This document is intended to familiarise Original Equipment Manufacturers (OEMs) and Mine Site Users with the objectives and concepts of the Operability and Maintainability Analysis Technique (OMAT). It is not intended to provide detailed directions for the facilitation and implementation of OMAT.

OMAT was developed by the Minerals Industry Safety and Health Centre (MISHC). This risk assessment technique was developed in alignment with the Earth Moving Equipment Safety Round Table (EMESRT) vision, specifically by providing processes for User Engagement and the application of the Design Philosophies.

Trials involving Mine Site Users and OEMs were undertaken to refine and finalise the technique as part of a 2008 Australian Coal Association Research Program (ACARP) study entitled ‘Identification of Priority Operability and Maintainability Issues and Potential Solutions Related to Large Surface Haul Trucks.’ Subsequently, the tool has been refined and implemented at various mine sites.
OMAT Introduction

OMAT is a risk assessment technique, ideally performed by OEMs with the assistance of Mine Site Users.

OMAT is a task-oriented process which systematically examines the health and safety risks imposed on operators and maintainers of mining and exploration equipment. This qualitative risk assessment technique distinguishes relative levels of risk to highlight the priority design concerns.

Risk management practices are most effective when incorporated early in the equipment design life cycle. OMAT is a 6-step process that aligns with, and spans across, the OEM design milestones and ideally begins at the concept phase of the design process.

A modified version of the OMAT can also be used at a mine site during operation or modification phases of existing equipment or to address any residual risks or site specific risks of newly purchased equipment.
Step 1: Critical Task Identification

The first step of the OMAT process is the Critical Task Identification. This step should be completed early in the Design Phase, ideally in a joint OEM and User workshop. The User is defined as the operator, maintainer or other mine personnel with extensive experience with the equipment at a mine site. The OEM should include both factory engineers and field personnel.

Critical Task Identification exposes the priority operability and maintainability tasks that warrant further investigation.

This process begins by detailing all operation and maintenance tasks specific to the equipment being analysed. For each of these tasks, a Priority Score is determined by considering the impact of a less than adequate design using a list of key hazards/risks relevant to the scope of the OMAT. The EMESRT DPs were used to select the key hazards/risks for OMAT. The complete list of suggested OMAT key hazards/risks is below:
The Priority Score is determined from a frequency-consequence matrix and the Total Priority Score is tallied for each task. The highest scored tasks should be further analysed in the OMAT. Ideally, all Catastrophic (5), Severe (4) and Serious (3) consequence tasks should be resolved.
The second step involves the development of a task flow chart for each priority task flagged during the Critical Task Identification. This step should be completed early in the design life cycle, ideally in a joint OEM and User workshop.

When constructing the task flow chart, each task should be divided into its individual discrete steps, as there may be different risks associated with each step. Important notes and observations should be documented as part of the risk assessment. In this step and subsequent steps, improved realism of task performance and equipment design enhances the risk assessment.
Step 3: Risk Identification

Risk Identification is the third step of the OMAT process. This step should also be completed during the joint OEM and User workshop.

The purpose of the Risk Identification is to uncover the possible risks in every step of the Task Flow Chart. The User’s input is vital at this point to effectively identify all risks.

<table>
<thead>
<tr>
<th>Task Step:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Problem</th>
<th>Consequence</th>
<th>Task Frequency</th>
<th>Priority Score</th>
<th>Suggested Solutions (User)</th>
<th>Hierarchy of Control</th>
</tr>
</thead>
</table>

The ‘risks to be mitigated’, which are outlined in the EMESRT design philosophies, can be reviewed to help identify the potential risks for each task step.

For each unwanted event identified, the appropriate consequence and frequency is determined. The frequencies are broad enough to cover both operation and maintenance tasks. If the actual frequency falls between these preset frequency
values the assessor should be consistent in selecting either the closer value or the more conservative value.

A score for the particular event will be generated from a frequency-consequence matrix to identify the highest priority task steps. This approach allows designers to systematically consider these risks in their design concepts.

Using a brainstorming approach, the workshop team should now propose potential design solutions. The purpose is not to stipulate specific solutions, but rather to provide potential options for consideration by the OEM design engineers. These options may stimulate their thinking to create other innovative solutions or fundamental design changes. Next, the team should determine where on the Hierarchy of Controls the Suggested Solutions fit.

The Hierarchy of Controls, sometimes called the Safety Precedence Sequence, considers hazards in terms of energy. There are many types of energies present on a mine site including chemical, electrical, mechanical, pressure, noise, gravity, thermal, and biomechanical.

The best way to ensure the risk has been controlled is to design to eliminate the energy source. In order of effectiveness, the levels of the hierarchy used in OMAT are:

- Eliminate the energy source
- Substitute or minimise the energy source
- Implement a passive engineering control that does not require human involvement (example, kickboards)
- Implement an active engineering control that does require human involvement (example, tie off point for safety harness)
- Install a warning or alarm system
- Implement procedural controls, including personal protective equipment; and lastly and least effectively
- Awareness and competency controls
Step 4: Solution Options

Step 4, Solution Options, also takes place early in the Design Phase.

In addition to the User’s Suggested Solutions from Step 3, further solutions to mitigate the risk can be provided by the OEM.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Priority Score</th>
<th>Suggested Solutions (User &amp; OEM)</th>
<th>Hierarchy of Control</th>
<th>Selected Solutions</th>
<th>Rationale</th>
</tr>
</thead>
</table>

Risks of the highest priority, as determined in step 3, will require more robust controls or a greater number of controls.

When selecting appropriate controls it may be helpful to consider the EMESRT design philosophies section entitled ‘industry attempts to mitigate risks’. This section provides some examples of industry designs and mine site retrofits that have been implemented to eliminate or mitigate human factors risks associated with mining and exploration equipment. Another tool that can assist with selection of appropriate controls is the Minerals Industry Risk Management Gateway, known as MIRMgate (www.mirmgate.com/emesrt.asp).
Step 5 is the Feedback & Action Plan. By means of a workshop, this step provides an opportunity for the Users to provide the OEMs with crucial feedback on the practical nature of the solutions.

After solutions have been agreed by the OEM and Users, personal responsibility and an implementation date can be assigned.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Priority Score</th>
<th>Agreed Solutions (OEM &amp; User)</th>
<th>Who</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additional controls may be identified as the design evolves and existing verification practices are applied. Any new controls should be added and tracked on the Action Plan.
Step 6, the final step, is the Equipment Risk Register. This step should be completed by the OEM in preparation for the ‘hand-over’ before commissioning the equipment.

The Equipment Risk Register compiles and summarizes all relevant information collected during the OMAT. It collates the results of the OMAT into a risk management document that outlines all the prioritised unwanted events/problems and the associated risks and controls for that particular piece of mining and exploration equipment.

![Equipment Risk Register Diagram]

For OEMs the most useful information in the Equipment Risk Register is the detailed record of risk controls that have been investigated using the OMAT process. These controls may also be used as a reference for the development of future equipment models.

Individual mine sites can also benefit from the information contained in the Equipment Risk Register, from both the implemented controls and identified residual risks.

Ultimately, this comprehensive risk assessment process is intended to deliver mining and exploration equipment that will ensure the safety and well being of all operators and maintainers.