Managing Safety Risks in Mining

Prepared for the National Mining Association

Risk is a part of mining like risk is a part of our everyday lives. There is no situation in life where there is no risk. However, risk can be reduced to more acceptable levels through risk management.

The rationale for risk management continues to be the need to improve health and safety performance. Though industry performance has improved in the past two decades, major unwanted events are still more common than the community expects.

Risk management might be best described as a process to proactively and systematically reduce these losses.

Risk management activities should be applied in the development and execution of a safe and productive work process.

The Goal of Risk Management

The Work Process Model, illustrated below, is a model of an ideal process for achieving safe production. The model identifies four components of a safe and productive work process.

The term **Competent People** is intended to not only refer to competency related to training and skills but also appropriate motivation and "fitness for duty".

Safe Work Practices refers to the availability of appropriate clear expectations for the work. This might include plans, procedures, guidelines or some other document.

The term **Fit For Purpose Equipment** suggests that a safe and productive work process will include equipment, plant or materials that are well designed, maintained to a set standard and made available as appropriate to the work process.

The **Controlled Work Environment** refers to both physical factors and supervisory control in the work process. All work processes occur in some environment where conditions such as lighting, ventilation, traffic control, ground control, etc. affect safety and health in the process. Supervisory control refers to the need for the work process to be defined, directed and checked. The effective role of the "supervisor" is key to a quality work process.

This basic model can be understood by all mining personnel. It also provides a clear goal for the risk management process. Engineering and management decisions lead to the design and development of the work processes. Day-to-day decisions by supervisors and workers affect the risk during execution of the work process.

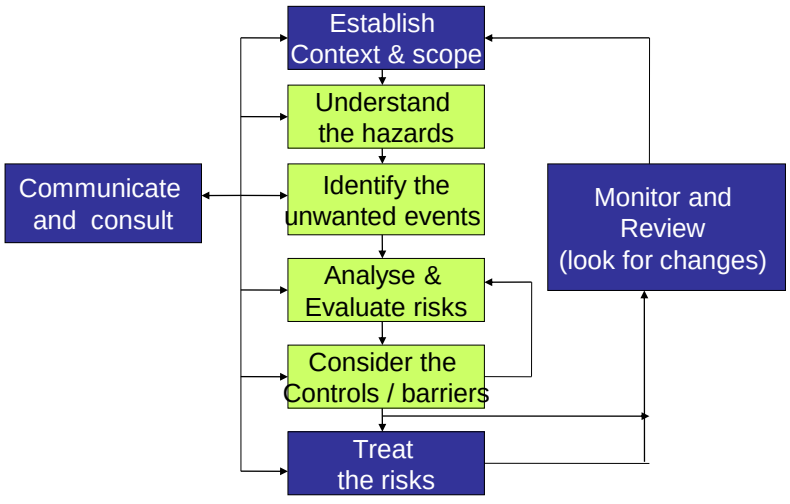
The Process of Risk Management

Risk management requires that a proactive mindset be undertaken by everyone at a mine site. Everyone must look for and think about what can go wrong, speculate on its causes and apply controls (engineered or procedural) to reduce unacceptable risk. This approach is done in addition to the existing, reactive approaches of the site which address existing problems to ensure they do not repeat in the future.

Risk assessment methods attempt to estimate the quality of controls that have been in place. This can be done formally or informally. Formal risk assessment involves a documented, systematic analysis for identifying hazards and unwanted events, assessing the relevant risk and implementing required actions or controls. Global mining has adopted formal risk assessment techniques since the late 1980's. There are many different formal methods that suit different risk situations such as design, change and work planning.

The diagram below is an illustration of a basic risk management system that can be applied formally or informally through individual thinking.

Minerals Industry Risk Management Process



The need to **communicate and consult** is critical to the entire risk management process. Consultation through involvement and open communication is a clear feature of successful risk management systems.

Establishing the context within the risk management process involves the overall direction setting and rationale for the entire process. It includes consideration of external factors such as regulations, and internal factors such as site policy and values.

The first step involves understanding the hazards to ensure that we optimally examine hazards to identify and analyse risks before unwanted events are encountered. Sometimes it is helpful to think of hazards as 'energies'. To have damage there must be an unwanted energy release.

Common Mining Energies

Biological	bacteria, viruses, contagious diseases, natural poisons, etc.
Chemical	coal, gases, fuels, lubes, degreasers, solvents, paints, etc.
Electrical	high voltage, low voltage, batteries, etc.
Gravitational (objects)	falling coal, rock, tools, components, structures, etc.
Gravitational (people)	falling from or into equipment, structures, ladders, sumps, etc.
Machine (Fixed)	powered by electrical, hydraulic, pneumatic, combustion, etc.
Machine (Mobile)	haulage trucks, LHDs, service vehicles, gen sets, tools, etc.
Magnetic	(handling metal objects in strong magnetic fields)
Noise	from machines and other sources
Object	pressurised systems, cylinders, springs, chains, flying bits, etc.
People	slip, trip, lift strain, push/pull sprain, repetitive /postural strain
Thermal	conducted (contact) , convected (airstreams), radiation
Vibration	from vehicles, equipment, tools, etc.
Other	friction, wind, animal, bio-chemical

The specific amount and nature of the damage is determined by factors such as the nature of its destructive potential and the mechanism for release. For example, large pieces of mobile equipment are obviously major energy sources when moving around the mine that, should control be lost, can do major damage.

Once hazards are reasonably understood the second step is to **identify the unwanted events**. These are not only what has happened in the past but <u>also</u> what could happen in the future.

Once the specific unwanted events have been clearly defined the next step is to **analyse and evaluate risks**. There are a variety of methodologies that combine likelihood and consequence to determine risk. There is a feedback loop between the next step and this one because you need to consider existing control quality and availability in order to establish risks.

The third step in the risk management process is to **consider the controls**. The following Hierarchy of Control (see box below), offers a good framework for considering the quality of controls. The closer the control type is to the top of the list below, the more potentially effective the control.

The feedback loop in the model to **analyse and evaluate risks** is intended to indicate that this is an iterative process, considering existing, as well as any potential new controls to reduce risk.

- **Eliminate** the hazard or energy source (do not use the energy)
- **Minimise or replace** the hazard or energy source (reduce the amount of energy to a less damaging level or replace the energy with another that has less potential negative consequences)
- **Control** the hazard or energy **using reliable engineered devices** (e.g. lock outs, chemical containers, mechanical roof support, gas monitors, etc.)
- **Control by using physical barriers** (e.g. machine guarding, etc.)
- **Control with procedures** (e.g. isolation procedures, standard operating procedures, etc.)
- **Control with personal protective equipment** (e.g. hard hats, boots with toe caps, gloves, safety glasses, welding gear, etc.)
- **Control with warnings and awareness** (e.g. posters, labels, stickers, verbal warnings, etc.)

Treat the risks is intended to indicate a step where new or improved existing controls, that have been identified, are applied.

The model also provides a connecting arrow after **treat the risks** to the **monitor and review** feedback loop. It is necessary to monitor and review the hazard and control status to ensure that the risk remains acceptable.

Monitoring and reviewing can be informal or formal. Auditing is a common formal review process. Incident and incident investigation is also a review process triggered by an unwanted event. As such, auditing and investigation are risk management tools.

Watching for **change** in hazards or the status of controls is also important since it is a demonstrated major contributor to accidents in the mining industry.

By applying this Risk Management Process where important decisions are made about Health and Safety, a mine site can further reduce risks to people.

For more information see www.mishc.uq.edu.au

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