

# A Process for Managing Catastrophic Risk at BHPAC

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## SUMMARY

The BHPAC Catastrophic Risk Management Program is a unique way to assess the very high consequence risk to which a business is exposed. Trials to date have identified some significant risks at some sites. They have also identified opportunities to improve the controls. Some of these risks may not be adequately managed by other existing programs. The program is holistic, and engenders a total loss control approach. It is deliberately biased towards the very high consequence events.

The system slogan of "What-if" is entirely appropriate and forces one to consider credible catastrophes.

## INTRODUCTION

In response to a number of crisis situations BHPAC has developed a process which identifies and evaluates the risk of catastrophic events at each of its sites.

The process identifies management needs to control the risks. It primarily produces a management plan which shows existing controls and an action plan for upgrading management effectiveness. It also produces various numerical and graphical outputs for contrasting risk profiles at a site which also assists in developing priorities.

The system has been developed over a period of several months. Trials at various stages have been conducted at minesites and refinements made.

## WHAT IS CATASTROPHIC RISK MANAGEMENT?

Catastrophic Risk Management is a proactive, systematic and continuous process to identify and reduce risks to an organisation that may result in crisis situations. It therefore deals with circumstances that have potentially devastating consequences but that are likely to occur less frequently than those that are typically addressed within existing systems.

BHP Australia Coal's Catastrophic Risk Management System is designed to assist management, both corporate and operational levels to identify exposures to Catastrophic Risk and to help in making decisions regarding equipment, procedures and competences that collectively form the risk control measures. These "controls" may or may not be already in place and a series of computer-based facilities assists their formalisation into site-specific plans.

The program developed has three main phases:-

1. Assessment of site risks, controls and actions to improve.
2. Ongoing management of the controls and re-assessments of risk.
3. Auditing of control and system effectiveness.

## WHY DO WE NEED CATASTROPHIC RISK MANAGEMENT?

The concepts of Catastrophic Risk Management are generally consistent with other more familiar risk management processes. However there are three important differences for implementation within BHP Australia Coal.

*Scope of potential loss (Consequence)*

Existing systems such as NOSA, Quality Assurance, Safe Working Procedures, etc. are generally targeted at people, safety and/or assets and totalling:

The Catastrophic Risk Management System addresses a broader scope of potential consequences including:  
Safety, Assets, Business interruption, Environment, and business Reputation  
.....which is the source of the acronym **SABER**

### *Catastrophic level*

Although existing formal systems are generally focused on *serious* losses, they do not adequately address situations that may cause absolutely *disastrous* consequences. Cultural and organisational environments may also contribute to a lesser focus on the potentially catastrophic. Catastrophic losses, although less frequent, may result in impacts that are at least comparable to the sum of losses currently being managed and so on legal, business and moral grounds the management of this level needs to be reinforced. Defining a catastrophic level is discussed later in this paper.

### *Method of evaluating risk*

Typically within BHPAC, risk is evaluated as a combination of consequence and probability of an unwanted event based on the qualitative assessments of an experienced group of people. For catastrophic events however, there is very limited historical data, which precludes effective probability predictions. Therefore to evaluate Catastrophic Risk, the system must employ an indirect means of probability assessment. This is done using the concept of "management system effectiveness": ie: "poor effectiveness" implies "high probability"; "high effectiveness" implies "low probability".

<b>CATASTROPHIC RISK =</b>	<b>Catastrophic Consequence (SABER) times Management Systems Effectiveness</b>
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The "Management Systems Effectiveness" is determined by ranked assessments of the following three contributory factors:

- the Catastrophic Risk Management Process
- the presence of Hazard Controls
- the Quality of the Hazard Controls

### **SCOPE OF THE SYSTEM**

The scope of the BHPAC system includes all BHP Australia Coal sites and applies to the gathering of information about catastrophic hazards, assessing priorities for action, implementing those actions, and documenting those issues that should be highlighted, monitored and audited.

Its application is focussed at site level, and includes existing activities and planned new projects that fall within the accountabilities of site management. Other issues have been identified that may be Catastrophic to BHPAC but that are under the control of third parties, for example rail transport. Such issues fall within a Corporate level of Catastrophic Risk Management, which would be a future development of the system.

The methodology is based on the principles of System Safety and employs a team approach throughout. A computer database is provided for information entry, storage and report generation.

Once in place the system will form the basis for a continuous improvement cycle of both the effectiveness of the implementation of Catastrophic Risk Management, and of the system itself.

### **AN OVERVIEW OF THE PROCESS**

#### *Process Outputs*

Two key management planning aids are produced, which when implemented within the feedback paths of monitoring and auditing, form the complete Catastrophic Risk Management System for a site. Additionally, summary reports are provided which show an overview of a site's risk and Management Systems Effectiveness profiles. These outputs are described below.

### *The Site Catastrophic Risk Management Plan*

This document is a compilation of all identified Catastrophic Hazards together with the corresponding Equipment, Procedures and Competency controls that are actually in place. This plan can be used as source information for training, and will be used as the basis of monitoring adherence, and auditing the effectiveness, of existing controls.

#### *Action Plans*

Action Plans are produced covering all three aspects of "Management Systems Effectiveness" examined, ie:

- the Catastrophic Risk Management Process
- the presence of Hazard Controls
- the Quality of the Hazard Controls

Action Plans document chosen improvement initiatives. They may be to improve existing measures or to introduce additional measures. They become a reference to monitor the implementation of improvements.

#### *Summary Reports*

These outputs are bargraphs of the total Catastrophic Risk assessed as present at a site, and the corresponding "Management Systems Effectiveness" evaluations. Because they show risk exposure under various categories they can be used as a means to assist resource allocation priorities, and monitor risk reduction and control "Effectiveness" over time.

#### *Process Phases*

The adoption of the BHP Catastrophic Risk Management Program requires three phases:-

##### *Site Assessment and Planning*

This is the initial phase designed to introduce the system and produce the first set of plans, showing site risks and "effectiveness" profiles.

The depth and details of planning information will be determined by the Site Management, but it must be understood that the first set of profile information will likely appear to be poor. This is because a significant contributor to "effectiveness" is an assessment of the "Catastrophic Risk Management Process" which will probably not be in place at this time; after all, this is what the Catastrophic Risk Management System is designed to implement. Once actions arising from the initial assessment have been implemented, subsequent assessments will indicate considerable improvements to the profiles.

This phase includes:

- Identification of Site specific hazards using a BHPAC minimum set as guidance.
- Assessments of three elements comprising "Management System Effectiveness":
  - the presence of hazard "Controls"
  - the Quality of these controls
  - the Management Process itself.
- Preparation of plans to record the site's Catastrophic Hazards and corresponding existing Controls, and the improvement actions for all three elements.

### *Ongoing Risk Management*

Is the continuing process of identifying, assessing, planning and controlling hazards. It includes monitoring existing control status and action progress, and may include optional re-assessments as determined by Site Management. The basic process used for hazard identification and controls planning in the assessment phase is continued, including a particular requirement for the identification of changes arising due to internal or external circumstances.

### *Auditing*

Periodic audits are made to confirm the Site Assessment outputs and compliance with the Catastrophic Risk Management System, and to review the progress of actions. The Audit process uses the same Assessment process using teams selected to suit the nature of the site and the selected topics, and always includes persons independent of the home site. Such persons may be drawn from within BHPAC or other BHP divisions. Specialist outside personnel can be used if circumstances require their skills.

### *Process Support*

Key personnel are the local site Catastrophic Risk Management System Co-ordinator and an overall BHPAC System Administrator.

Documentation resources are provided in a system manual and include general source information, forms and questionnaires for teams to complete, and guidance as to requirements for Hazard controls.

The system is supported by computer facilities which store all relevant data, provide reports, and provide some documentation resource on demand.

## **BACKGROUND OF THE SYSTEM DEVELOPMENT**

This system is based on the concepts and principles of System Safety, and was jointly developed by BHPAC and BHP Minerals Corporate and Site personnel. Staff of MineRisk Management Services and information systems consultants, over the period from December 1995 to April 1996. A prototype system was trialed as a pilot programme at four BHPAC sites, including two open cut coal mines, an underground mine and a port. Key development phases are described below.

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### *Site types*

All types of businesses within the BHPAC operation were defined (open cut mines, underground mines, exploration sites, coal loading facilities, administration sites, etc.) together with the set of major activities or processes that they are required to manage (surface mining, workshops and stores, offices, etc.).

***The Consequence Assessment Model***

The SABER model provides a way to sum the consequences under each of the S.A.B.E.R. categories.

		Consequence Category				
		S	A	B	E	R
Range of Consequence	1					
	2					
	3					
	4					
	5					

The “cut-off” point that determines whether a hazard is deemed to be “Catastrophic” was set after various approaches and formulae were trialed by a group of BHPAC safety professionals. Actual site hazards were identified then assessed using the SABER model and the “Catastrophic” point agreed based on the nett impact of all five SABER categories and the scope of other loss management programmes. The cut-off point selected initially was designed to ensure the program considered the truly catastrophic, and did not extensively overlap other initiatives such as NOSA, which focus more on events that may result in injuries. However, since the purpose of the Catastrophic Risk Management System is to continually reduce risks, BHPAC may reduce the “cut-off” point as improvements are realised.

Hazards assessed as not being Catastrophic (by the “cut-off” criteria) are not to be considered further in this system, however the existing programme or mechanism that addresses them is recorded to ensure that they are addressed.

***Minimum Hazard Sets***

The site hazards identified and assessed when creating SABER were summarised into a table of generalised Major Hazards considered applicable for each Activity. This represents the minimum set for review by a site considering the specific local realities and circumstances.

***The Management System Effectiveness Model***

The concept of Management Systems Effectiveness was determined to be the means by which the very low probability of a catastrophic event would be assessed. The model required three elements to be satisfied for high levels of effectiveness:

- the overall Process...      ... by which Catastrophic hazards are managed.
- the Controls...              ... that exist to manage individual hazards
- the Quality...                ... of the controls

Emphasis is placed on the elements of Process and Quality in determining a site’s overall risk/effectiveness profiles as these are essentially issues that are managed on a site-wide basis, however controls for specific hazards are treated on a case-by-case basis.

**Identification of Hazard Controls**

For each Catastrophic Hazard in the minimum BHPAC set (for each activity), a Fault Tree was developed to show causal factors including initiating events, exacerbating factors, monitoring failures, emergency control failures and other causes contributing to the Hazard. Based on these fault trees, the controls were identified.

It will be clear that controls for every conceivable situation could not be pre-defined, nor could they be totally specific, since local Site Management must determine the most appropriate means for their circumstances. A series of "Control Intents" was therefore prepared to guide and indicate general requirements, providing Site Management with the scope to define the actual details of how these requirements would be fulfilled.

Since controls were only pre-defined for the BHPAC minimum hazard sets, there has to be a method to establish requirements for hazards not covered. (Specific situations will vary or a site may wish to extend their scope beyond the minimum hazard sets.) The "9-Box" model was developed as a systematic guide to ensure all control aspects would be addressed. i.e. the Equipment, Procedures and Competencies controls for hazard Prevention, Monitoring and Contingencies.

The "9-Box" Model		Aspect of Hazard Control		
		Prevention	Monitoring	Contingency
Control Type	Equipment			
	Procedures			
	Competencies			

**The Models for Process and Quality Assessment**

Using the general concepts and principles Risk Management at a best practise process for the management of catastrophic hazards was developed. A questionnaire was then prepared which is used by site assessors to ask about identification and management of catastrophic hazards in order to assess compliance.

Based initially on a System Safety "Programme Evaluation Tree" and modified as a result of feedback from the pilot programme, a questionnaire was developed to assess the "Quality" of controls. This asks the site to identify activities that illustrate a quality management system that ensure the required equipment is fit-for-purpose, procedures or other relevant information is documented and utilised to ISO 9000 standards and that there is a clear approach to developing people skills, competencies and setting accountabilities.

**CONCLUSIONS**

The BHPAC Catastrophic Risk Management Program is a unique way to assess the very high consequence risk to which a business is exposed. Trials to date have identified some significant risks at some sites and BHPAC have provided opportunities to improve the controls. Some of these risks may not be adequately managed by other existing programs. The program is holistic, and engenders a total loss control approach. It is deliberately biased towards the very high consequence events.

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## ACKNOWLEDGMENTS

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