PROJECT MANAGEMENT

COLLEGE OF PETROLEUM AND MINING ENGINEERING

Dr. Ibrahim Adil Ibrahim Al-Hafidh

Mining Engineering Department

College of Petroleum and Mining Engineering

University of Mosul

Email: iibrahim@uomosul.edu.iq

LECTURE 5

Risk Management

- Objective.
- Responsibility.
- What is project Risk?
- Mining project threats.

Project Management
Dr.Ibrahim Al-Hafidh
Email: iibrahim@uomosul.edu.iq

Risk Management

Risk management encompasses the steps for identification, assessment, and prioritization of project risks. Following these steps is the key follow-up action for coordinated and economical application of resources to mitigate the probability and/or impact of unfortunate events and to maximize the realization of any opportunities.

Objective.

Risk management is the formal identification, assessment, and prioritization of project risk, followed by the coordinated and economical application of resources to minimize, monitor, and control risks.

In other words, risk management seeks to reduce the probability and impact of those risks. Risk management's ultimate goal is to maximize the realization of opportunities. A risk management framework needs to run through every stage of the project to ensure that the long-term decisions, as well as the day-to-day operational choices, are all made objectively with the project's goals in mind (McVeigh and Rutherford 2013).

Risk management has earned an unfortunate reputation of being a laborious, bureaucratic process, but it does not need to be. It can be applied in simple, logical steps, and its implementation can mean the difference between failure and success for the project.

The objective here is for the project team to understand the risks of a mining project, and to apprise the team of the risk management mechanisms that are available to address the factors that underlie these risks.

Responsibility

The execution of any capital project requires that all risks associated with the design, construction, and initial operations be properly managed and mitigated. Risk management is a primary responsibility of the project manager.

This responsibility begins during the planning stage and continues through project turnover and completion. The project manager should not stand alone in managing risk, however. The mining company needs to support the project manager's risk control efforts by bringing a corporate focus into the management of risk, starting with the governance framework. Corporate guidance is needed for project risk assessment from both an enterprise risk management and a technical perspective, at the beginning and throughout the project life.

What is Project Risk?

Risk in its fundamental sense is simply the possibility of suffering harm or loss. *Project risk* can be more specifically defined as an unforeseen event or activity that can impact the project's progress, result, or outcome in a negative way. The opposite of project risk is ***project opportunity***, which can impact project progress in a positive way. To be even more specific for the mining industry, Stantec's Hard Rock Miner's Handbook (de la Vergne 2003) defines mining project risk as "an alteration of anticipated capital expenditures caused by an unforeseen circumstance or event." Risk can be assessed using two factors: impact and probability. Thus, if the probability is 1, the risk has already materialized. If the probability is 0, the risk will not happen and it should be removed from the risk register.

Mining project Threats

In its July 2012 global analysis of the mining industry, Ernst & Young reported that the threats facing the mining sector in 2013 were becoming more extreme and complex. ***Resource nationalism*** remains the number one threat. Many host governments are seeking a greater take from their mining projects and are imposing new requirements, such as mandated beneficiation, export levies, and limits on foreign ownership.

"***Global labor skills shortages***" and "***difficulties with infrastructure access***" retain second and third spots on the threat rankings. Both threats highlight the supply capacity constraints that continue to hamper the mining projects world.

Demands for a greater sharing of the project benefits made its debut on the threats list in 2012. Stakeholders ranging from the government to employees, the local community, and suppliers all believe they are entitled to a greater proportion of the mining project revenues.

The top mining threats for 2013 were as follows, in order of concern:

1. Resource nationalism.
2. Labor skills shortage.
3. Infrastructure access.
4. Cost inflation.
5. Project execution.
6. Social license to operate.
7. Price and currency volatility.

8. Capital access.
9. Sharing the benefits.
10. Corruption and fraud.
11. Access to water and energy.
12. Joint venture partner issues and agendas.
13. Land use competing demands.
14. Climate concerns.
15. New technologies.
16. Increased regulation.
17. Community activism.

What is Risk Management?

Project risk is essentially defined as any factor that may potentially interfere with successful completion of the project. Thus risk, by its strict definition, is not a problem; risk is a recognition that a problem might occur. Semantics aside, the objective of the project manager is to recognize any and all potential problems so that a path of appropriate action can be charted to prevent these risks from becoming a problem. This is risk management.

Risk management is the process of identifying, quantifying, and managing the risks that can prevent an organization from achieving its objectives. Risk management uses analysis, assessment, control, avoidance, minimization, and/or elimination to handle unacceptable risks. Note: If risks are acceptable, they do not need to be managed.

Prior to the active management of project risk, a robust project governance approach needs to be implemented to ensure a consistent approach to risk assessment and handling. Once governance is in place risk management can proceed.

The Risk Management Process

The approach the project team will use to manage risk is defined up-front in the planning stage, captured in the Project Execution Plan, and then executed throughout the project life:

1. Understand the objectives of the project and the project scope.
2. Define expectations and deliverables.
3. Identify the risk “owners” among the project participants.
4. Execute the risk management process.

The risk management plan documents the procedures used to manage project risk. In addition to describing the risk identification and analysis phases, it must cover who is responsible for managing the various areas of risk, how risks will be tracked through the life cycle, how contingency plans will be implemented, and how project resources will be allocated to handle the risks. Risk management encompasses the following distinct elements (Owen 2010):

- **Risk identification.** Identifying the risks is the responsibility of all project team members. A risk register is created.
- **Risk prioritization.** Risks are grouped into risk categories.
- **Risk criteria quantification.** Likelihood and potential impact of each risk is quantified.
- **Risk analysis.** An analysis is prepared for risk, using the actual data collected and/or assumptions made. The analysis contemplates what can go wrong within the project.

- **Risk "ownership" assignment.** Accountabilities for developing and successfully executing mitigation plans are established.
- **Risk mitigation.** The risk mitigation, that is, the risk treatment, is implemented.
- **Risk monitoring.** Risk monitoring tracks risk mitigation activity.
- **Risk reporting.** Risk reports review status and update the risk register. Reports should additionally refresh mitigation plans and incorporate any new identified risks.

The process of risk assessment against the strategic, business, and operational objectives of the project is central to project management. The risk registers have to be maintained and regularly updated, and actionable controls for the identified risks must be implemented.

Risk Identification

Risks are present in all phases of just about every project. The question to initially ask is thus, "**What adverse things can happen to our project**?" To answer this question, an appropriate group of senior executive, operations, and project personnel need to come together as a group in a working session and agree on the specific list of risks for this particular enterprise.

Company and prior project experiences, along with the project stages ahead, need to be considered. Any assembled list would certainly need to include the following elements, among others, such that all potential risks to the project are captured:

- Constructability .
- Installation cost .
- Operations .
- Geology .
- Technology .
- Environmental impact, permits, social acceptance, and sustainability.
- Market .
- Political, country, and business climate .
- Financeability, tax, and foreign currency .

Risk Prioritization

After identifying the risks, the next step is grouping the risks into logical categories, such as strategic, financial (cost), operational, execution, schedule, quality (reliability), safety, environmental, customer, and reputation.

Risk Criteria Quantification

The next question after risk prioritization is, “How likely is it that the events listed in the risk register will actually occur?” Criteria have to be developed to prioritize the likelihood of the risk occurring, ranking likelihood from one extreme to the other for the particular project, to allow the process of managing the risk to be appropriately handled. The following five criteria are common likeli hood levels:

Rare		**< 5% chance of occurrence**
Unlikely		**5% to 19% chance of occurrence**
Possible		**20% to 49% chance of occurrence**
Likely		**50% to 94% chance of occurrence**
Almost Certain		**≥ 95 chance of occurrence**

Relative weights for each level of likelihood are assigned after the risk is identified, grouping the risks and thus leveraging them into standard risk categorizations. This step takes place before placement in the risk analysis matrix engine.

Figure 1 illustrates the five-criteria ranking that most mining organizations use to rank risk, along with the rationale for the likelihood assignments. Some firms use three criteria (high, medium, and low), while others use four (very high, high, moderate, and low). The authors favor a five-criteria ranking as it seems to better segregate risk. The actual number of criteria in the scale makes little difference; the important thing is the logical assignment of relative likelihood to each identified risk.

Level		
1	Rare	Doubt it could happen in present, or even in a changing, environment. **Conceivable** but highly improbable. The aspect or event may occur in **very exceptional** circumstances.
2	Unlikely	**Less likely** to happen in present, or even in a changing, environment, but **could occur** at some time. The aspect or event has happened elsewhere under **slightly similar** circumstances.
3	Possible	It **could happen** in present, or even in a changing, environment. **Would not be a surprise** to see it happen. The aspect or event **has occurred** before here or in similar circumstances elsewhere.
4	Likely	It **probably will** happen in present, or even in a changing, environment. It is **expected** to occur. The aspect or event **occurs** in most circumstances.
5	Almost Certain	Happens **all of the time** in present, or even in a changing, environment. The aspect or event occurs in **almost all** circumstances.

Fig. 1: Risk likelihood table

Along with the assignment of likelihood to each risk, a necessary parallel step is to deter mine the impact of that risk on the project. The tool to accomplish this is the impact assessment scorecard. On this scorecard, quantitative parameters are subjectively assigned for different levels of impact by the same group that subjectively assigned the likelihood parameters. Typical impact levels for a five-criteria scale are the following:

1. Insignificant: no material effect on project conduct or outcome.
2. Minor: causes modification to Project Execution Plan, but does not impact outcome.
3. Moderate: causes project disruptions and needs resources and actions to fix.
4. Major: reduced ability to achieve project budget and/or schedule goals.
5. Catastrophic: loss of ability to complete the project.

Figure 2 shows a five-criteria impact assessment scorecard for a fictitious OK Gold Mine project. The scorecard allows a quantitative impact to be assigned to each identified risk in the risk register.

Impact assessment scorecard—criteria to consider

Project: OK Gold Mine

Impact

Impact Score	Financial Impact*, $ millions	Schedule†	Environmental	Reputation
5	>15	>10 days	Very serious long term	International coverage
4	10–15	7–10 days	Serious medium term	International coverage
3	5–10	3–7 days	Moderate short term	National coverage
2	1.5–5	1–3 days	Minor impact	Local/regional coverage
1	<1.5	<1 day	Minimal	No coverage

Likelihood

Probability Score	Frequency Descriptor	Percentage Frequency	Annual Frequency
5	Almost Certain	≥95% chance of occurrence	Occurs more than once per year
4	Likely	50–94% chance of occurrence	Occurs at least once every other year
3	Possible	20–49% chance of occurrence	Occurs once every 2 to 5 years
2	Unlikely	5–19% chance of occurrence	Occurs once every 5 to 20 years
1	Rare	<5% chance of occurrence	Occurs less than once every 20 years

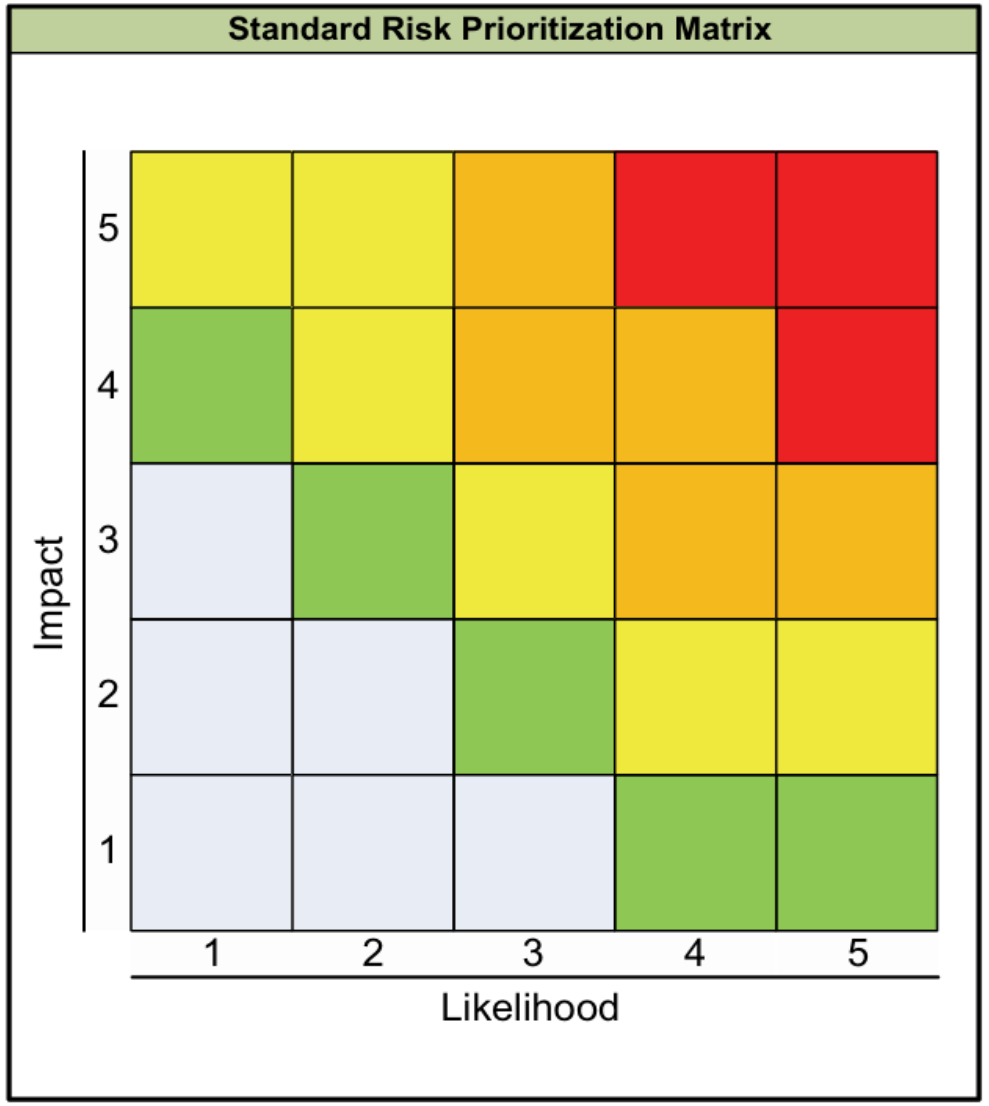
* Financial impact is determined in terms of operating cash flow (before tax).
† Schedule impact is calculated to be equivalent to the financial impact assuming 1 million oz/yr, $1,000/oz, 35% effective tax rate.

Fig. 2: Risk Criteria Quantification

Risk Analysis

After each risk has been quantified for likelihood and impact, an analysis has to be prepared for the overall risk of each activity, using the data collected and the assumptions made. The standard way of assessing and displaying overall risk for each activity identified by the risk register is graphically, within a risk matrix. Such a matrix is shown in Figure 3, where impact is measured on the y-axis and likelihood on the x-axis.

Prioritizes and focuses risk management efforts



Proposed Activities for Varying Levels of Importance

Catastrophic priority
- Manage at project level.
- Develop detailed risk management plan* with clear actions and expected outcomes, resource requirements, success metrics, and progress reporting plan.

Major priority
- Manage at project level.
- Develop detailed risk management plan* with clear actions and expected outcomes, resource requirements, success metrics, and progress reporting plan.

Moderate priority
- Manage within area or functional department.
- Develop detailed risk management plan* with clear actions, resource requirements, and success metrics.

Minor priority
- Communicate to relevant functions for awareness.
- Monitor for change in status.

Insignificant priority
- Inform relevant functions for awareness.
- Monitor for change in status.

* The risk management plan includes risk mitigation, risk monitoring, contingency planning, and emergency response plans.

Fig. 3: Typical Standard Risk Matrix

Each risk is reflected against the sliding scales of likelihood and impact, producing an instantaneous evaluation of exposure for the project. The potential impact of each risk is literally displayed (assessed) within the predefined evaluation grid of the risk matrix.

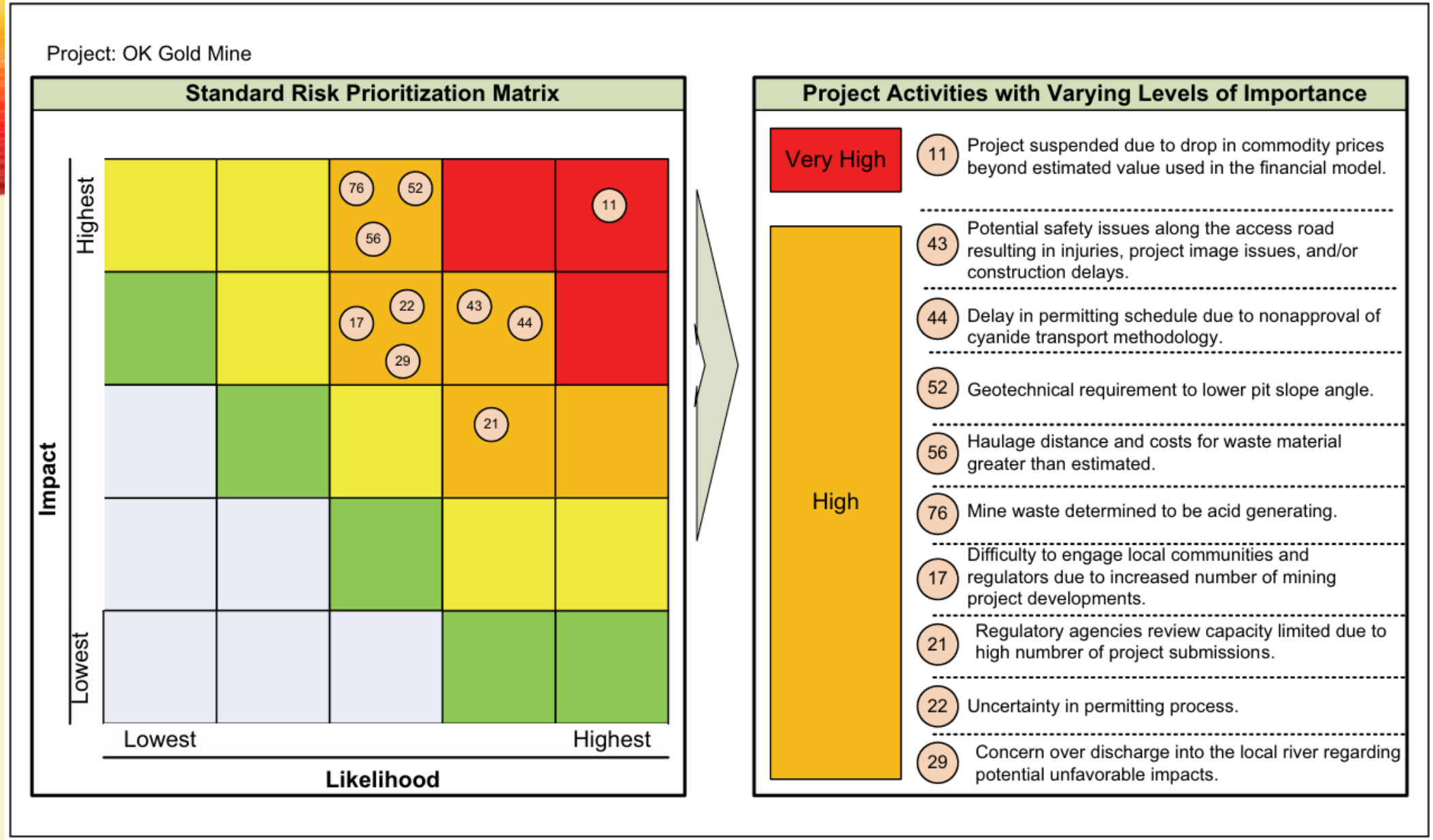


Fig. 3: Risk Matrix

Risk Ownership assignment

After all the risks are identified, logged in the risk register, and quantified, then the question becomes, “Who is best placed to handle the risk?” The chosen entity to handle (or “own”) the risk is often characterized as the “risk champion بطل” for that particular risk. The key here is to assign risk ownership and accountability to the entity best qualified to handle that risk. The mining company—the real Owner—will ultimately pay for the risk management, wherever it is assigned, so it is always smart to assign risk to the entity with the best chance of minimizing it. For many risks, the Owner will end up being the best entity to handle it, but for some risks, it could be the construction company or the engineering, procurement, and construction management (EPCM) firm. Owners’ attempts to shed risk from themselves to less qualified “others” generally backfires and ends up just diminishing the chance of project success.

Risk Mitigation

Risk mitigation (or risk treatment) involves addressing the risks identified in the risk register. The questions to ask here are “What can be done to manage the risk?” and “What are the relative merits of the management options?” There are essentially four ways of handling risk:

1. Avoidance—take action to avoid the risk.
2. Alleviation—define actions to take if and when the risk occurs.
3. Transfer—have someone else handle the risk (e.g., insurance, bonds).
4. Acceptance—identify the risk as acceptable and let it happen.

The umbrella term mitigation embraces all these ways of handling risk. Determining which of the four options to choose for risk mitigation is primarily financial, but schedule, resources, and personnel will also come into play.

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The first task when commencing the risk mitigation process is to identify the key risks that need immediate action. One or two risks may even need elevating out of the project domain and into the hands of others within the mining company. While most risks will require some type of action plan, a few risks will be fine to accept, monitor, and possibly re-evaluate at a later date.

Mitigation methodology generally follows this logic:

- Discuss the identified risk with the present risk owner; evaluate any ongoing actions.
- Assess current mitigation initiatives against other mining industry and company practices.
- Identify gaps.
- Identify, evaluate, and quantify alternative options to manage the risk.
- Determine risk interdependency. Could risk failure have a cascading effect?

■ Determine an appropriate mitigation course of action ("horses for courses" pertains). Mitigation could mean:

1. Transfer of risk to a new "owner,"
2. Taking project action to manage the risk,
3. Taking on additional project insurance or bonding,
4. Assigning contingency if this is a systematic risk, or
5. Establishing a management reserve if this is a major but unlikely project risk from external events.

- Calculate the potential costs for the selected mitigation actions.
- Determine if any residual risks will remain even after mitigation.
- Document the impact of each risk if it were to occur, monetarily and otherwise.
- Establish key performance indicators for monitoring.
- Document the action plans, risk champions, key performance indicators, mitigation timeline, and milestones.
- Update the risk register.

Risk Monitoring

When monitoring risk, the questions to ask are “What measures best capture the outcome?” and “Are the enacted measures having the intended effect?” Periodic and ongoing reviews to monitor the effectiveness of the risk management program are essential. The risk-monitoring process has to incorporate the following:

- Identification of the individuals making the decisions on management of the risks
- Clarification of the information needs for the managers of the risks
- Development of the reporting requirements
- Escalation procedures for when risk tolerances are in danger of being exceeded

Risk Reporting

When reporting risk, the question to ask is “Who needs to know the status of the risk?” The original risk register created at the end of the risk identification stage should be populated with the relative risks from the risk criteria quantification exercise as well as with the risk champions’ names from the risk ownership assignment step. The register thus becomes the prime deliverable from the risk management analysis. The register can be used to highlight the top ten or the top twenty risks, or whatever the situation demands.

Reports are developed to meet the specific information needs and to provide transparency to leadership on progress. Risk status updates need to be a standard component of all weekly meetings, monthly reports, and periodic (quarterly?) reviews with the Owner. Weekly meetings facilitate issues resolution. The monthly reports will update the Owners by:

- Tracking mitigation actions and providing a review of the status of the risk exposures,
- Providing a forum for securing support and intervention to handle obstacles, and
- Ensuring that mitigations are being conducted according to program requirements.

Periodic review meetings with the Owner's leadership and the governance board:

- Provides a comprehensive update of exposure,
- Disseminates an early warning of issues that can impact the Owner,
- Informs the Owner of any new risk exposures and/or required interventions, and
- Maintains the visibility on overall risk assessment. When set up properly, the reporting process is a tool to help discern how and where the risk management process can be improved.

Because of the criticality of risk management, a risk dashboard page is frequently established as a second support page to the summary project dashboard management page. Major risks can be tracked on a project dashboard.

Benefits of Risk Management

Deployment of risk management procedures will provide the following benefits:

- Provide assurance to Owner executives that the risks are being proactively handled.
- Focus project management's attention on the highest risk areas.
- Improve capital allocation decisions and investment returns.
- Enhance the interface with contractor management.

Schedule Risk

1. Project dependency failures—the other party not delivering its work on time.
2. Parts delays—equipment and/or materials not being delivered on schedule.
3. Estimation errors—poor or improper sources used for estimating project activities.
4. Decision delays—untimely decisions causing schedule delay.
5. Equipment malfunctions—insufficient attention to quality in the procurement process.

Resources Risk

1. Outsource entity delays—project contractors not mobilizing or progressing as planned.
2. Insufficient funds—for items (equipment, people, etc.) overlooked in the estimate.
3. Attrition of resources—equipment breakdowns, personnel and contractor desertions.
4. Late staffing—project workforce buildup falling behind plan.
5. Skills scarcity—workforce skill sets not available or trained to match project needs