</b> Certain	Extreme	Extreme	Extreme	High	High
<b>B</b> Likely	Extreme	Extreme	High	High	Medium
<b>C</b> Possible	Extreme	Extreme	High	Medium	Low
<b>D</b> Unlikely	Extreme	High	Medium	Low	Low
<b>E</b> Rare	High	Medium	Medium	Low	Low

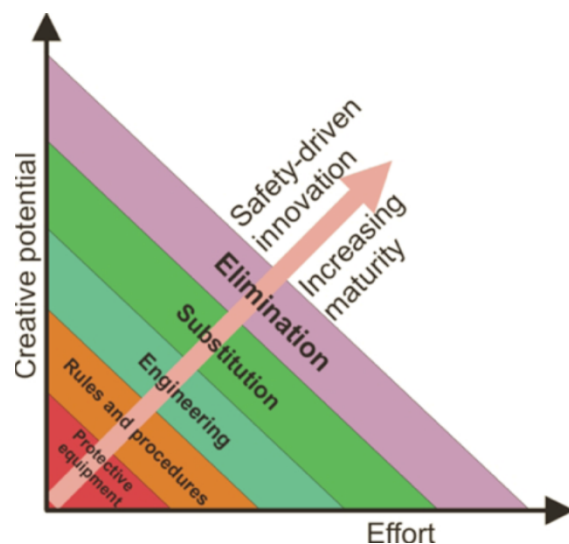
**Consider the controls**

Additional risk assessment tools are used to help determine what prevention controls and recovery measures are currently being used. The same process that identifies existing prevention controls and recovery measures is used to identify new prevention controls and recovery measures. When a hazard is eliminated, the risks associated with the hazard are also eliminated. This should always be the first action of the risk assessment team – to investigate how to eliminate the hazard. However, this is usually difficult to do, since a hazard can owe its origin to many different factors. If it is not possible to eliminate the hazard, attempts must be made to mitigate the potential effects of the hazard.

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Mitigation consists of actions to minimize the hazard, most often with engineering methods, or to use physical barriers capable of separating the hazard from the worker or the work process. Warning devices are often used to assess the performance of engineering controls, and physical barriers are used to prompt a change in administrative or work processes.

Controls that are largely focused on operational and work processes include procedures and personnel skills and training. Procedures can often rely on the personnel skills and training of the worker. Reliance on worker behavior increases the potential for human error and reduces the effectiveness of the risk reduction control when compared to mitigation efforts.



This consideration of controls is a crucial step, since it potentially produces a list of actions to be investigated that are capable of further risk reductions at a site. It is important for management to consider the merits of each new idea suggested by the risk assessment team. At the end of this step, a detailed list of all prevention controls and recovery measures for the hazard in question are documented so they can be monitored and audited on some regular basis.

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### **Treat the risk**

The important output of the risk assessment team is the list of existing and new controls. Assessing the quality of this output can only be accomplished when the effectiveness of these controls is understood. The team should be cautious of an over-reliance on warning devices that require manual readings, administrative procedures, and the personnel skills and training of the work force. In general, treatments should strive to go beyond the standards and regulations for mining.

### **Monitor and review**

A re-assessment of the site's hazards and an evaluation of the implemented risk mitigation program should be done on a regular basis by skilled and experienced personnel. This can be accomplished at three levels:

- A site assessing its own controls
- A site assessing its own controls using someone from the outside (2nd party)
- Site controls are assessed by an external entity (3rd party)

An audit and review should, at minimum, determine the status of the risk management plan and make recommendations for improving potential deficiencies in the plan. Tools, such as a risk checklist, are sometimes used to help with auditing and reviewing important controls at a mining operation. Once a risk mitigation program has been implemented, the change management procedure should be followed to ensure any new changes made to the operation don't introduce new hazards, alter existing risk or negatively affect controls.

## **Summary**

The risk management process is a comprehensive method to identify, rank, and mitigate employee and community exposure to risks associated with the mining process. It must be scalable to all sizes and stages of mining operations and to every level of sophistication in the safety continuum. This is an introduction to the process. Additional resources are available in the CORESafety resource section. Like any new tool, using risk management takes time and patience, but can be a game-changer in terms of the degree of control and the positive impact on a company's safety culture and performance.

## Workbook Materials For Module 4

### Process Scope

#### Work Areas

A cross-sectional team of knowledgeable persons, cross sectioned from all departments should be assembled to identify the work areas that present hazards where significant injury or harm could result. A list of all areas should be developed to then be used to identify each hazard individually.

List each work area. i.e. production section, maintenance shop, warehouse, mine office, mobile equipment, preparation plan

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_
- e. \_\_\_\_\_
- f. \_\_\_\_\_

#### Understand the Hazard

For each work area, identify all relevant hazards that could lead to a potential event. Associate the hazard with the job and persons involved. Hazard identification should include, but not be limited to; worker input, injury records, near miss reports, and agency regulations/guidelines. Current company policy and SHMS plans should also be considered.

#### Work Area:

List each HAZARD associated with the work area and job to be performed. Include a description and potential result if not addressed.

Hazard: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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**Work Area (cont.):**

Hazard: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Hazard: \_\_\_\_\_  
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Hazard: \_\_\_\_\_  
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Hazard: \_\_\_\_\_  
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Hazard: \_\_\_\_\_  
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**Identify the Risk**

Analyze & Evaluate Risks – Once a comprehensive list of hazards is identified and characterized by work area, a risk assessment evaluation should be performed to rank the potential unwanted events. Ranking should be done with consideration to the likelihood of occurrence and consequence. The following matrix may be considered as a ranking tool.

Likelihood	Consequence				
	1 Catastrophic	2 Major	3 Moderate	4 Minor	5 Insignificant
<b>A</b> Certain	Extreme	Extreme	Extreme	High	High
<b>B</b> Likely	Extreme	Extreme	High	High	Medium
<b>C</b> Possible	Extreme	Extreme	High	Medium	Low
<b>D</b> Unlikely	Extreme	High	Medium	Low	Low
<b>E</b> Rare	High	Medium	Medium	Low	Low

**Work Area:**

For each HAZARD associated with the work area, rank the degree of risk as to the likelihood of occurrence and severity consequences. (Once comfortable with the process, this task may be completed during the hazard identification process)

Hazard: \_\_\_\_\_

Likelihood (A-E): \_\_\_\_\_ Consequence (1-5): \_\_\_\_\_

Hazard: \_\_\_\_\_

Likelihood (A-E): \_\_\_\_\_ Consequence (1-5): \_\_\_\_\_

Hazard: \_\_\_\_\_

Likelihood (A-E): \_\_\_\_\_ Consequence (1-5): \_\_\_\_\_

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### **Prioritize and Treat the risk – Consider the Controls**

Prioritize and categorize the hazards by their evaluated degree of risk.

- Extreme: 1A-D, 2A-C, 3A
- High: 1E, 2D, 3 B-C, 4 A-B, 5A
- Medium: 2E, 3 D-E, 4C, 5B
- Low: 4 D-E, 5 C-E

For each hazard, beginning with those of potentially extreme risk, analyze the hazard details and design/implement controls to eliminate or mitigate the potential effects of the hazard to an acceptable level. Take into account all existing (company policy, SJP, agency regulations) and new controls, but strive to go beyond existing standards and mandates. Once Extreme risk hazards have been completed, move to the next category, High potential, and so on.

Work Area: \_\_\_\_\_

Hazard: \_\_\_\_\_

Risk Category: \_\_\_\_\_

Risk Description: \_\_\_\_\_

\_\_\_\_\_

Controls to Eliminate/Mitigate: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Controls to Eliminate/Mitigate: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



## Monitor and Review

Establish a time period for the re-evaluation of each hazard/risk assessment plan. This audit should be;

- Regular and,
- Performed by skilled and experienced personnel.
  - Site assessing its own controls
  - Site assessing its own controls using someone from a 2nd party
  - Site controls are assessed by an external entity (3rd party)

Work Area: \_\_\_\_\_

Hazard: \_\_\_\_\_

Risk Management Plan #: \_\_\_\_\_

Scheduled Re-Evaluation:

\_\_\_\_\_

Responsible Person/Group:

\_\_\_\_\_

Audit/Assessment Checklist #:

\_\_\_\_\_