

SAFEmap at BHP Cannington Mine

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1. INTRODUCTION

During December 1999 and January 2000, BHP Cannington Mine conducted a safety perception survey of its work force, to determine trends, strengths, limitations or other possible deficiencies in the “safety culture” of the organisation. The survey was conducted with the e-Profile survey system, a patented survey technology of SAFEmap.

The SAFEmap safety survey deals specifically with safety perceptions and attitudes in the organisation.

2. OBJECTIVES

The objectives of the SAFEmap Survey are as follows:

- To identify strategic strengths and limitations of the organisation’s safety culture.
- To measure, against a baseline of industry employees, supervisors and managers, the trends in perceptions and attitudes of employees.
- To use such information to benchmark against other resources companies in Australia.
- To measure the changes in perception and attitude trends as measured against the company’s own baseline. Note that this process can be implemented in a second and subsequent survey.
- To provide recommendations to management based on the results of the survey, on specific actions, initiatives or systems to contemplate for implementation.

3. THE SAFEMAP SURVEY

3.1 Background

Eighty percent of accidents or incidents can be linked to “risk-taking” – a fact long recognised across all industries. Most employees have all the skills to do the job in the correct way - but they still take risks, which may result in accidents. However, research shows it is not as simple as “employees must change their attitudes”. Most risk-taking is a consequence of the systems, work practices or processes. Employees develop a perception of what is expected and “permissible” – in the way they see others (peers, supervisors and managers) behave around them. This is the “work environment” of employees and it has a powerful influence on risk-taking in the organisation.

Therefore, a more “correct” definition of an accident is “normal people reacting normally to abnormal work environments”.

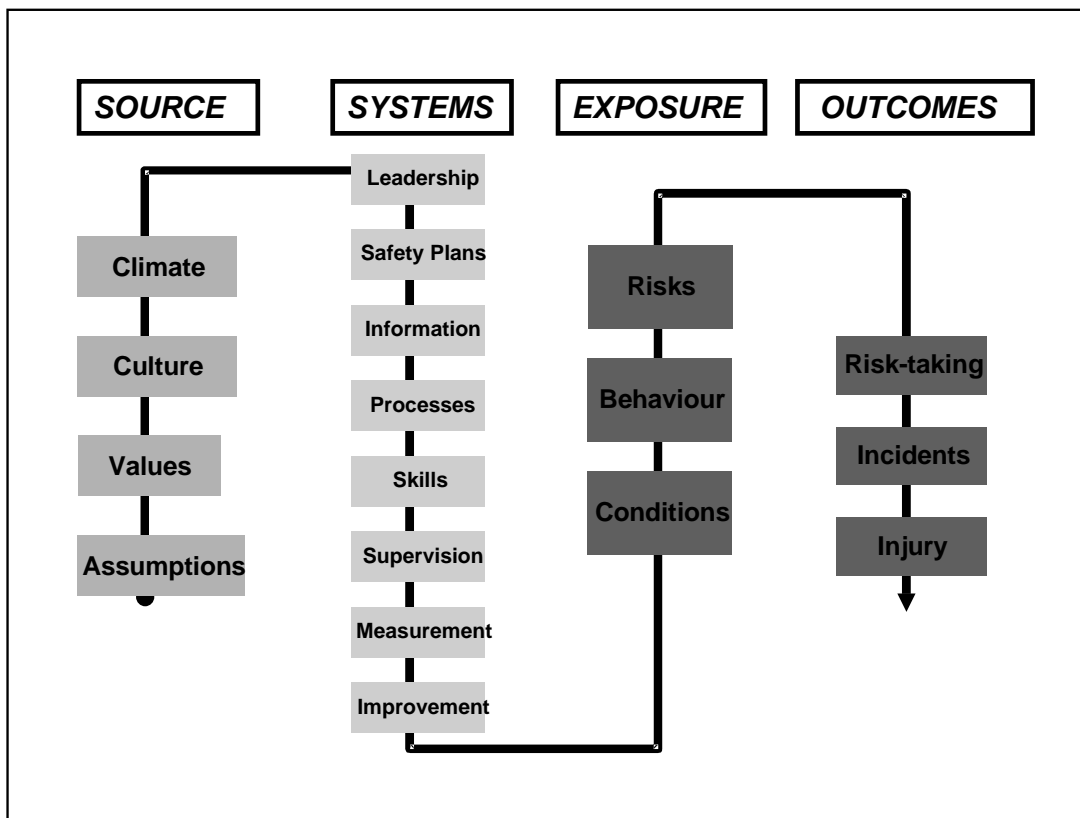
The “abnormal” work environment (systems/practices) that produce risk-taking are themselves ‘produced’ by the type of Safety Culture that exists - namely the values, beliefs and perceptions of all employees and managers. It is the original source of safety problems.

The sources of risk-taking in the organisation are often not well understood or recognised. There are two important concepts in understanding the processes in a business, namely upstream and downstream processes in a company

In the context of safety management, the downstream processes are the occurrence of hazards and unsafe work activities (the exposure level) that result in accidents (the end-point). It is important to realise that the vast majority of exposures (hazards and unsafe activities) occur with no noticeable end-point result (accidents).

The upstream processes in a business are the management systems (or lack of) which produces or allows the exposures to unsafe work practices and/or hazards. But even further upstream in the business is the culture of the organisation. The organisation’s culture is the most fundamental upstream process and has a direct and indirect influence on the organisation as a whole.

3.2 The Process Model of Accidents



At the risk of over-simplifying a very complex and dynamic process in a business, the development of risk-taking behaviour in an organisation is not something that “happens at employee level” and that behaviour at that level should be targeted through some kind of “behavioural program”. The total system, upstream in the organisation, should be managed and affected and changed where necessary. The logic of managing the safety culture in the organisation is a very sound one, yet it is one that few organisations pursue in their endeavours to improve safety.

One of the main reasons why organisations do not continuously manage the safety culture is because it is an inexact and complex subject. The average manager cannot be expected to manage something that is not measurable. It is this fact that leads us to depend so much on some kind of measurement of safety, and in most cases it is the LTIFR rates. Despite the well-known problems and deficiencies of the LTIFR rates and of any of the so-called “lag” indicators that focus on measuring accidents or even incidents, the industry continue to use them. However, measurement of a so-called “lead indicator” is now possible through the SAFEmap surveys.

3.3 Risk-Taking and Behaviour

People take risks because of the following reasons:

- The risk or danger was not identified/recognised
- The risk was inherent in the task or job procedure
- There was no incentive to do the job safely or there was a negative result in avoiding the risk
- Other reasons may be behind the risk-taking

Some risk-taking behaviour can be eliminated by training to provide people with the skills to recognise dangers or to raise the awareness of people, while almost all other risk-taking can be traced back to Safety Culture. The first step in the change process is to make strategic changes to the safety culture of the organisation - to ensure that the employees become motivated to avoid risks.

Employees' motivation is not an independent variable that can be addressed and managed and manipulated. It is a result of the complex work arrangements, management systems, influences, power plays, expectations and behaviours of everybody in the organisation. The discernible patterns are that "perceptions" in the organisation, at every level and within every unit and sub unit, create the motivations, attitudes and eventually behaviours of people. The starting point therefore must be these perceptions: measured, analysed and then actioned.

4. MODEL AND CONTENT OF THE SAFEMAP SURVEY

The "morale" (or attitudes) in the organisation is the combination of the organisation's values, characteristics and its basic approach to safety management. The perceptions of employees are a manifestation of the culture and climate in the organisation and therefore it forms the basis of this measurement.

Culture, for the purposes of this project, relates more to the philosophical level of thinking in the organisation that translates into, and affects, the behaviours of people.

Technically, it is very difficult, maybe even impossible, to measure the *culture* of an organisation. What *can* be measured are the behaviours of people and, in the strict technical sense, the *perception* of people's behaviour. The term "climate" is often used as an alternative to "culture", and can be defined as the "aggregate perceptions that employees have of the work environment".

While, technically speaking, we are reporting on a "climate perception survey" we will continue to use the term "safety culture survey". All organisations definitely do have a climate that can be measured, but not all organisations have a culture that can be measured.

The term safety culture (or climate) is therefore defined as the characteristics of the organisation's approach to safety that:

- Distinguish one organisation or work unit from another
- Endure over time
- Influence the behaviour of people in the organisation.

These "characteristics" are the "collective behaviours of people in the organisation that over time become patterns, typical or habit".

In Britain the ACSNI study group (HSC, 1993a) proposed the following definition for safety culture:

"The safety culture of an organisation is the product of individual and group values, attitudes, perceptions, competencies and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organisation's health and safety management."

In the simplest terms, this translates into "those things that are regarded as important in the company, and how they affect the behaviour of people".

The SAFEMap Model consists of eight sections, namely perceptions of:

Organisation (The company...)
Management (the senior management of the division)
Supervision (the direct supervisors)
Management Systems (formal systems of day-to-day managing)
Safety Systems (typical issues of safety management)
Job Factors (perceptions of job-related issues)
Team factors (perceptions of peer group influences)
Individual Factors (typically individual attitudes and perceptions)
Each of these sections is made up of a number of so-called "factors", described below.

6. DEFINITIONS OF MEASURED FACTORS

The following positive statements are used to measure each category.

CULTURAL FACTORS	
FACTOR	POSITIVE PERCEPTIONS
ORGANISATION	
Commitment	<i>"This company is very serious about safety"</i>
Policy	<i>"This company clearly states that safety is important"</i>
Goals	<i>"This company has clear goals and targets for safety"</i>
Leadership Style	<i>"This company is interested in employees' views on safety"</i>
Value	<i>"This company does a lot for its employees"</i>
Security	<i>"Our jobs are secure with this company"</i>
MANAGEMENT	
Credibility	<i>"You can trust the management in this company"</i>
Commitment	<i>"Management is genuinely serious about safety"</i>
Balance	<i>"Management always puts safety first"</i>
Management Style	<i>"Management listens to our views on safety"</i>
SUPERVISION	
Credibility	<i>"I can trust my supervisor"</i>
Commitment	<i>"My supervisor genuinely cares about safety"</i>
Balance	<i>"My supervisor always puts safety first"</i>
Supervision Style	<i>"My supervisor listens to our views on safety"</i>
PROCESSES	
Consultation	<i>"The safety committee does a good job on safety"</i>
Information	<i>"We get enough information from management on safety matters"</i>
Discipline	<i>"When you break a safety rule, you will be treated fairly"</i>
Participation	<i>"My supervisor listens to my ideas on safety"</i>
Follow-Up	<i>"If you raise a safety concern, someone follows up very quickly"</i>
Decisions	<i>"People are mostly happy with management's decisions on safety"</i>
SAFETY SYSTEMS	
Safety Staff	<i>"Safety personnel generally do a good job"</i>
Systems Quality	<i>"The safety program is well managed in this company"</i>
Safety Rules	<i>"We have good safety standards in this company"</i>
Training	<i>"Safety training in this company is of high quality"</i>
Recognition	<i>"If you work safely, you will get recognition for it"</i>

CLIMATE FACTORS	
FACTOR	POSITIVE PERCEPTIONS
JOB FACTORS	
Risk Incentives	<i>"In my job, it is not necessary to cut corners"</i>
Work Pressures	<i>"My job is just enough to handle everyday"</i>

Tools & Equipment	<i>"Our tools and equipment are generally safe and well maintained"</i>
Satisfaction	<i>"I enjoy the work I do"</i>
Risk Level	<i>"I am worried about the dangers in my job"</i> <i>"I am not worried about the dangers in my job"</i>
Job Design	<i>" Given the opportunity, I can make a lot of improvements in my job"</i>
TEAM FACTORS	
Rule Compliance	<i>"People around me generally comply with safety rules"</i>
Risk-Taking	<i>"I know people don't have to break safety rules to get jobs done"</i>
Team Spirit	<i>"There is a positive team spirit in our team"</i>
Conflict	<i>"I get along quite well with my supervisor"</i>
Team Work	<i>"Our team is often involved in safety improvements "</i>
INDIVIDUAL FACTORS	
Fatalism	<i>"It is possible to achieve zero accidents"</i>
Duty	<i>"If I have an accident, it will be my own fault"</i>
Motivation	<i>"I am happy to work for this company"</i>
Stress	<i>"After a day's work, I go home and forget about work matters"</i>
Risk Perception	<i>"The safety standards in this company are very high"</i>

Safety Culture

Safety Culture refers to the formal safety issues in the company, dealing with perceptions of Management, Supervision, Management Systems and perceptions of the Organisation (company). Where the respondents are managers themselves, their perceptions on the Supervision factors refer to their direct supervisor/manager.

Safety Climate

Safety Climate refers to the more intangible issues in the company, such as perceptions of Safety Systems, Job Factors, Team Factors and Individual Factors. These are also commonly referred to as the social work climate and are the dynamic influences on the individual and on the group.

Important Note

The factor "Risk Level" can be considered as a measurement of employees' risk "awareness", and was measured by a combination of two statements.

The factor of "Duty" can be considered as the "extent to which employees accept responsibility for an accident", and should not be simply equated with "duty of care".

7. The e-Profile Database

7.1 Comparisons with Employee Groups:

Cannington Mine is compared with a current list of over 42 resources companies in Australia, which includes mines, refineries, processing plants and quarries.

More than 7000 employees participated in the safety culture surveys across the resources industry. This delivered the most comprehensive database ever in the resources industry and it now enables participating resources companies to benchmark themselves against other companies in the industry. For the first time, a true benchmark on safety culture is available.

Each group is compared with an appropriate Norm Group; namely Operators are compared with all Operator employees in Australia:

Operators are defined as employees of the company who perform manual operating tasks, for example artisans, production crews, etc.

Contractors are defined as employees who perform manual operating tasks, but who are employed as a contractor or through a contractor company.

Supervisors are defined as the group responsible for the direct supervision of these operator and/or contractor employees.

Other groups defined in this survey are Upper management, or the group of managers responsible for overseeing the company's operations. Middle management, where such a group would exist in the company normally includes superintendents and foremen, if they were not included in the supervision category. Staff Specialists refers to the group of employees who are outside any of these categories, and normally perform some specialist task or activity in the company, such as training, planning etc.

Benchmark comparisons of each of the employee groups of your Company are shown as compared against the resources industry overall, and also against the companies in your State, Type of Company (Surface or Underground), Commodity (Gold, Coal, Other Minerals) and Size of Company (Smaller or Larger companies). The baseline for these comparisons is based on the following sample.

7.2 Companies in the database

An overall total of approximately 94,000 minerals industry employees are distributed as follows:

- | | | |
|---------------------------------|-----|-----|
| ▪ Western Australia | 43% | |
| ▪ New South Wales | 19% | |
| ▪ Queensland | | 21% |
| ▪ Victoria, NT, SA and Tasmania | 17% | |

Within each state, the criterion of "Commodity Mined" was used to further stratify the sample. In New South Wales and Queensland the main division is Coal and Metalliferous, while in Western Australia the main division is Gold and Nickel and other Metals/Minerals.

The sample was also stratified proportionally in each state into Underground and Surface Mines.

The size of the companies was a secondary criterion, and in the overall sample small, medium and bigger companies (in terms of employee numbers) were proportionally represented. As far as possible, the ownership (i.e. whether the Company was or was not part of a larger corporation) was also factored in.

The sample structure is as follows: -

Western Australia

- Eight gold/nickel companies
- Four other metals/minerals companies
- Two groups of contracting companies at several sites

New South Wales

- Eight coal companies, from the different regions, including both open cut and underground coal companies in the appropriate proportions
- Four metalliferous companies/units

Queensland

- Five coal companies, from the different major regions
- Five metalliferous companies

Other States

- Two gold companies
- Four other companies, including metals, coal and minerals

The sample consisted of a total of 42 companies that well represented the stated criteria, with employee numbers as follows:

Employee Group	N	% of Total N	Sample	% of Total S
Senior Management	212	1.8	161	2.3
Middle Management	380	3.2	279	4.1
Staff/Specialists	1733	14.8	1030	15.3
Supervisors	700	5.9	476	7.1
Operators	6647	56.6	3837	57.1
Contractors	2074	17.7	935	13.9
TOTAL	11746	100	6718*	100

This is by far the most comprehensive database developed to date on safety culture measurement in the resources industry of Australia.

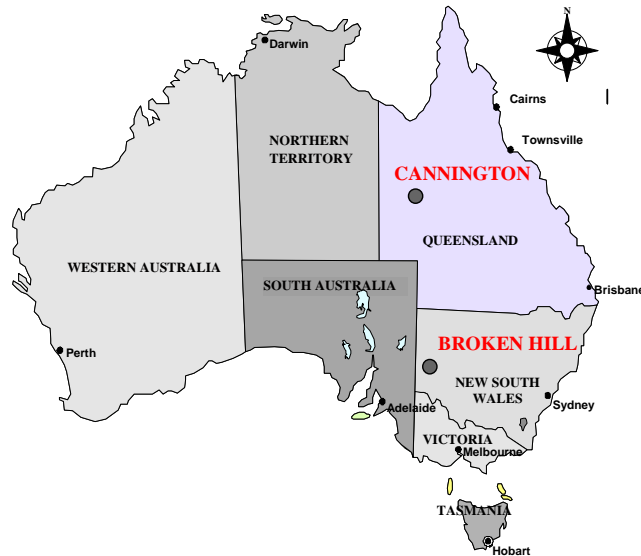
9. CANNINGTON MINE

Introduction

The development of the Cannington deposit by BHP Minerals followed more than a decade of research and investigation into the geological environment that would potentially contain another substantial Broken Hill style base metal deposit.

The Cannington deposit of silver, lead and zinc was discovered in June 1990 after the large scale application of a range of modern (predominantly aeromagnetic) exploration techniques and processes over areas of the Mount Isa Inlier.

The deposit is located 820 kilometres west-south-west of Townsville.



Following a detailed and thorough feasibility study the decision was made in early 1996 to develop an underground mine, processing plant and supporting infrastructure at Cannington.

Mine site construction started in May 1996 and was completed on schedule with the first production of concentrate in October 1997.

Construction of a concentrate handling facility started in the Port of Townsville in August 1996 and was completed on schedule with the shipment of first concentrate in January 1998. The construction activities were notable for their exceptional safety records and harmonious working relationship; both aspects being facilitated by partnering agreements with a number of construction companies.

Cannington is an underground mining operation using a combination of open stoping and benching techniques. Mine production started in May 1997, with ore being initially trucked to surface. The commissioning of the permanent ore handling arrangements in May 1998, allowed Cannington to ramp up to its nameplate mining and processing capacity of one and a half million tonnes of ore per year

Now in full production, the mine produced in the 12 months ending June 2000 29 million ounces of silver contained within 295,000 tonnes of lead concentrate and 130,000 tonnes of zinc concentrate. Cannington is currently the world's largest single mine producer of silver and lead accounting for an estimated 7% of both the world's primary silver and lead production.

At current production rates Cannington employs 315 people comprising permanent BHP and strategic long term contractors/partners. They work an extended shift commute roster from locations within the Mount Isa Townsville corridor and Cairns.

Our Vision at Cannington

In 1996 a vertical cross section of BHP employees were involved in creating and evolving the vision, supporting values and behaviours for the business.

This group saw the vision as "***Creating success through people with passion***". This is supported by the following values::

- Simply safe;
- Care & Respect for our environment;
- Take Pride in Our Success;
- Recognise & Value Our People;
- Promote Effective Workplace & Community Communications; and
- Strive for Improving Quality

Both BHP and Cannington recognise that people are the means by which to maintain a licence to operate, deliver results and competitive performance. People are thus a major focus of our efforts.

Current Safety Model

Cannington's safety system framework is provided by NOSA (National Occupational Safety Association); this being customised as CanWorkSafe. The framework provides a systematic and comprehensive safety management system and forms an integral part in the pursuit of safety excellence. The NOSA system was first implemented at Cannington in 1995

The perceived weakness in the system approach can be best explained by the expression "learned helplessness" whereby the reliance on the system breeds dependency on those who perpetuate them, ie safety professionals. This can lead to a sense of dis-empowerment of the employees, supervisors and line managers.

In 1995 it was also recognised that to empower and involve the employees (both BHP or contractor) in pro-actively improving their workplaces, and improve safety communications something other than traditional safety systems approach was required.

The system that meet Cannington's defined needs of;

- focusing & improving safety communications on a daily basis;
- empowering people to immediately fix problems themselves or as teams;
- providing an avenue for positive feedback and;
- allowing the operation as a whole to develop professional "CAN DO" behaviour style,

was the Positive Attitude Safety System (PASS®)

The PASS process was first implemented in 1985 by its developer, James S. Burns, at Cominco's underground Sullivan Mine in Kimberley, British Columbia. The first Australian mine to introduce PASS was Rio Tinto's Peak Gold Mine in Cobar NSW in the early 1990's.

The PASS process is now an international safety system that is being used in diverse industries such as mining, offshore oil production, smelting manufacturing, storage and transport operations. These industries are operating in countries such as Canada, Australia, Indonesia United States, New Zealand and Vietnam.

The combination of NOSA as a procedural system foundation with PASS as the daily safety communication lead the Cannington business to achieve a Lost Time Injury Frequency Rate of 1.95 for the year ending January 1999 and up until March 1999 BHP Minerals employees both on surface and underground had worked for 15 months without sustaining a lost time injury.

In May 1999 a BHP Minerals employee sustained serious injury in a fall underground and a review was begun on the safety culture existed at Cannington. Between December 1999 and January 2000 IOSA were engaged to conduct a safety perception survey using the SAFEmap survey.

The number of employees surveyed exceeded the statistical requirement for sample size and the results of the survey were considered a true representation of the actual perceptions of the employees at Cannington (Table 1)

Table 1 Survey sample of Cannington employees

Profession	# Employed	# Surveyed	%
Management	28	9	32
Staff/specialists	72	61	84
Operators	155	88	56
Contractors	163	109	67
Grand Total	418	267	64

The results were mixed:

On the positive side:

- Cannington overall ranked in top quartile of performance in Australian mines and was equal top in Queensland
- Very positive perceptions of the “company” with most employee groups
- Very positive perceptions of management with most employee groups
- Effective safety communication apparent from positive responses on Information
- Maintenance of a high level of safety standards, with most employees
- Safety training seen as of high quality with most employees
- Most employees express high level of motivation to work for the company

However on the other side of the ledger the main issues were identified as:

- Strong tendencies to take risks under pressure identified in most groups
- Contractors expressed strong perception that risk-taking is “generally necessary
- Some supervisors seen to be compromising safety for production
- Risk awareness possibly deficient, especially with staff employees
- Safety program seen as “too much paperwork” with most groups
- Safety committee is negatively perceived by most employees
- Contractors groups profiles mostly significantly more negative than other Australian contractor responses
- Large difference on “zero accidents” issue between manager and operator levels

It was apparent both from the survey and anecdotal evidence that the essential balance between safety and production had been lost. During the twelve months leading up to the survey Cannington had exceeded its production targets by a comfortable margin and the view that it was “tonnes at all costs” was beginning to drive the decision making processes throughout the business.

It was therefore essential that daily targets were viewed in the context of the larger weekly or monthly picture with work to be scheduled on a more detailed basis. The first area in the underground mine to be addressed was underground development where detailed schedules on a weekly basis were laid out on a collaborative basis between the scheduling, planning and operational groups. This has curtailed the “dash for cuts” and has led both to reduced incident rates and a significantly more focussed development programme with priority development headings being achieved 95% of the time. Production is now having the same discipline being applied to it.

Greater accent is being given to planned maintenance shutdowns both in the mine and processing plant. These are being planned on a periodic basis with a defined work programme.

The underground mine now shuts down for a complete Saturday day shift for a safety day where the both the short term safety issues not immediately fixed following the PASS meeting and medium term issues can be addressed. Typically sections of the heavily trafficked access decline are resurfaced and check scaled, accessways checked, and development headings standards raised with additional check scaling, and extension of services.

The whole philosophy is to provide a more disciplined environment where work is planned, the operation has time to breath and make additional time for safety to receive equal weight to production.

Risk awareness and the risk reward trade off is being addressed through a series of three day workshops for all supervisory personnel, and OH&S representatives.

The “Take 5” programme which provides a simple “paper minimization” assessment of risks prior to entering the work area is being progressively introduced. In more complex work tasks or in one off situations this will lead to the more involved JSA procedure.

The PASS meeting is receiving greater attention, as it is the early warning system for impending safety issues. Training of PASS champions is about to start with the intention that every huddle is lead by a champion. The issues raised at the meetings are now clearly documented and acted on with follow up discussion at the daily morning senior managers meeting

The intent of the overall Cannington safety system is being clarified with the intention that every employee will sit down with his or her supervisor for a one to one briefing.

The role of the overall site safety committee is currently under review. The original intent was not to have it act as the “fixer “ of the daily safety issues, this role being embedded in the PASS process, but rather to act as the longer term policy maker and strategy setter. However It has become obvious that a more responsive safety valve is needed, particularly in the mine and so a separate mine safety committee has been formed which meets one per roster for each crew. This committee's brief is to address the medium term safety issues that are not tackled by PASS but are not the policy decisions required to be made by the site safety committee.

The use of the number of contracting partners at Cannington is being reviewed and a number of these activities brought “in house” where this change makes sound business sense. The supervisory staff of those who remain will be relocated within the site operations building adjacent to their Cannington supervisor. This move has been made in parallel with the move of the mine's safety advisor and the mining engineers providing direct operational support to offices underground adjacent to the main workshop and underground cribroom.

It is difficult to tackle the “zero accidents” issue head on as it is the consequence of a safe work environment; an outcome not a process. There is no doubt that the Cannington managers believe passionately as a group that a “zero accident” environment is possible; it has been achieved for fifteen months and even today it is being achieved in many parts of the business. We as leaders have the responsibility both morally and legally to turn it into the reality for everyone.

Conclusion

The SAFEmap survey provided multiple views of the safety culture existing at Cannington in November 1999. There is no doubt that the results were confronting but provided the necessary stimulus to confront the hard truths and move the our safety performance to a higher plane. We look forward to the November 2000 survey.