RISK BASED DEVELOPMENT OF PROCEDURES

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SUMMARY

New mining safety and health legislation in Queensland requires standard operating procedures or standard work instruction to be developed as part of a formal safety and health management systems.

How often do procedures / work instructions become just pieces of paper stacked on office shelves?

How often are procedures / work instructions prepared with little or no involvement of the people who need to use them and who really know how the task is done?

How often are risk assessments carried out only to become reports on shelves without effective corrective and preventive action being taken?

This paper discusses a method of developing procedures and work instructions using hazard analysis and risk assessment techniques. It will describe a method that:

- involves operators / miners in brainstorming sessions
- analyses work processes
- identifies hazards
- assesses risks
- focuses on the hierarchy of risk control
- links corrective and preventive actions to sustained improvements in the management system
- improves current procedures / work instructions
- develops new procedures / work instructions
- gives ownership to operators / miners of procedures and work instructions

INTRODUCTION

There are many different forms of risk assessment techniques available in the market today. This paper specifically utilises the technique known as HACCP.[1]

HACCP will be a key element of a complete product /process management or good manufacturing practice system. In brief HACCP is applied through taking a number of easy steps:

- look at your processes / product from start to finish
- decide where hazards could occur
- put in controls and monitor them
- write it all down to keep records
- ensure that it continues to work effectively

HACCP was originally developed as a microbiological safety system in the early days of the US manned space programme, as it was vital to ensure the safety of food for the astronauts. At this time most food safety and quality systems were based on end product testing, but it was realise that this could only fully assure safe products through testing 100% of the product, a method which obviously could not have worked as all product would have been used up.

As identified here HACCP is a total management system, however, it also has some very important key components. The most important is the risk assessment component.

The HACCP plan is a formal document which pulls together the key information from the HACCP study and holds all that is critical to the safety management process under review. The HACCP plan is drawn up by a team of personnel, personally effected by the output of the plan, ie operators/miners, supervisors and managers). This is the only way to ensure ownership of the procedures by the general workforce.

The plan has two essential elements:

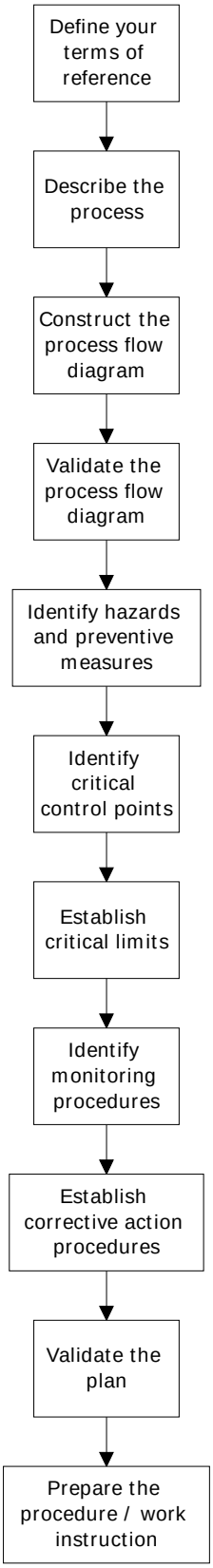
- the process flow diagram and the
- HACCP control chart

The process flow is a stepwise sequence of events through the whole process, giving a clear and simple description of how the end product / process is determined.

It is an essential part of the HACCP plan which enables the persons in the team to understand the production process and is the basis for the hazard analysis.

[1] HACCP – Hazard Analysis and Critical Control Point

At the end of the HACCP study all CCP's (critical control points) are identified and tied back to the original process flow.



The process flow diagram can then be used as the skeleton for the preparation of the procedure or work instruction.

This process is demonstrated by the following flow chart (figure 1):

THE HACCP PROCESS
DEFINE THE TERMS OF REFERENCE

To define the terms of reference the following questions should be asked:

1. do you want to cover all types of hazards initially or just one type of hazard (consider chemical, stored energy, physical, biological etc)?
2. will the study cover the entire process or just a part of it?

DESCRIBE THE PROCESS

At this stage it will be most important for all members of the team to accurately know what it is they are assessing. Therefore, by formally documenting down the process the team can identify what it is they are actually assessing.

CONSTRUCT THE PROCESS FLOW DIAGRAM

Develop a Flow Diagram for the Specific Process.

Include where appropriate:

- location of work ie mine / pit, workshop, hardstand, plant
- tasks being done
- training that personnel have received to do the work
- written work practices, permits to work, procedures ie procedures that we currently have in place
- numbers of personnel who normally / occasionally carry out the work
- any other persons who may be affected ie consider how frequently people are trained in this task and how often it is audited (assessed) etc

Points for consideration with respect to the essential points (above) and the answers already stated:

- plant and machinery used to perform the task
- manufacturers or suppliers operating instructions
- manufacturers or suppliers maintenance instructions
- size, shape, surface character and weight of materials that may be handled

- distances and heights that materials may have to be moved
- services used
- substances used
- physical forms of substances used or encountered
- material safety data sheets (Chem Alert)
- any control measures already in place ie procedures, training, maintenance etc
- legislative requirements
- monitoring data
- accident and incident reports ie review the existing reports and determine which apply to this situation

The style of the process flow diagram will be specific to each organisation. However, figure 2 has been adopted by Audit Services International and has proven very effective.

VALIDATE THE PROCESS FLOW

Once the process flow diagram has been prepared, the team needs to validate the diagram by asking the following questions:

1. have we addressed all parts of the identified process
2. have we addressed all impacts of the identified process
3. have we addressed all potential personnel / situations involved

IDENTIFY HAZARDS AND PREVENTIVE MEASURES

Once the process flow diagram has been validated, the team needs to brain storm out the hazards associated with each step of the process flow.

Further, they need to identify if there are any sub-sets of the hazard. As an example:

- a hazard may be generated through poor or less than adequate visibility and the sub set hazard would be:
  - visibility hazards caused through dust
  - visibility hazards caused through sunlight / glare
  - visibility hazards caused through lack of lighting / luminescence
  - etc

Once each of these hazards have been identified they need to be recorded. As well as recording the hazard and the subset of the hazard, if there is any, the team should also the record the consequences of the said hazard. This assists in the recording of the assessment and in the repeatability of the assessment at a later date. This information can be recorded in a table as shown in figure 3.

IDENTIFY CRITICAL CONTROL POINTS

The only way that you can identify the critical control points is by completing three sub steps:

1. identification of risk
2. determination of the acceptability of the risk
3. determining corrective measures (based on the hierarchy of control) for the unacceptable risk

The process of completing these three steps is actually identifying the critical control point.

There is no correct risk assessment method. AS / NZS 4360 – 1999, Risk Management identifies the probability verses consequence model.

To ensure that the risk assessment from a HACCP perspective is complete the tie line risk assessment technique is used. It has been chosen because it also includes exposure.

An example of the tie line risk assessment tool is provided in figure 4.

ESTABLISH CRITICAL LIMITS

Based on the identified critical control points, critical limits need to be determined.

A critical limit can only be determined for a control point that is quantifiable, such as:

- noise – critical limit – 85dBA for 8 hours
- dust – critical limit – 3mg/m^3
- rill heights – critical limit – half the height of the largest wheel using the dump

If the critical control point is not quantifiable there will be NO critical limit. It is important to identify the critical

limits as they assist with determining the effectiveness of the corrective measure previously identified.

This information should be recorded on a form similar to the one shown in figure 5.

IDENTIFY MONITORING PROCEDURES

Monitoring procedures are simply the additional controls that will be implemented to verify the continued implementation and effectiveness of the corrective measures. Good examples of monitoring procedures include:

- auditing
- inspections
- pre-start checks etc

This information should be recorded on a form similar to the one shown in figure 5.

ESTABLISH CORRECTIVE ACTION PROCEDURES

Once the monitoring procedures have been identified, there is a necessity for the team to establish a "corrective action procedure".

This may also be known as a plan. This plan will outline:

- what the action is, what limits apply, and the monitoring procedure (this will allow the team to identify when there has been a deviation from the corrective action or the critical limit). *The actions that will be identified will* ***not just be to write procedures****, but they will also include other controls to eliminate the identified hazards. This ensures that the entire system improves and not just a single hazard being controlled.*
- who is responsible for the implementation and maintenance of the above
- timeframes for implementation
- timeframes for maintenance

Once this has been determined, the identified actions / control points will never be lost and the real value of the HACCP study will be realised.

This information should be recorded on a form similar to the one shown in figure 5.

VALIDATE THE PLAN

Validation (substantiation) of the plan, allows to team one final opportunity to review the entire plan to ensure that:

- all parts of the process have been identified
- all relevant hazards (subset hazards) have been identified
- hazards have been appropriately assessed for risk
- appropriate corrective measures have been implemented based on the hierarchy of control
- critical limits have been determined where appropriate
- monitoring methods have been established to verify the implementation of the corrective actions
- a plan has been prepared for the implementation, maintenance and monitoring of the corrective actions.

After the plan has been validated, it should be authorised for use by the relevant management and the team involved.

PREPARE THE PROCEDURE / WORK INSTRUCTION

After the previous steps have been completed there is enough information documented as part of this HACCP plan to allow the team to prepare a procedure. The following information will be used for the preparation of the procedure:

- process flow diagram
- hazards deemed to have an unacceptable risk
- corrective actions for those hazards
- critical limits
- monitoring methods

Based on the "corrective action procedure" accountabilities for the actions can also be written into the procedure.

FINALISING THE ASSESSMENT

As well as completing the above the following must be recorded for the assessment to have any value in the future.

- Assessment procedures – a procedure using this process as an outline should be prepared to guide the team through the process. Reference to the procedure should be made in the report. (Refer to Appendix 1 for an example procedure)
- Report format – the information from the assessment should be prepared in a standard format. This format should make reference to the working documentation, but not necessarily include it.
- Competency level of assessor – the report MUST outline the members of the team and what expertise that they individually brought to the team. This will ensure that the credibility of the assessment is not questioned and if it needs to be repeated at a later date, the appropriate team can be duplicated.
- Instrumentation specifications and calibration – if any physical measurements are taken, the instrumentation identification, specification and calibration data should be recorded to ensure repeatability at a later date.
- Frequency and timing of measurements – following on from instrumentation, the analyst must record frequency and timing of said measurements for future repeatability.
- Identification of measurement points for future reference – as above the location of measurement points must also be recorded and made available in the written report
- Standards applied – if standards (Australian Standards, Industry Standards, Codes of Practice etc) are applied they must be referenced at the relevant location in the report
- Period of day/night – a statement should be made in the report to identify if the risk assessment covers works performed on all shifts or just day shift verses night shift etc.
- Test work carried out by accredited authorities – if any test work has been completed (as an example, dust sampling) the relevant laboratory reports must be attached to the assessment report to identify the credibility of the numbers.

CONCLUSIONS

Risk assessment should not just be completed to ensure that legislative compliance is met. The HACCP technique demonstrated in this paper shows that risk assessment can be significantly more powerful than that.

- Not only can the HACCP technique assist you to formally complete and document your risk assessment, but the final outcome is the preparation of a standard work procedure or a work instruction.). Further, the actions that will be identified will **not just be to write procedures**, but they will also include other controls to eliminate the identified hazards. This ensures that the entire system improves and not just a single hazard being controlled.

As well, HACCP requires that a team be assembled for the completion of study, therefore, by following the guidelines of HACCP, a team (vertical slice of the organisation) has also been used for the preparation of the procedure.[2]

[2] An example HACCP Procedure is attached as Appendix 1.

References:

Mortimore. Sara., and Wallace. Carol., **HACCP A practical approach**, Chapman and Hall, London 1994

PROCESS FLOW DIAGRAM

LOCATION WHERE WORK IS PERFORMED

1 2 3 4 5

SPECIAL AREAS OF INTEREST

TASKS ACTUALLY COMPLETED

6

a _____
b _____
c _____

7

a _____
b _____
c _____

COMPLETED TRAINING

12

8

a _____
b _____
c _____

PROCEDURES – REFERENCE DOCUMENT USED

14

13

9

a _____
b _____
c _____

15

10

a _____
b _____
c _____

16

Personnel involved:

_____
_____
_____
_____
_____
_____

11

a _____
b _____
c _____

17

18 (u) usually involved or
19 (o) occasionally involved

Figure 2

TABLE FOR RECORDING HAZARDS AND POSSIBLE CONSEQUENCES

Step	Hazard	Description of Hazard	Possible Consequences

Figure 3.

NSCA TIE LINE RISK ASSESSMENT TOOL

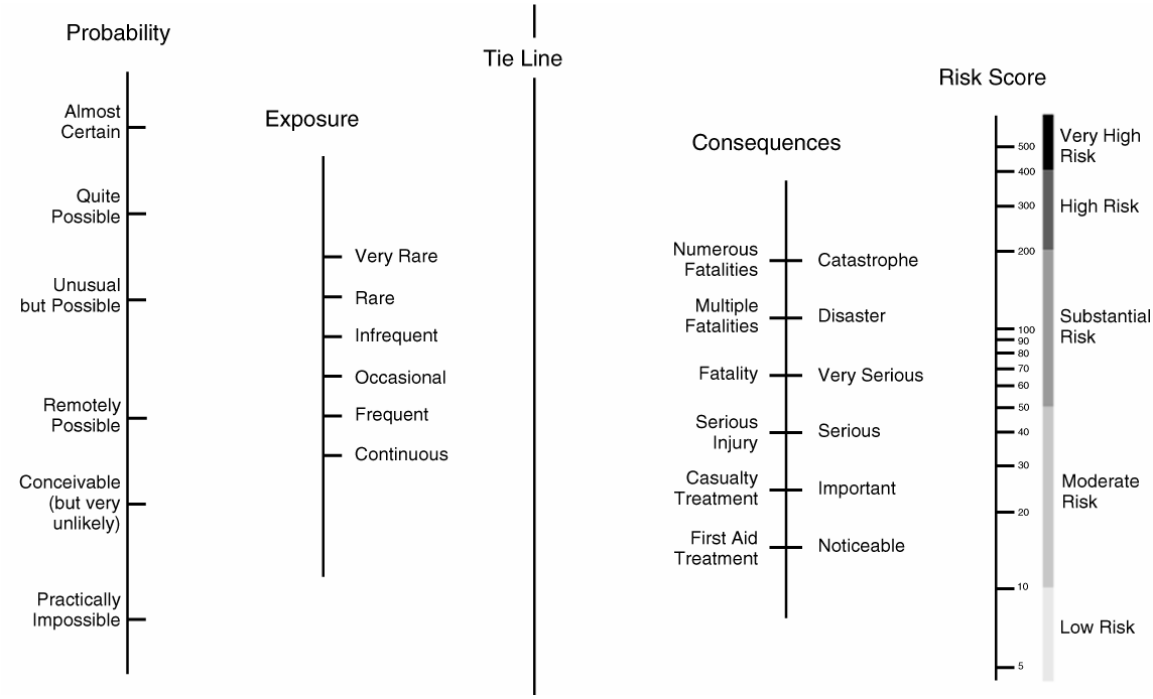


Figure 4

CRITICAL CONTROL POINT WORKSHEET

(ONE FOR EACH HAZARD DEEMED TO HAVE AN UNACCEPTABLE RISK SCORE)

Process: _____

CCP: _____

Hazards: _____

_____

_____

Preventive Measures: _____

_____

_____

Critical Limits: _____

_____

_____

Monitoring Procedures (to include, what, how, when, where and who) - reference the procedure numbers only: ___

_____

Corrective Action (include assignment of responsibility): _____

_____

_____

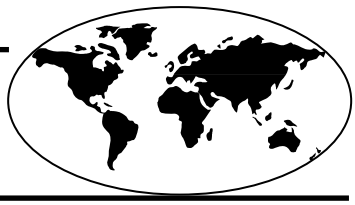
Records Generated: _____

_____

Verification - Authorised: _____

Date _____

Figure 5



Intent To detail the process to be followed by the Risk Assessment Team when completing a Hazard Analysis and Risk Assessment. This technique identifies the hazards and risk associated with a particular process rather than a single task.

Requirements

To determine:

- the relevant hazards associated with the performance of the process
- to calculate the risk associated with the hazard
- to determine controls associated with the risk – based on the hierarchy of control
- to prepare a written safe work procedure to act as an administrative control based on the information gained through the assessment.

Critical Few Analysis

Before the commencement of the hazard analysis, a critical few analysis needs to be completed. This analysis is a brainstorming exercise with a cross section of the workforce and the facilitators to identify the processes that are performed that are believed to present the most risk or have the potential to present the most risk to the organisation.

To complete the critical few analysis a list shall be required of all currently documented processes. These process will then be discussed by the cross section of the workforce and the facilitators to determine which of these have the most potential risk or the most perceived risk. These processes shall be ranked so that the most significant are addressed first. (Ranking is completed on a judgemental basis)

Once the known (documented) processes have been ranked, the non-documented processes shall be discussed. In this instance the cross section of the workforce and the facilitators shall brainstorm out other processes that are completed that are currently not documented and complete a ranking on them.

The two lists shall be compared and the most significant of these shall be formally assessed through the HACCP method.

Unacceptable Level of Risk

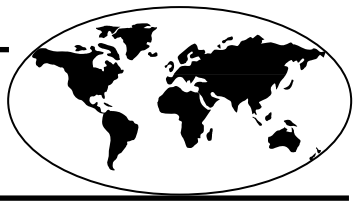
Before the commencement of the assessment the organisation's management must determine the level of unacceptable risk. When any identified risks are in excess of the unacceptable level of risk a control measure must be established in accordance with the hierarchy of control. When any identified risks are lower than the unacceptable level of risk, they shall be considered acceptable and that the existing controls are adequate.

HACCP Method

Selection of a Team

A team shall be selected that represents the process to be assessed. The team shall consist of cross section of the workforce and a facilitator. The names and skills of the team members shall be documented on the Hazard Plan to identify that the personnel utilised in the assessment had the appropriate competencies to genuinely assist in the assessment.

Each assessment shall be uniquely identified and the process shall be named. The name of the process will be used to title the safe work procedure.



Formal Identification of the Process Involved

Using page 2 and 3 of the Hazard Plan, the Team shall develop a flow diagram which identifies the actual process that is undertaken. To complete the flowchart on page 3 every question on page 2 must answered. Care must be taken to ensure that the correct answers are placed on the flowchart as this will effect the identification of hazards and the subsequent risk assessment.

Note the completion of this flowchart is not to be based on hazard – but – to be based on the individual tasks that are performed within the overall process.

When completing the flow chart special care should be taken with respect to documenting "*special areas of interest"*. These may be sub-steps in the task or particular issues that must be discussed when discussing the task.

When identifying the personnel involved in the process, the team must identify personnel who are "usually" involved and "occasionally" involved. Usually means that they are the personnel responsible for the performance of the process, occasionally means personnel that may have to work in the process but that is not their normal role, ie a trainer, auditor etc.

Hazard Identification and Risk Assessment

Using the flowchart now documented on page three the hazard identification can commence. In this instance the team must document down each hazard associated with the locations for the performance of work and the tasks that make up the process.

In this instance there will be a hazard sheet per location and a hazard sheet per task. The form will be filled out as identified below:

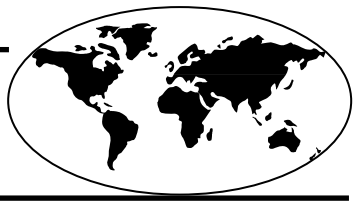
Step	Unique identifier from the flowchart ie location 1
Hazard	The specific type of hazard associated with location 1, ie visibility
Description of Hazard	A sub-set of the hazards associated with location 1 and visibility, ie dust, lack of lighting, sun in eyes etc
Potential Consequences	The result of the risk (multiple fatalities, fatality, serious injury, injury, first aid treatment etc)

The Tie Line risk assessment calculator shall be used to identify the perceived and potential risk associated with the identified hazards. To use the calculator the team must assess the following from the available options:

- probability – the likelihood that the event will happen
- exposure – how often personnel are exposed to the event
- possible consequences – the worst case outcome of the event should it happen and knowing the number of personnel that will be usually and occasionally involved.

Critical Controls

For each of the unacceptable risks a critical control must be implemented. The form on page six of the hazard plan shall be used to document each critical control. Note a separate form shall be used for each significant hazard or unacceptable risk. To complete the form refer to the following table:



Process	The overall process that is being assessed
CPP	The critical control point (the name of the hazard / sub-set hazard) that needs to be controlled due to it having an unacceptable risk
Hazards	All of the identified hazards
Preventive Measures	Using the hierarchy of controls brainstorm out the measures that would correct / prevent this hazard from occurring
Critical Limits	Are there any critical limits that need to be considered ie daily noise dose equals 85dBA
Monitoring Procedures	Identify the current procedures that are available to monitor the implementation of the preventive measures. If no procedures are currently written, they will need to be prepared, and should include – who, what, how, when, where, why information to complete the monitoring
Corrective	Assign responsibility to personnel to implement the identified corrective and preventive actions
Records generated	Document the records that will be generated as part of the implementation of the corrective and preventive action to ensure that there is a traceability of the data
Authorisation	Once the team believes that the assessment has been completed the organisation's management should authorise each critical control point worksheet and the overall hazard plan.

Preparation of a Standard Work Procedure for the Process

Using the flowchart now documented on page three and the controls on page six a standard work procedure can be prepared. Note the procedure should be prepared in a format to suit the organisation.

Report

A report shall be prepared in accordance with the report format at the completion of each assessment to consolidate the findings in one document.

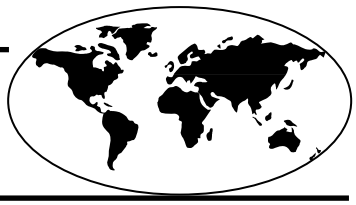
Definitions

Hazard: a source of potential harm or a situation with a potential for harm
Hierarchy of Control: the implementation of control methods in a formalised manner to ensure that the most disciplined controls are completed first. Hierarchy is, *Design / Eliminate, Substitute, Separate, Redesign, Administration, Personnel Protective Equipment*
Risk: the chance of something happening that will have an impact on the organisation's objectives. It is measured in terms of consequence and likelihood.
Risk Assessment: a combination of risk analysis and risk evaluation
Risk Analysis: a systematic use of available information to determine how often specified events may occur and the magnitude of their likely consequences.
Risk Evaluation: the process used to determine risk management priorities by evaluating and comparing the level of risk against pre-determined standards or other criteria.
Risk Register: formal organisational determination and ranking of risk

Accountability

Organisation's Management

- provide personnel to complete critical few analysis
- provide personnel to complete process based risk assessments
- determine the level of unacceptable risk
- authorised the completed assessments and identified controls



Organisational Personnel

- follow the procedure as written to ensure that the appropriate hazards, risks, controls are identified

Facilitators

- ensure that all personnel understand the procedure to be used
- assist in the critical few analysis
- assist management in the determination of unacceptable risk
- facilitate the performance of the assessments using the hazard plan
- facilitate the preparation of a safe working procedure
- prepare a report based on all completed assessments

Related Documents

- Hazard plan
- Risk assessment report format