

Vendor Assurance of Machine Safety The MSA Model

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Executive Summary

- **Vendors**, ie Designers, Manufacturers, Importers, and Suppliers now have statute law obligations, under the new Qld Mining Safety & Health Acts, to manage risk. Whilst statute obligations for safe work starts and stops at the minesite gate, obligations for safe machines now starts with those with most influence in the first place, the Vendors.
- **“No Risk”** to persons or workers is now a prescribed benchmark of some Users. To support such a target, requires redundancy and/or very high quality vendor processes (approaching 6 sigma or 99.7% confidence) in assuring safety outcomes where Vendors have influence.
- **Machine Safety Assurance (MSA)** is a model for such a risk management process embedded in Vendors’ quality systems. Under MSA, Vendors undertake certain prescribed risk management duties and tasks, from which just 3 key safety outcomes arise.
- **3 Key Safety Outcomes** prescribed by MSA for Vendors are:
 1. **Technical File** Archive (10 years) for each individual machine Serial No.
 2. **User Information** Specific to that machine made available to Users.
 3. **Incident Reporting** System for Hazard Alert and Product Recall,
- **The Technical File** need not be one physical file. It is a compilation of the risk management processes applied uniquely to individual machines (including Importer & Supplier modifications) developed and maintained by Vendors. All technical inputs by Vendors must be able to be assembled for the authorities to identify the risk management steps taken. Modification and User Information Supplements to the Technical File, as well as an Incident Reporting system, are also provided for modifications in order to maintain an equal or better level of risk for Workers and other persons.
- **User Information** (provided by Vendors) is critical safety information for Holders, Operators, SSE’s, Supervisors, Persons and Workers at a Mine or Quarry (Referred to here as Users). User Information derives from each machine’s unique Technical File. User Information must be implemented as appropriate for Worker competency & site conditions prevailing.
- **Incident Reporting / Hazard Alert / Recall** systems are an integral part of any safety assurance process. Designer/Manufacturers have the prime duties here, however Suppliers must have feedback and reporting procedures in place to support it. Reported Incidents must be acted on.
- **Working Together for Safety** is a duty of Vendors and Users, under an MSA process, to discharge their obligations under the Acts. Communication of User Information and Incident Reporting are two obvious common duties under MSA. We see the duties of Users, is not to re-invent, and possibly corrupt, Vendor risk management outcomes in areas of vendor influence, but to take reasonable steps to assure themselves that Vendors are managing risk on their behalf. Users must also fully consult the risk management strategy provided by the Vendors (ie User Information).
- **Going it Alone** exposes Users to Vendor Obligation Traps (where they perform Vendor tasks). Where Users do commit to support and maintain the Vendor Technical File over the life cycle of the machine, they are themselves freed of the duties, tasks, and obligations of Vendors.
- **“Managing Safety to Have a Future”**, is the ultimate outcome and benefit of Machine Safety Assurance processes for Users & Vendors. This is possible only by the new common performance obligations for “plant” safety now imposed by the Acts on Vendors. Those Vendors who assure machine safety efficiently, to a “No Risk” benchmark will continue to grow their mining business in the 21st century. A 1st step for Vendors and Users is to have a common, vision as to the part that each plays to achieve a “No Risk” machine safety outcome.

Nomenclature

For the purposes of brevity & clarity, the following terminology is used:

Acts	This is the author's terminology for both the Mining and Quarrying Safety and Health Act 1999 and the Coal Mining Safety and Health Act 1999
Users	This is the author's terminology for those in the user chain (Holders, Operators, SSE's, Supervisors, Persons and Workers) at a Mine or Quarry. It also includes all other persons in other uses, eg transport on public roads.
Vendors	This is the author's terminology for those in the supply chain (Designers, Manufacturers, Importers, Suppliers), in the case of mobile machines.
Duty	This is the author's terminology for prescriptive actions designed to discharge Vendor obligations under the Acts.
Machine	This is the author's terminology for the mobile equipment, plant and components covered in the Acts. Typically they are heavy mobile, earthmoving plant, including components, parts and substances supplied.
OEM	This is an acronym for Original Equipment Manufacturer. In this paper, OEM's are typically large companies with worldwide markets and applications.
MSA	This is the author's acronym for Machine Safety Assurance.
TCF	This is an acronym for Technical Construction File. A TCF is the Technical File information originating from the OEM for the ex factory machine into an application envisaged by the OEM.

Scope

This paper outlines a risk management model for "plant" applicable to Vendors of production line heavy mobile, earthmoving machines from major OEM's (Original Equipment Manufacturers), not one-off specific design fixed plant. User skills, expertise, experience and resources to manage mobile machine safety, is different from that of fixed plant

Typically life cycle and learning curve of mobile machines is shorter, and product development and change-out cycle much faster. High populations worldwide, provide wide exposure to hazards on which to base the risk management process. Mobile machines are also increasingly having a second life in another application; being disposed of by the 1st Users as operational machines to 2nd Users.

Any "No Risk" machine safety model must therefore be applicable to new supplied machines, "second hand" machines, modification, certain repair and upgrade to machines currently in service.

The model must deal with:

- User obligations for safety of plant being relinquished to Vendors.
- Prescriptive outcomes and duties of Vendors under any such process designed to meet the performance obligations under the Acts.
- How User obligations for mobile plant safety can be efficiently discharged by the assured outcomes of Vendors.
- How certain tasks and duties influence the obligations of each party. (For example, how Vendor obligations could be imposed on mines, by them performing Vendor tasks).

Vendor Obligations

As well as User obligations, the new Mining Safety and Health Acts (Coal & Metalliferous) (Part 3 Division 3) places obligations on those in the supply chain, “the Vendors” to identify plant hazards and manage risk where they have influence. The Acts state:

Obligations of Designers, Manufacturers, Importers and Suppliers of plant etc. for use at mines

41.(1) *A Designer or Importer of plant for use at a mine has an obligation to ensure the plant is designed so that, when used properly, the risk to persons from the use of the plant is at an acceptable level.*

(2) *A Manufacturer or Importer of plant for use at a mine has an obligation to ensure the plant is constructed so that, when used properly, the risk to persons from the use of the plant is at an acceptable level.*

(3) *A Designer, Manufacturer or Importer of plant for use at a mine has an obligation to ensure the plant undergoes appropriate levels of testing and examination to ensure compliance with the obligation imposed by subsection (1) or (2).*

(4) *Also, a Designer, Manufacturer, Importer or Supplier of plant for use at a mine has the following obligations—*

(a) to take all reasonable steps to ensure appropriate information about the safe use of the plant is available, including information about the maintenance necessary for the safe use of the plant;

(b) to take the action the chief inspector reasonably requires to prevent the use of unsafe plant anywhere.

The Coal and Metalliferous Regulations further detail specific requirements. Whilst the Coal and Metalliferous Regulations have not harmonised their “plant” requirements, the overriding obligations within the Acts are the same. The prescriptive process and procedures Vendors must put in place to discharge their obligations to manage risk, are therefore very similar.

In order to harmonise the “acceptable levels of risk” between coal and metalliferous users, Vendors are safest to adopt a common risk management philosophy and implementation for both. The model for this should be in harmony with expected outcomes of both coal and metalliferous, but be able to accommodate the specific coal regulatory prescriptions as they arise.

The risk management model should also be in harmony with other statutes as the Qld. Workplace Health & Safety Act and Advisory Standard for Plant. Although not explicitly recognised in Qld, the National Standard for Plant is increasingly important for other jurisdictions within Australia.

Vendor Approach to Risk Management

Risk Management for major OEM's has traditionally focused on harmony and conformance to codes and standards, together with worldwide incident reporting systems. In that sense, they have been largely reactive. However, together with their quality systems, the depth of testing and experience, and the simplicity of most hazard events, there is a high assurance of machine safety.

In order to obtain greater design flexibility, meet faster product development time frames, as well as conform to European Commission Machinery Directives, machine hazard analysis has been adopted for many years. In addition, wider scope risk management techniques, (eg Hazop) has also been used in collaboration with Users at their sites where the situation required it.

As stated above, major Vendor design and risk management procedures rely heavily on achieving harmony with recognised standards and codes, both internally, and those adopted by government and industry bodies. The advantage of major OEM focus on conformance is that it helps to harmonise the safety performance and User interface. Other make and model machines, therefore, are similar to use (eg brakes, steering, stability, ergonomics, human access etc). This is an advantage to users as it provides for standardisation in operation, portability of skills, and machine safety.

To be cost effective and assured at all times; Vendor risk management must be part of their quality management processes. The reason for this is that a quality management system allows Vendors to leverage their knowledgebase without entirely re-inventing the wheel every time a machine is commissioned. Managing risk as a discrete step (done at machine delivery) is simply not feasible for Vendors given the numbers of machines and resource drain involved.

"No Risk" to persons or workers is now a prescribed benchmark of some Users. To support such a target, requires redundancy and/or very high quality vendor processes (approaching 6 sigma or 99.7% confidence) in assuring safety outcomes where Vendors have influence.

Machine Safety Assurance (MSA)

- ✓ Machine Safety Assurance (MSA) involves Vendors and Users working together to achieve quality assured safety outcomes spanning a ten-year period, from date of supply of each machine.
- ✓ MSA is a systematic risk management process embedded in Vendors' quality systems to assure prescribed safety outcomes specific to each machine.
- ✓ MSA involves a number of smaller prescriptive risk management steps in contrast to a discrete risk assessment study of the "delivered machine". MSA is built in, not tacked on.
- ✓ MSA provides Vendors with prescribed policies, procedures, duties and outcomes which, when implemented within a quality system, assures that the obligations under the Acts are discharged.
- ✓ Under MSA, the risk management processes are built into the design, manufacturing, importation, supply, transport and commissioning processes of mobile machines supplied to Users. This is achieved by a combination of safety assurance processes by the OEM Designer & Manufacturer followed by the Importer and Supplier safety assurance in the provision of value added services.
- ✓ A by product of a robust MSA process for Mining machines, is that other jurisdictions (eg Workplace Health & Safety) are further safety assured by the high quality prescriptive risk management outcomes of the MSA process.

Without an MSA type process, risk management becomes generic or ad-hoc.

- ✗ Ad-hoc processes can be, and are, quite effective in the short term. However they deteriorate and can even be lost over time with staff and structural change. Ad-hoc risk management therefore, is a challenge for Vendors to manage over time.
- ✗ Generic risk management processes can be important elements in a Vendor's MSA Toolkit, however generic risk assessments and generic User Information fall below a 6 sigma level of safety assurance. The risk with generic processes on their own, is that they can easily be a placebo for all parties, ie something is being seen to be done, but in reality, the obligation remains undischarged.

Key Safety Outcomes..... in a Nutshell

In a nutshell, 3 key risk management outcomes are prescribed for Vendors under MSA:

1. **Technical File** Archive (10 years) for each individual machine Serial No.
2. **User Information** Specific to that machine made available to Users.
3. **Incident Reporting** System for Hazard Alert and Product Recall,

The 3 Keys to Machine Safety

The principal outcome of Vendor assurance of machine safety is not a discrete risk assessment document, but rather it is the Technical File (for each machine including modifications) and the "User Information" provided. Under a quality-managed, safety assured system, the equivalent outcome to the "discrete" risk assessment document can still be identified in the various databases, systematic references, & User Information contained in the Technical File.

Under MSA, the Technical File contains the key references to the OEM's Technical Construction File (TCF), as well as to any Modification Supplements and Machine History/Condition Reports. These references must be sufficiently robust that they are able to uniquely capture and record the exact specification for each machine, including all modifications and the machine condition as supplied for a minimum of ten years.

The Technical File is in effect a virtual archive of machine information in various locations, from a number of origins, which must be able to be assembled for statutory authorities for ten years from first use. User Information must be made available to Users in formats appropriate for the specific Users, for a minimum of ten years after first use.

Most OEM User Information regarding functional specifications in their Technical Construction File is provided in published specifications available to Users. These documents are also supplemented by information releases from time to time as detail specification changes.

No 1 The Technical File

This is a machine serial number unique reference to the following archived risk management processes. For example:

- ✓ Machine Hazard and Potential for Human Error Identification and risk assessment and control processes for the product.
- ✓ Detailed design calculations, design notes, drawings, testing results appropriate to the design and/or construction of the product.
- ✓ Results of any commissioning trials or other activities used to verify the design (eg technical reports or certificates).
- ✓ References to any recognised standards (eg. ISO, AS, SAE etc) as well as statutory regulations, codes, guides & procedures that were used in the design of the product.
- ✓ If applicable, the qualifications, experience, training and knowledge of employees or others relevant to the design, construction or modification of the product.
- ✓ On going results of quality control measures or testing programs.
- ✓ Calibration/external auditing of any test equipment, tooling or work processes and quality necessary to ensure the product safety specifications remain in conformity to specifications.
- ✓ A copy of all instructions provided to the end User.
- ✓ Inspection report or other appropriate documentation assuring the machine and components age and condition as supplied in areas which influence risk.
- ✓ The Technical File does not need to include detailed plans or other specific information of sub-assemblies used in manufacture unless they are essential to verify conformity with standards.
- ✓ The Technical File need not exist as a permanent single file but it has to be possible to assemble it to make it available in a reasonable time.

No. 2 User Information

User Information is a machine serial number unique reference covering “safe use” labelling, instrumentation, signage, manuals, training, & training aids. The scope covers all aspects of use including operation, maintenance, repair, replacement parts identification, transport, and decommissioning. For example:

- ✓ Machine operating specification and limits including prohibited uses.
- ✓ Labels and warning signs attached to the machine where applicable.
- ✓ O&M Manual fixed via hardened steel lanyard into the operator’s cab.
- ✓ Parts and Service Manual available to workshop staff.
- ✓ Installation instructions or installation design guide where applicable.
- ✓ Dimensions and weights of components where appropriate. (eg manual handling)
- ✓ Information for safe transportation of the machine on public roads.
- ✓ Component serviceable limits and Inspection & Repair recommendations over the envisaged life cycle of the machine, where it influences risk.
- ✓ Material Safety Data Sheets & Packaging Information for parts and fluids as appropriate

The availability of User Information from the Designer and Manufacturer is critical. “Available” means in an appropriate language and format accessible to all Users. The operation and maintenance manual, for example, must be in English, hard copy and permanently attached in cab. (Typically via a hardened steel lanyard fixed inside the cab.) Soft copy (computer files) compatible with on-line maintenance systems are generally best for parts and service manuals. Suppliers have the prime duty to ensure that all such User Information from the Designer, Manufacturer or Importer is available to Users. Special clauses, disclaimers, and “small print” in common law instruments such as quotations, tenders and letters do not suffice for this purpose.

Information Overload?

Not all User Information needs to be explicit to each machine. For example Vendors know that Workers must be competent under the Acts. Therefore information the Worker should know or reasonably ought to know need not be explicitly made available.

So how much does a competent Worker reasonably ought to know?

In the administration of the Acts following an incident, “lack of User Information” is likely to be simpler for authorities to identify and hold accountable than “lack of worker competence”. Therefore for Vendors, the availability of adequate User Information is now a key issue.

Excessive User Information however, may be potential for human error from “Sticker-Shock”. This is where essential safety information is “lost” in other information (which a competent Worker would “reasonably ought to know” anyway). Warnings are lowly ranked in the hierarchy of risk control. Therefore a predominance of warnings on a machine is an indication perhaps of zealous hazard identification but ineffective risk control processes. Warning stickers also place a burden on users to maintain them. This can be difficult in a mining environment.

No. 3 Incident Reporting / Hazard Alert / Recall Systems

Incident Reporting / Hazard Alert / Recall systems are an integral part of any safety assurance process. Designer/Manufacturers have the prime duties here. However Suppliers must have feedback and reporting procedures in place to support it.

A User’s & Supplier’s failure to report incidents to the Designer/Manufacturer may lead to dire consequences for users elsewhere, so underlying the importance of this new User duty. An alternative conduit in practice for incident reports may also be the Inspectorate’s database.

To assist Users and Suppliers, to discharge their obligations, Designers and Manufacturers must ensure their Incident Reporting system is able to provide timely and appropriate feedback on reported incidences and hazards.

Modifications

To minimise cost, it is advantageous to minimise “nice to have” local modifications and standardise on “must have” modifications where possible. This is achievable by working together to keep vendors focus on all machine safety issues or concerns at all minesites. In this way, today’s modifications have a better chance of becoming tomorrow’s OEM standard specification in a process of continuous improvement.

A modification is any change to the specification or method of use (application) which is not in harmony with the OEM’s Technical Construction File (TCF). Under MSA, a modification must be supported by a Technical File Modification Supplement archived for 10 years. In order to maintain safety integrity, the Modification Supplement must ensure a level of risk in harmony with the original OEM’s TCF. To do so, requires it to be strictly machine and application specific.

Requirements for a Technical File Modification Supplement

- The machine must be clearly identifiable to the User as containing modifications as well as identifying the holder of the Technical File Modification Supplement.
- The Modification Supplement must be able to uniquely archive and track the design plan actioned and risk management inputs and process as well as codes and standards used.
- The Modification Supplement must be able to track exactly all drawings and other instructions used in construction.
- Therefore all drawings and, specifications used in manufacture and assembly must be issued specifically for that Serial Number machine and recorded.
- The Modification Supplement must be able to uniquely track and reproduce the User Information manuals unique to that serial number machine.
- User Information must be Serial Number unique and harmonise with all modifications performed.
- Individual risk assessments for each modification must be carried out for the use envisaged, and archived in the Technical File.
- Machine risk assessments for the combination of modifications unique to each machine for the application envisaged must be carried out and archived in the Technical File.
- User Information generated from these risk assessments must be archived & copies made available to Users.
- All relevant documents, including drawings, drawing issue records, drawing revisions, manuals, modification groups, design jobs, and risk assessment incident reports must have unique identity numbers and serial number linked and searchable.

It is an onerous task for anyone to assure “No Risk” outcomes using ad-hoc paper based Technical Files. It is however, feasible for Vendors to manage Technical Files for modifications using electronic database and quality assured systems. However the unit cost of implementation is still a consideration, as would be, any system assuring “No Risk” outcomes.

Working Together for Safety

Under the new Acts, all parties, Vendors, Users are obliged to manage risk where they have influence. All parties must "work together" to assure that the management of risk occurs. The prescribed **outcome** of the risk management process carried out by each party must be communicated to others where it is necessary for their influence of risk, eg,

Vendors:

- Incidents must be recorded and appropriate response made back to Users.
- User Information must be passed on to Users

Users:

- Incident reports must be fed back to Vendors (if it is something they can influence)
- Vendor supplied User Information must be available and fully consulted.

In this context, "Incidents" also includes identified hazards. In practice, each party has a duty to recognise and consult as appropriate with the common outcomes of each other's Risk Management Processes below. A 1st step for Vendors and Users is to have a common, vision as to the part that each plays to achieve a "No Risk" machine safety outcome.

Minimum Outcomes of the Risk Management Processes:

Designer&Manufacturer Importer	TCF, User Information and an Incident Reporting System Access to TCF & User Information, Incident Reporting System, Ensures TCF harmonises with local statutes.
Supplier	User Information & Incident Report management with Users. Ensures application, machine specification and condition, all harmonise with the TCF. Ensures Technical File Modification Supplements for all modifications.
User	Undertakes appropriate use in harmony with User Information, site conditions & Worker competence. Reports Incidents to Suppliers.

Going it Alone?

Vendor obligation Traps for Users

Under the Act, mines could inadvertently take on Vendor obligations, particularly in the acquisition, disposal, and modification of plant/machines. In doing so, mines may take on defacto Vendor obligations. At least a dozen different scenarios called "Obligation Traps" have been identified in this regard by the author.

The meaning and performance of "acceptable" levels and "reasonable steps" applicable to the duties which discharge today's Vendor obligations is yet to be tested. Under the previous Mines Regulation Act 1964 & Coal Mining Act 1925, there was little if any prescription or safety performance requirements for Vendor tasks.

It is now probable that duties required for mines to discharge the new obligations as a defacto Vendor may now be at a higher performance level. What seem reasonable duties for a Vendor to undertake, (like those MSA duties listed in this paper), may be onerous but still compulsory for mines undertaking Vendor tasks.

Such mines would need to commit sufficient resources, competency, diligence and precautions in order to discharge defacto Vendor obligations, either ad-hoc or via a systematic MSA type process.

Avoiding Vendor Obligation Traps

Users should consult with a safety assured supplier as to the options available to avoid Vendor obligations prior to undertaking any of the activities listed below.

Internet & Imports	Mines who import machines take on Designer & Manufacturer obligations. The obligations are significant and the risk high.
Resale to another User	Mines take on Supplier obligations. The 1st User must ensure the "User Information" for the machine inc. modifications are also passed on to the second User. The 1 st User must assure the Technical File Supplement & Condition Reports/Records are also passed on if appropriate to the management of risk
Modifications	Mines risk taking on Designer/ Manufacturer obligations. Modifications require Technical File Modification Supplements & User Information as well as an Incident Reporting system.
Going it Alone	Mines risk taking on Designer/ Manufacturer obligations if they intentionally work outside the spec. A non-standard specification or "use" is a modification requiring measures listed above.

Conclusion – Sharing Duties to Manage Risk

Provided Users have competent workers who implement the Vendors' User Information, then the Acts clearly place most obligations for machine safety on the Vendors, not the Users.

Users, Standard Operating Practice/Work Instruction should be in harmony with the User Information in the first instance. Where deviation is desirable to suit local conditions, then Vendor involvement is recommended if the outcome is unlikely to harmonise with the standard machine specification or approved use.

The notion of sharing duties to discharge obligations of Vendors and Users represents a "sea change" compared with the previous Acts in how plant/machine safety should be managed. As such, it will take some time for all Vendor parties to adjust.

We see the duties of Users, is not to re-invent, and possibly corrupt, Vendor risk management outcomes in areas of vendor influence, but to take reasonable steps to assure themselves that Vendors are managing risk on their behalf. Users must also fully consult the risk management strategy provided by the Vendors (ie User Information).

Where the User for his application, does not consider the Vendors risk management strategy adequate, the Vendors should be involved in some way as to the additional controls required. This closes the loop and leads to continuous improvement in the OEM's machine to the benefit of all Users.

Vendors may lack the first-hand knowledge & detail of the work practices and risk at each mine in relation to machine hazard identification, assessment and control. It will take patience, understanding and cooperation of all parties for Vendors to complete that learning curve.

Those Vendors who assure machine safety efficiently, to achieve a "No Risk" benchmark will continue to grow their mining business in the 21st century.

References

The following references contain typical information supportive to any MSA process:

- Mining and Quarrying Safety and Health Act 1999 and Regulations (effective March 1, 2001)
- Coal Mining Safety and Health Act 1999 and Regulations (effective March 1, 2001).
- Qld Workplace Health and Safety Act 1995
- Qld WH&S Advisory Standard for Plant 2000
- Qld WH&S Advisory Standard for Risk Management 2000
- AS/NZS 4360: 1999 Risk Management Standard
- NSW MDG1010 Risk Management Handbook for the Mining Industry
- National Standard for Plant [NOHSC:1010(1994)]
- Qld Transport Operation (Road Use Management Act) 1995
- European Commission Machinery-Directive 98-37-EC

Many Codes, Acts and Standards etc for safety of plant and equipment are locatable at the following URL's:

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| <input type="checkbox"/> Qld Government, | http://www.qld.gov.au , |
| <input type="checkbox"/> Qld WH&S, | http://www.detir.qld.gov.au/hs/hs.htm |
| <input type="checkbox"/> Qld DME Mines Inspectorate, | http://www.dme.qld.gov.au/safety/mines.htm |
| <input type="checkbox"/> NSW DME Safety | http://www.minerals.nsw.gov.au/safety/safety.htm] |
| <input type="checkbox"/> Nat. Occ Health & Safety Comm'n, | http://www.worksafe.gov.au , |
| <input type="checkbox"/> Standards Australia, | http://www.standards.com.au . |
| <input type="checkbox"/> US Mine Safety & Health Admin'n | http://www.msha.gov/ |
| <input type="checkbox"/> US Equipment Manufacturers Institute | http://www.emi.org/index.htm |

The following sites have useful links

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| <input type="checkbox"/> NSW DME Safety Links | http://www.minerals.nsw.gov.au/safety/links.htm |
| <input type="checkbox"/> Nat Inst for Occ S&H Rsch Links | http://www.cdc.gov/niosh/otherwww.html |
| <input type="checkbox"/> Nat Road Trans Comm Links | http://www.nrtc.gov.au/links/index.asp?lo=links#L6 |