SAFETY IN MINES RESEARCH ADVISORY COMMITTEE

SIMRAC

Final Project Report

Title: **ASSESS THE DOMINANT CIRCUMSTANCES AND FACTORS GIVING RISE TO ACCIDENTS IN THE GOLD AND PLATINUM MINING INDUSTRIES**

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Project No.: GAP055 (PART 1)

Date: March 1994

PREFACE

In drawing conclusions from both the statistical analysis of accident data and the detailed accident case studies, detailed in this report, the following observations can be made:

- There is a need to obtain more detailed in-depth information to arrive at full and complete conclusions as to all the causes of accidents, especially circumstances indirectly contributing to accidents, than can be obtained through the accident reporting practice, and hence from the SAMRASS record system. Fuller more detailed accident investigation and reporting may well be done at mine level and only by examining/auditing such reports can all circumstantial factors leading to an accident be identified.

- There are a number of themes that run through the majority of accident reports. For rockbursts, the main cause given is that the systems or technology does not exist or is unsuitable. For falls of ground inadequate examination is given as the main cause. For most of the other accident types, the cause is blamed on immediate human failing. Of major significance is the lack of cause attributed to such factors as safety devices, training, and environmental factors.

- There are a number of hazard areas that could be addressed for which successful solutions would lead to a significant reduction in the safety hazard:

    - work must continue to help solve the problems of rockbursts.

    - methods of reducing rockfalls (a significant number of accidents are caused by falls of ground at the stope face while undertaking a non-productive or supervisory activity which result in multiple injuries).

    - improved methods and/or equipment to safely and effectively examine the working place. This is obviously closely linked to rockfalls.

    - methods to prevent derailing and/or improved methods to re-rail tracked vehicles.

    - means of reducing the risk of personnel inadvertently falling into excavations while travelling.

    - improved methods of handling bulky or awkwardly shaped equipment especially in haulages, shafts and crosscuts.

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SAFETY NEEDS OF THE SOUTH AFRICAN GOLD AND PLATINUM MINING INDUSTRIES

INTRODUCTION

In 1993, the Safety Research Levy was introduced under the new Minerals Act as a means for funding research aimed at improving the health and safety of mining operations. In order to provide expert advice on the most appropriate directions for expenditure of the available research funding, the SIMRAC system was established during 1992.

It was identified at an early stage that, in order to facilitate the management of a safety research programme which would have maximum impact on the safety records of mines, in depth analysis of the underlying causes of accidents would be essential. It was anticipated that the results of such studies would provide SIMRAC with the necessary framework within which to assess, on an objective basis, the relevance of proposed research projects to mine safety, as well as to promote the implementation of research outputs in such a way as to maximize their safety impact.

A considerable amount of previous work has been carried out to investigate the causes of accidents in gold mines.

In particular Roberts and Jager (1991) provided valuable information on the location and causes of fatal rock related accidents and their causes in the different mining districts. This work is to a large extent being used as a basis for the current SIMRAC programme of work in the rock engineering area.

Lawrence (1974) addressed the role of human factors in causing accidents and developed models of human behaviour which consider the reliable perception of hazardous situations and selection of appropriate responses. Lawrence focused attention in his model not only on the mineworker injured through an accident but also on other mineworkers in some way associated with the accident. Failures to accurately perceive warnings of danger were identified as the most common type of human error.

This work is complemented by Simpson and Widdas (1992) who identified the dominant role of the human factor in accidents within British Coal. Simpson, in his report entitled "Promoting safety improvements via potential human error audits", emphasizes that, while human factors are directly instrumental in the majority of accidents, it is often features inherent in the mining system which predispose that slips, lapses, mistakes or violations will result in serious consequences. Accordingly, a wide variety of solution routes may prove effective dependent on the underlying causes of accidents. In general, greater returns would be obtained by rectifying inherently unsafe systems where human error has serious consequence rather than seeking to address the immediate direct causes of accidents. Typical areas where solutions may be found would be redesign of equipment

to improve ergonomics, modified procedures to ameliorate the consequences of human error and improved training of mineworkers.

Raath (1993) has also reported recently on the dominance of human factors as causative of accidents in the South African mining industries. He emphasizes the importance of training in running mining operations safely.

During 1993 and early 1994, in preparation for the process of needs identification leading to the call for project proposals in mid 1994, three parallel studies have been carried out addressing each of the sector specific sub-committees of SIMRAC, ie gold and platinum, coal mining and other mines. The results of the coal mining exercise are described by Phillips and Landman (1993), and the results of the other mines study are contained in Peake and Ritchie (1994).

This report provides the results of the study relevant to safety of the gold and platinum mining sector. It is structured into a number of sections providing:

- the sources of data and the methodology adopted,
- an overview of the more important contributors to safety hazard which would represent foci for attention (this section is supported by two appendices providing detailed results of the statistical analysis of historical accident data and of the analysis of accident reports), and
- recommendations on changes in accident reporting practice and procedures which would enable additional insights to be obtained from future analyses.

It is considered that the information presented in this report should assist SIMRAC in:

- identifying circumstances giving rise to significant hazard which are not being addressed through current research initiatives,
- assessing the probable impact on safety of proposed research projects in terms of an objective framework, and
- promoting the implementation of research findings in industry in a manner which will have the most impact on mine safety.

DATA SOURCES AND METHODOLOGY

The scope of the studies described in this report encompassed a detailed analysis of accidents which have taken place during the period 1988 to 1992 in the gold and platinum mining industries. This analysis consisted of two components.

The first component was the quantitative statistical analysis of the data stored on SAMRASS (South African Mines Reportable Accidents Statistics System). Through manipulation of the information stored in this system, it was possible to quantitatively allocate the hazard of incurring different types

of accident to various parameters describing the mining circumstance. While this component of the analysis has the merit of being highly objective and quantitative and being based on substantial quantities of data, it is subject to restrictions in terms of the level of detail which can be considered. This is because the information stored per accident is according to a structured format with fixed data elements.

Accordingly, the second component of the analysis, in depth studies of individual accident reports, was able to provide information complementary to that obtained from statistical analysis. A number of accidents were selected on a random basis from accident groupings identified to have a major contribution to the overall safety hazard. The more detailed but less structured information available from the accident reports was analysed to obtain additional insights on the circumstances surrounding accident occurrences and to permit more reliable interpretation of some of the statistical associations observed.

In this report, the findings from both of the components comprising the methodology have been amalgamated to present a comprehensive statement of the contributors to safety risk in gold and platinum mining.

ANALYSIS OF SAFETY HAZARD IN GOLD AND PLATINUM MINING

The two appendices to this report give details of the analyses which support the summary findings provided here. Detailed results of the statistical analysis are provided in Appendix 1 to this document as reference material which will prove to be of importance to readers desiring to consider specific issues. Appendix 2 contains a summary of the information obtained through individual detailed accident case studies.

In this report, a summary is presented of the characteristics of accident groupings identified as important contributors to hazard and which may represent foci for research projects or other measures designed to improve safety. In this regard, possible foci would be to influence the hazard arising from:

- accidents due to a specific agency (eg rockbursts, trackbound vehicles),
- accidents occurring to personnel engaged in particular activities or employed in particular occupations (eg drilling, walking, pinch bar user),
- accidents occurring in particular types of place in the mine (eg stope face, shafts, orepasses), or
- accidents causing particular types of injury (eg foot, hand).

It is envisaged that almost any research project which may be proposed would have as its focus either a subset of or a complete accident grouping falling into one of the categories described above. Accordingly, by presenting the major attributes of accidents falling in these groupings, it should assist SIMRAC in assessing the pertinence of a proposed project in terms of addressing real

problems and also in quantitatively projecting the probable impact of the proposed project in terms of reducing hazard. This would represent an important input to the project selection process. It is also considered that, at the stage of ultimate implementation of research findings by industry, the information would serve as a useful guide towards the realization of maximum safety benefits.

Table 1 summarizes the accident groupings which have been identified as important possible foci for research, and also identifies in which tabulation more detailed information can be located on each accident grouping and the contribution of each grouping to the total hazard in terms of both allocated lost days and number of incidents. The tabulations which follow, Tables 2 to 29, provide summary information extracted from Appendices 1 and 2 on the following accident groupings. Except where specified, the total hazard, as measured by number of allocated lost days, has been used throughout. For each accident grouping, this has been apportioned according to the type of place where accidents occur, the occupation of the injured mineworker, his activity, the type of injury and the body part injured, and the assigned cause of the accident. Informal observations and comments, which are recognized not to be comprehensive, have also been provided to identify more detailed features of accidents in a particular grouping.

In addition to comments specific to each accident grouping incorporated in the tables, a number of comments are of general relevance to all the information presented. Firstly, with regard to activities, the data obtained via SAMRASS only provides the activity at the time of the accident of the mineworker killed or injured. While this activity is one of the more important descriptors of a mining circumstance to which hazard is apportioned, the activities of other personnel may frequently be of relevance to the understanding of accident occurrences. In certain instances, the accident report case studies have provided insights into the activities of other mineworkers which may have bearing on the propensity for accidents to occur.

Similarly, with regard to the assigned cause of the accident, in most cases only a single immediate cause is recorded. Except through the medium of case studies, it is therefore not possible to consider the factors inherent in the mining circumstance which lead to a greater propensity for accidents to take place. While the assigned cause may represent an act of omission or comission by a mineworker other than the deceased, it is indicated that in the majority of records this is not the case. Regardless, it is not possible to determine to whom the assigned cause refers or to elicit details on the nature of the error.

With regard to occupation, it is also noteworthy that the different mining groups appear to adopt different practices. For example, those groups who make use of multiskilling do not employ mineworkers in specific occupations. While driller, winch driver and loco driver appear to be relatively standardly used occupations across industry, other significant occupations such as pinch bar user or lasher are only used at certain mines. This may lead to some minor distortions in the information presented, and it is recommended that the activity at the time of the accident is generally

a more reliable descriptor of circumstance.

A more sophisticated risk analysis would probably attempt to break down total hazard into the two components of exposure duration to specific circumstances, and the risk of incurring an accident of a particular type per unit of exposure duration. However, this was beyond the scope of the current project as a substantial amount of work study data would need to be collected in order to obtain a representative work breakdown structure for occupations which contribute substantially to hazard. Accordingly, using the risk analysis presented in this report, it will be necessary to estimate the change in exposure to the circumstances influenced by a proposed project as well as the danger levels of these circumstances. By combining these changes appropriately, the change in total hazard which would result from the project can be determined; if the change in total number of employees is also considered, the improvement in safety could also be specified as a rate per thousand employees per annum. The example presented below illustrates on a simplistic basis how the risk model could be used to assess changes in various safety indices. The onus will however at this stage rest with research agencies to estimate the effects of technology in terms of exposure duration and danger level.

Circumstances influenced by implementation of research outputs *(eg Drilling at the stope face, Trackbound vehicle accidents occurring to personnel walking in haulages)*	Current hazard (allocated days/annum) *(determined from analyses in this report)*	Change in duration of exposure to circumstance *(Estimated effects to be derived through implementation of research outputs)*	Change in danger level of circumstance	New hazard (allocated days/annum)
A	200 000	-10%	-20%	144 000
B	50 000	+30%	-5%	61 750
C	100 000	+5%	+20%	126 000
Total	350 000			331 750

These safety improvements could be translated into rates per thousand employees by also considering the change in total number of employees which would result from the implementation of research outputs.

RECOMMENDATIONS FOR CHANGES IN ACCIDENT REPORTING PRACTICE

Arising from the analyses which have been conducted, the following observations have been made regarding the collection and storage of accident information.

Firstly, it is noted that the accident inquiry procedure frequently tends to represent a means for

assignation of blame. In this environment, it becomes difficult or impossible to determine the factors inherent in the mining system which contributed to the incidence of accidents being more likely, as efforts tend to be concentrated on identifying direct causes. These direct causes are typically mistakes, slips or lapses on the part of mineworkers which will occur as an inevitable part of human behaviour. Since the most effective solutions often lie in modifying the mining system such that the consequence of a mistake, slip or lapse is not an accident, it would be of considerable importance for accident investigations to include an appropriate examination of features of the mining system which increased the probable serious consequence of a human error.

In connection with this point, it would be of considerable advantage for the SAMRASS system to record information on the activities of other personnel contributing in either a direct or indirect way to the accident. Currently, only information on the activity of the person injured is captured. It is proposed that, for each person who influenced the incidence or severity of the accident, his activity, whether the activity was carried out properly or not and the nature of its influence on the accident should be recorded. In cases where an activity was not carried out properly, it would be appropriate to identify the underlying reasons. For example, overload of responsibilities on an individual, the impracticality of fulfilling job requirements or a lapse of concentration may be valid entries. In addition to the identification of factors contributing towards the occurrence of the accident, it may also be advantageous to solicit and record suggestions from the various personnel involved in the accident on measures which would have proved most effective in preventing the accident or mitigating its effects.

For example, in the case of a mineworker injured or killed by a trackbound vehicle while walking, it may be appropriate to record, inter alia, the service condition of the locomotive especially with regard to its warning devices and brakes, the track condition and clearance, the operation being carried out by the locomotive and the status of the driver's and guard's training. It would also be important to record, where appropriate, those activities which should have been carried out but were not. Where any shortcomings are identified, provision should be made to identify how they contributed either to the occurrence or the severity of the accident. Such information could possibly be captured in a checklist format appropriate to the type of accident as a supplement to the MD16 forms. Availability of such information per accident would permit a more in depth examination of the underlying factors leading to a greater propensity for accident occurrence. In turn, this would result in an improved capability of assessing the probable relevance of proposed research projects towards the improvement of safety. It is suggested that a working group could be established to develop an appropriate methodology for recording this information in as structured and effective a way as possible without imposing an unduly burdensome activity on the mine personnel required to complete the documentation.

Finally, it is considered appropriate that attention should be directed towards defining the most appropriate indices to use when reporting accident statistics to measure industry performance. At

present, a wide range of measures are used with the two most common being the reportable injury rate per thousand employees per annum and the fatality rate per thousand employees per annum. These two statistics are used to determine the winners in the mine safety competitions run by the Chamber of Mines, and as such receive considerable publicity. In addition, a frequently quoted statistic is the total number of fatalities per annum, without regard to the number of mineworkers employed by the industry. On mines, the number of disabling injuries per million man hours is commonly employed to adjudge safety risk. With the introduction of the Safety Research Levy, the measure of allocated days incurred by a mine over a pre-defined time period was adopted as a basis for calculating individual mine contributions. While this measure suffers from the disadvantage that it does not relate immediately to the number of injuries or risk per mineworker, it has the considerable merit that it takes into account the severity of accidents more appropriately than any other available measure. The use of other measures which do not adequately cater for the severity of reportable injuries would lead to a decision making process favouring a maximum reduction in injury rates by addressing minor injuries with undue emphasis. As such, it is recommended that, in selecting foci for research and judging their impact, allocated lost days currently represents the most appropriate quantifiable measure of hazard. To convert this into a measurement of safety risk rather than total hazard experienced by industry, this statistic could be divided by the number of mineworkers, or perhaps more appropriately by tons broken.

CONCLUSIONS

It should be recognized that much of the value of the analyses presented lie in the quantitative details of the risk model developed for the gold and platinum mining industry, and it will be necessary for personnel seeking to effect improvements in mine safety to make use of the information presented on a case specific basis to estimate the likely benefits of proposed innovation or change in practice. Nevertheless, the following provides a summary, in point form, of the most important generic findings to emerge from the study.

- In the case of the majority of accidents due to rockbursts and strainbursts (18% of the total hazard), it is adjudged that the systems and facilities currently available to mine personnel are inadequate to cope with the hazard. Accordingly, it may be deduced that technological developments represent the only means through which the hazard from this source may be reduced.

- The cause assigned to the majority of fall of ground accidents, which account for some 29% of hazard, is inadequate examination. In only relatively few cases is it suggested that the examination was not conducted according to proper procedures. Using the information obtained from accident case studies it is therefore concluded that the dominant problem is one of reliably recognizing hazardous circumstances. While training may have a role to play, it appears that new technologies to assist in

hazard recognition would provide a high safety benefit.

- With the notable exceptions of a few accident groupings, in the case of accidents which are not rock related the causes assigned relate to failings on the part of mineworkers to adequately fulfil their responsibilities, with a reasonably even division between mistakes, slips and violations. In general, it must be accepted that errors are an inevitable part of human behaviour, probably exacerbated by the harsh physical conditions experienced in mining. While training and safety awareness undoubtedly have a role to play in reducing human proneness to error, significant benefits would be achieved by seeking to adapt the mining system in such a way that the consequences of such mistakes are reduced in severity or eliminated completely.

- The accident reporting culture tends to focus on the direct and immediate cause of accidents, and the statistical analysis therefore tends to identify these aspects predominantly. It has not generally been possible, except where case studies have been undertaken, to identify conclusively those factors inherent to the mining system which predispose the serious consequences of operational errors or mistakes. Even in the latter case, it was only possible to deduce indirectly from the information provided and in a small percentage of cases which factors represented fundamental causes.

- Only in the cases of monorails and monoropes, and eye injuries (accounting for some 4% of total hazard) are the roles of safety devices or protective equipment specifically referred to. In the former case, the unavailability of suitable safety devices is identified, whereas in the latter the failure to use available protective equipment is considered to be an important factor. It must therefore be concluded that, for the vast majority of accident groupings, it is considered that failure or unavailability of safety devices does not represent a major contributing factor to accident occurrence.

- Difficulties in communication between mine personnel appear to play a significant role in the occurrence of accidents. For example, in the case of trackbound vehicle accidents, communication between locomotive driver, guard and other personnel is frequently quoted as an issue, and, in the case of both locomotive and scraper winch accidents, failure to heed warning signals is often referred to.

- Lack of adequate or suitable training is very infrequently invoked as a cause of accidents in all categories. It must therefore be concluded that mine personnel are generally trained to the required standard, and that the training is considered to be

adequate to enable the mineworker to function effectively in his occupation.

In addition to these generic conclusions on the occurrence of accidents in the gold and platinum mining industry, two further observations are considered to be of potential value to industry decision makers on safety improvement strategy.

- It is recommended that significant benefits could be achieved in the longer term by seeking to obtain more diagnostic information through accident inquiries. Template forms requiring specific items of information for certain categories of accident could be used to identify in a structured and factual way those factors which contributed towards the occurrence of an accident, and, equally importantly, those factors which did not play a role. By eliciting factual information on the circumstances under which accidents tend to take place, it will become possible to identify in more detail inherent factors in the mining system which are contributory to accident occurrence.

- Establishment of a uniform system for measuring safety hazard would represent an important step towards identifying those measures which could be considered to provide optimal cost effective improvements in mine safety. While better measures than allocated lost days may be desirable, this measure, in contrast to others, has the merit of incorporating number of incidents and their severity. Accordingly, its use as a monitoring instrument may at this stage represent the best means of optimizing industry's efforts to improve safety and measuring the effectiveness of the initiatives undertaken.

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Table 1 Major accident groupings which may represent possible foci for research projects

Type of accident grouping	Accident grouping representing possible focus for research projects	Table number	Contribution to hazard (%)	
			Allocated days	Number of incidents
Agency causing accident or activity responsible for accident	Fall of ground	2	29,4	23,9
	Rockburst/strainburst	3	17,5	4,4
	Trackbound vehicle	4	8,6	8,1
	Falling or slipping and falling	5	7,4	8,1
	Manual handling, hand trammed and mechanical loader	6	5,0	15,1
	Falling rock or material	7	4,8	11,7
	Scraper winch	8	3,6	4,5
	Shaft equipment	9	3,2	1,0
	Explosives	10	3,1	0,5
	Monorope or monorail	11	2,4	2,6
	Machinery	12	1,4	2,4
	Other	-	13,6	17,7
Activity at time of accident	Non-productive or supervisory activities	13	23,2	20,6
	Activities associated with transportation of ore or materials	14	14,4	22,1
	Activities of the drilling and blasting cycle	15	12,7	12,7
	Activities of the cleaning cycle	16	10,6	7,2
	Equipping, installing, maintaining or operating machinery	17	8,8	10,1
	Activities concerned with working place preparation	18	7,8	6,6
	Activities concerned with supporting excavations	19	7,2	5,7
	Driving or riding vehicles	20	5,3	3,0
	Other	-	10,0	12,0
Type of location where accident occurred	Stope face	21	35,1	26,8
	Haulage, return airway or travelling way	22	12,1	15,2
	Shaft	23	11,5	12,2
	Strike gully, centre gully or tip	24	10,7	11,7
	Crosscut	25	8,2	12,0
	Other	-	22,4	22,1
Body part injured	Hand	26	10,1	31,0
	Head	27	9,5	2,0
	Foot	28	2,7	17,3
	Eye	29	1,1	2,4
	Other	-	76,6	47,3

Table 2 Key characteristics of accident grouping - Fall of ground

Information derived from statistical analysis of accident data		
Contribution to hazard	29,4% of allocated days lost	
Frequency of incidents	23,9% of number of accidents	
Variation by mining region	Less frequent than average in Far West Rand due to predominance of rockburst type accidents.	
Principal activities of personnel injured	Non-productive or supervisory activities (standing, walking) Drilling and blasting cycle (mainly drilling) Working place preparation (mainly barring) Cleaning cycle (mainly lashing) Installing support	20% 15% 15% 15% 12%
Principal occupations of personnel injured	Driller/drilling crew Labourer Team leader Winch driver	31% 18% 13% 12%
Experience in occupation of personnel injured	No significant variation from overall pattern	
Principal types of place for accident occurrence	Stope face Other reef horizon (Worked out area 25%; strike gully 32%; centre gully 18%; reef drive 14%; raise or winze 11%) Haulage, return airway, travelling way or crosscut	55% 25% 13%
Principal assigned causes	Inadequate examination, inspection or test Failure to comply with good practice, standards or procedure Lack of suitable systems or facilities Failure to comply with instructions	66% 11% 7% 5%
Number of contraventions	Probable contraventions	10%
Principal types of injury (allocated days)	Multiple Fracture Crushing	55% 25% 10%
Principal types of injury (frequency of incidents)	Fracture Laceration Multiple	34% 32% 15%
Principal body parts injured (allocated days)	Multiple Head Unspecified Trunk	34% 18% 18% 17%
Principal body parts injured (frequency of incidents)	Leg Foot Hand Trunk Arm Multiple Head Unspecified	21% 19% 16% 13% 12% 12% 5% 3%

Information derived from accident case studies

The predominant problem appears to be one of recognizing hazardous hangingwall conditions where some form of remedial action is required. Failure to attempt to conduct the examination to an acceptable standard or to remediate identified hazards are not recorded as frequent contributing factors.

Comments

It is suggested that the techniques available to mineworkers responsible for examination of the hangingwall are largely inadequate to detect hazards reliably over the large areal extent in the stope face area.
The observation that a relatively low percentage of the hazard occurs to personnel involved in making the working place safe implies that the operations involved in remediating hazardous hangingwall conditions, mainly barring, are not in themselves particularly hazardous.
It is noteworthy that, by implication from the causes assigned, the support systems and support codes of practice are considered adequate and are generally adhered to.

Table 3 Key characteristics of accident grouping - Rockburst or strainburst

Information derived from statistical analysis of accident data		
Contribution to hazard	17,5% of allocated days lost	
Frequency of incidents	4,4% of number of accidents	
Variation by mining region	77% of days lost due to rockbursts occur in the Far West Rand. Strainbursts are uniformly distributed across the regions.	
Principal activities of personnel injured	Drilling and blasting cycle (mainly drilling) Cleaning cycle (mainly lashing or shovelling) Non-productive or supervisory activities (standing, walking) Installing support Working place preparation	25% 19% 13% 13% 9%
Principal occupations of personnel injured	Driller or drilling crew Winch driver Labourer Lasher Team leader	35% 20% 13% 11% 11%
Experience in occupation of personnel injured	No significant variation from overall pattern	
Principal types of place for accident occurrence	Stope face Other reef horizon Haulage, return airway or travelling way	75% 15% 7%
Principal assigned causes	Lack of suitable system or facilities Inadequate examination, inspection or test	79% 9%
Number of contraventions	Probable contraventions	1%
Principal types of injury (allocated days)	Multiple Fracture	74% 17%
Principal types of injury (frequency of incidents)	Multiple Fracture Laceration	36% 28% 22%
Principal body parts injured (allocated days)	Multiple Unspecified Head Trunk	44% 29% 13% 10%
Principal body parts injured (frequency of incidents)	Multiple Trunk Leg Arm Unspecified Foot Hand Head	27% 16% 15% 11% 9% 8% 8% 8%

Comments

The predominance of the assigned cause "Lack of suitable system or facilities" implies that no technology is available to effectively prevent or ameliorate this hazard.

Table 4 Key characteristics of accident grouping - Trackbound vehicles

Information derived from statistical analysis of accident data		
Contribution to hazard	8,6% of allocated days lost	
Frequency of incidents	8,1% of number of accidents	
Variation by mining region	No significant departures from overall pattern	
Principal activities of personnel injured	Driving or riding trackbound vehicle (approximately equal contributions) Non-productive or supervisory activities (mainly walking or standing) Activities concerned with transport (tramming, coupling/uncoupling, rerailing)	34% 32% 21%
Principal occupations of personnel injured	Loco driver or guard Team leader Labourer	50% 14% 10%
Experience in occupation of personnel injured	Personnel with less than 1 year experience more susceptible than average to this type of accident	
Principal types of place for accident occurrence	Haulage, return airway or travelling way Crosscut Shaft Surface	53% 20% 9% 6%
Principal assigned causes	Failure to comply with recognized good practice, standards or procedure Failure to comply with instructions Lack of caution or alertness Lack of clearance	42% 16% 14% 6%
Number of contraventions	Probable contraventions	24%
Principal types of injury (allocated days)	Multiple Amputation Fracture Crushing	37% 24% 23% 12%
Principal types of injury (frequency of incidents)	Fracture Laceration Amputation	41% 15% 14%
Principal body parts injured (allocated days)	Multiple Trunk Head Leg Hand	23% 21% 17% 13% 13%
Principal body parts injured (frequency of incidents)	Hand Foot Leg Trunk	35% 19% 16% 13%

Information derived from accident case studies

The hazard arising from this category appears to be approximately equal whether the locomotive is pushing or pulling the span of hoppers.
Derailment was identified as a significant factor in 37% of cases.
Jacks slipping and coupling of vehicles during rerailing of trackbound vehicles are significant problems.
Poor communication between locomotive driver, guard and other mineworkers in the vicinity appears to be a significant contributory factor.
The absence, malfunctioning or inadequacy of safety or warning devices is rarely reported.
The clearance between trackbound vehicles and the sidewall or other obstructions is referenced in 70% of reports.

Comments

A large proportion of the hazard due to trackbound vehicles occurs to personnel not directly involved in the operation of locomotives or tramming operations.
Poor mining practice or non-compliance with standards is a frequent contributor to the hazard with a large proportion of contraventions being noted.

Table 5 Key characteristics of accident grouping - Falling or slipping and falling

Information derived from statistical analysis of accident data		
Contribution to hazard	7,4% of allocated days lost (falling in excavations 42%; slipping and falling 23%; falling in shafts 22%; falling from structures 14%)	
Frequency of incidents	8,1% of number of accidents (falling in excavations 7%; slipping and falling 79%; falling in shafts 1%; falling from structures 12%)	
Variation by mining region	Eastern Transvaal gold mines suffer from a greater percentage of hazard from these accident categories	
Principal activities of personnel injured	Non-productive or supervisory activities (walking, climbing and standing) Miscellaneous activities Activities associated with transportation (pushing and transporting) Equipping, installing or maintaining	43% 15% 13% 10%
Principal occupations of personnel injured	Labourer Driller or drilling crew (in particular suffer from falling in excavations and slipping and falling) Team leader Transport staff (in particular suffer from falling in shafts)	15% 12% 12% 10%
Experience in occupation of personnel injured	No significant differences from overall pattern	
Principal types of place for accident occurrence	Shafts (incur falling in shafts) Boxhole or orepass (incur falling in excavations) Surface (including plant) (mainly falling from structures) Stope face	27% 23% 9% 8%
Principal assigned causes	Failure to comply with good practice, standards or procedures Failure to comply with instructions Lack of caution or alertness (especially in the case of slipping and falling) Failure to use safety or protective devices	22% 19% 18% 10%
Number of contraventions	Probable contraventions	27%
Principal types of injury (allocated days)	Multiple (in case of falling) Fracture (in case of slipping and falling and falling from structures)	60% 26%
Principal types of injury (frequency of incidents)	Fracture Other Laceration	36% 35% 17%
Principal body parts injured (allocated days)	Multiple Unspecified Head	33% 20% 20%
Principal body parts injured (frequency of incidents)	Hand Leg Arm Foot Trunk	23% 20% 17% 14% 12%

Information derived from accident case studies

Slipping and falling accidents tend to be blamed on the carelessness of the person who fell. However, many incidents were found to occur on wet, smooth or inclined surfaces. There were only limited references to condition of footwear. In the case studies, in general the falling accidents were found to be a result of not wearing safety harnesses, or due to hazardous circumstances being left behind by other mineworkers. In the former case, there is often resistance to wearing a safety belt because it restricts movement required to carry out the job.

Comments

While found to be an important factor in the selected case studies, non-use of safety devices such as safety belts or harnesses was not found to be a major issue in the analysis of statistical data. This is interpreted as being closely linked to the observation that a large percentage of the hazard due to falling accidents occurs to personnel travelling or waiting. From the case studies, it would appear that these personnel encounter hazardous conditions left behind by other mineworkers. It is probable that non-use of safety devices influences accidents involving workers concerned with shaft or orepass maintenance.

Table 6 Key characteristics of accident grouping - Manual handling, hand trammed and mechanical loaders

Information derived from statistical analysis of accident data		
Contribution to hazard	5,0% of allocated days lost (manual handling 66%; hand trammed 18%; mechanical loaders 18%)	
Frequency of incidents	15,1% of number of accidents (manual handling 74%; hand trammed 18%; mechanical loaders 9%)	
Variation by mining region	No significant variations	
Principal activities of personnel injured	Activities associated with transportation (loading and offloading, raising or lowering and transporting)	53%
	Non-productive or supervisory activities (walking)	10%
Principal occupations of personnel injured	Labourer	22%
	Transport staff	10%
	Driller or drilling crew	9%
	Boesman driver (mechanical loader accidents)	7%
Experience in occupation of personnel injured	For mechanical loaders personnel with 5 to 10 years experience are at greater risk than average.	
Principal types of place for accident occurrence	Haulage, return airway or travelling way	19%
	Shaft	19%
	Crosscut	17%
	Stope face	9%
	Surface (including plant)	7%
	Centre gully or tip	7%
Principal assigned causes	Lack of caution or alertness	34%
	Failure to comply with good practice, standards or procedure	30%
	Failure to use safety devices	8%
	Inadequate examination, inspection or test	6%
Number of contraventions	Probable contraventions	4%
Principal types of injury (allocated days)	Hand	48%
	Foot	10%
	Head	9%
	Leg	9%
	Multiple	7%
	Unspecified	6%
Principal types of injury (frequency of incidents)	Hand	56%
	Foot	22%
	Leg	9%
Principal body parts injured (allocated days)	Amputation	39%
	Fracture	30%
	Multiple	15%
Principal body parts injured (frequency of incidents)	Fracture	41%
	Laceration	20%
	Other	17%
	Amputation	14%

Information derived from accident case studies

The unsuitability of equipment, eg chainblocks, for lifting bulky objects in confined spaces in a controlled manner is largely inadequate. Use of a team of mineworkers to lift objects manually also appears to be a significant problem. Handling of pipes and ventilation pipes appears to be a particularly common problem in this category especially during installation and removal.
It appears unlikely that personal protective equipment would be effective in ameliorating injuries arising from accidents in this category.

Comments

Accidents in this category tend to result in significantly less severe injuries than average.
While not indicated from the statistical analysis, it appears from the case studies that the equipment used for loading, offloading, raising or lowering is inherently inadequate.

Table 7 Key characteristics of accident grouping - Falling rock or material

Information derived from statistical analysis of accident data		
Contribution to hazard	4,8% of allocated days lost	
Frequency of incidents	11,7% of number of accidents	
Variation by mining region	No significant variation from the average pattern	
Principal activities of personnel injured	Non-productive or supervisory activities (standing, walking or supervising) Activities associated with transportation (transporting, carrying, loading and offloading) Miscellaneous activities (installing other than support, equipment or machinery) Drilling and blasting cycle Equipping, installing and maintaining (installing equipment, repairing and tightening) Cleaning cycle (lashing)	26% 17% 17% 11% 9% 9%
Principal occupations of personnel injured	Driller or drilling crew Labourer Team leader Engineering personnel	20% 20% 14% 13%
Experience in occupation of personnel injured	No distinctions from average pattern	
Principal types of place for accident occurrence	Shaft (sinking 50%; vertical 47%; incline 3%) Stope face Haulage, return airway or travelling way Crosscut Centre gully/tip	23% 19% 13% 9% 7%
Principal assigned causes	Failure to comply with good practice, standards or procedure Lack of caution or alertness Inadequate examination, inspection or test Failure to comply with instructions Use of unsuitable or defective equipment Inadequate fencing or guarding	31% 15% 12% 8% 7% 6%
Number of contraventions	Probable contraventions	11%
Principal types of injury (allocated days)	Fracture Multiple Amputation	40% 34% 14%
Principal types of injury (frequency of incidents)	Fracture Laceration Other	44% 22% 20%
Principal body parts injured (allocated days)	Head Multiple Hand Leg Trunk Foot	20% 20% 17% 12% 10% 10%
Principal body parts injured (frequency of incidents)	Hand Foot Leg	33% 29% 16%

Information derived from accident case studies

About half of the accidents selected as case studies in this category occurred in steeply dipping stopes or on or near orepasses, with manoeuvring or breaking of rocks on grizzlies being a particular problem area.
Timber mats falling on personnel during pack construction appears to be a fairly common occurrence.

Comments

It appears that a wide variety of objects falling are responsible for accidents in this category, and no coherent patterns can be identified. While vertical shafts represent a particularly hazardous area, especially during the sinking phase, these types of accidents are spread across the majority of the mine workings.
While not logged frequently as an assigned cause, it is probable that improved personal protective equipment or other protective devices would be effective in avoiding a large number of minor injuries in this category.

Table 8 Key characteristics of accident grouping - Scraper winch

Information derived from statistical analysis of accident data		
Contribution to hazard	3,6% of allocated days lost	
Frequency of incidents	4,5% of number of accidents	
Variation by mining region	No significant variations in occurrence between mining regions	
Principal activities of personnel injured	Non-productive or supervisory activities (mainly walking or standing) Equipping, installing or maintaining (mainly rigging and operating machinery) Miscellaneous (mainly breaking ore and signalling) Activities concerned with transport (mainly pulling and transporting) Cleaning (mainly scraping and lashing)	43% 17% 13% 11% 10%
Principal occupations of personnel injured	Winch driver Labourer Team leader Driller or drilling crew Lasher	42% 14% 11% 10% 10%
Experience in occupation of personnel injured	No significant pattern with experience	
Principal types of place for accident occurrence	Stope face Strike gully Centre gully/tip	38% 28% 26%
Principal assigned causes	Failure to comply with recognized good practice, standards or procedure Failure to comply with instructions Lack of caution or alertness	41% 15% 13%
Number of contraventions	Probable contraventions	16%
Principal types of injury (allocated days)	Fracture Amputation Multiple	31% 28% 27%
Principal types of injury (frequency of incidents)	Fracture Laceration Amputation Multiple	38% 16% 13% 11%
Principal body parts injured (allocated days)	Head Hand Trunk Leg	29% 22% 14% 14%
Principal body parts injured (frequency of incidents)	Hand Leg Foot Head	27% 25% 18% 10%

Information derived from accident case studies
A common cause of accidents in this category is scraper ropes fouling other ropes. This is frequently a consequence of the point of installation of the snatchblocks. A further large proportion of accidents result from winches being started without due warning.

Comments
It is concluded that approximately equal levels of hazard are presented by face, strike and centre gully scrapers. The majority of personnel injured or killed are engaged in activities not concerned with scraper winch operation, in particular travelling through areas where scraper winches are in operation.

Table 9 Key characteristics of accident grouping - Shaft equipment

Information derived from statistical analysis of accident data		
Contribution to hazard	3,2% of allocated days lost (Struck by shaft equipment 43%; travelling in shaft 34%; conveyance malfunction 22%)	
Frequency of incidents	1,0% of number of accidents (Struck by shaft equipment 62%; travelling in shaft 33%; conveyance malfunction 6%)	
Variation by mining region	More prevalent than average on platinum mines	
Principal activities of personnel injured	Activities associated with transportation (transporting) Non-productive or supervisory activities (mainly standing) Driving or riding vehicles (travelling in shaft) Equipping, installing or maintaining (struck by equipment while inspecting or adjusting machinery) Miscellaneous	27% 23% 14% 11% 10%
Principal occupations of personnel injured	Transportation staff Labourer Winch driver Engineering Driller or drilling crew Team leader	22% 16% 12% 11% 9% 9%
Experience in occupation of personnel injured	Accident of this type occur to personnel with greater than 5 years experience more frequently than average	
Principal types of place for accident occurrence	Vertical shaft (mainly travelling by shaft and struck by shaft equipment) Incline shaft (only significant place for conveyance malfunction) Sinking shaft (mainly struck by shaft equipment) Raise or winze Haulage, return airway or travelling way	43% 29% 15% 7% 5%
Principal assigned causes	Failure to comply with recognized good practice, standards or procedure (not in case of conveyance malfunctions) Failure to comply with instructions Lack of caution or alertness (not in case of conveyance malfunctions) Failure to use protective systems or devices (mainly in case of conveyance malfunctions)	37% 24% 12% 8%
Number of contraventions	Probable contraventions (almost 100% in the case of conveyance malfunctions)	42%
Principal types of injury (allocated days)	Multiple Fracture (predominantly resulting from struck by shaft equipment) Crushing (not in the case of travelling by shaft type accidents)	65% 15% 12%
Principal types of injury (frequency of incidents)	Multiple Fracture Other	37% 32% 14%
Principal body parts injured (allocated days)	Head Unspecified Multiple	30% 29% 27%
Principal body parts injured (frequency of incidents)	Unspecified Hand Leg Foot Head Multiple Arm Trunk	23% 20% 14% 11% 10% 8% 7% 6%
Comments		
A particularly high percentage of contraventions is noted in this category. In the case of incline shafts, which account for an anomalously high percentage of accidents in this category, there appear to be problems with the reliability of the shaft equipment or system.		

Table 10 Key characteristics of accident grouping - Explosives

Information derived from statistical analysis of accident data		
Contribution to hazard	3,1% of allocated days lost	
Frequency of incidents	0,5% of number of accidents	
Variation by mining region	Nitroglycerine accidents particularly damaging in Klerksdorp region as a result of a few serious accidents	
Principal activities of personnel injured	Drilling and blasting cycle (mainly drilling with blasting subsidiary) Non-productive or supervisory activities (walking, sitting, standing or supervising) Equipping, installing or maintaining (Repairing, servicing or maintaining) Cleaning (mainly lashing) Activities associated with transportation (mainly handling)	37% 21% 11% 8% 7%
Principal occupations of personnel injured	Driller or drilling crew Engineering personnel Labourer Team leader Supervisory or managerial	24% 17% 16% 13% 10%
Experience in occupation of personnel injured	Between 2 and 10 years experience at greater risk than the average distribution	
Principal types of place for accident occurrence	Haulage, return airway or travelling way Shaft Stope face	23% 22% 19%
Principal assigned causes	Failure to comply with instructions Failure to comply with recognized good practice, standards or procedures Inadequate examination, inspection or test	50% 20% 10%
Number of contraventions	Probable contraventions	63%
Principal types of injury (allocated days)	Multiple Other Fracture	53% 25% 15%
Principal types of injury (frequency of incidents)	Multiple Other Fracture	39% 31% 15%
Principal body parts injured (allocated days)	Multiple Unspecified Head	53% 22% 14%
Principal body parts injured (frequency of incidents)	Multiple Head Unspecified Hand	35% 29% 12% 10%

Comments

The hazard due to explosives occurs at many points of the mining and transportation cycles with drilling into misfires, poor handling and blasting being the three major problem areas.
Nitroglycerine is responsible for about half of the hazard, which, considering the extent of its use, implies that this type of explosive is more dangerous than others.

Table 11 Key characteristics of accident grouping - Monorope or monorail

Information derived from statistical analysis of accident data		
Contribution to hazard	2.4% of allocated days lost	
Frequency of incidents	2.6% of number of accidents	
Variation by mining region	No significant variations across the mining regions	
Principal activities of personnel injured	Non-productive or supervisory activities (walking and standing) Equipping, installing or maintaining cutting with tool, repairing or servicing) Activities associated with transportation (transporting) Miscellaneous (removing, holding, tying, guiding)	32% 25% 22% 19%
Principal occupations of personnel injured	Labourer Winch driver Team leader Driller Lasher	29% 18% 16% 11% 11%
Experience in occupation of personnel injured	No distinctions from overall pattern of accidents	
Principal types of place for accident occurrence	Stope face Stope worked out area Centre gully or tip Haulage, return airway or travelling way Strike gully Crosscut	23% 20% 17% 14% 9% 9%
Principal assigned causes	Inadequate fencing or guarding Failure to comply with good practice, standards or procedure Lack of caution or alertness	38% 20% 12%
Number of contraventions	Probable contraventions	17%
Principal types of injury (allocated days)	Amputation Fracture Multiple	89% 5% 4%
Principal types of injury (frequency of incidents)	Amputation Fracture Laceration	54% 15% 14%
Principal body parts injured (allocated days)	Hand Head	89% 4%
Principal body parts injured (frequency of incidents)	Hand Leg Head	87% 4% 4%
Comments		
The absence of guards on monoropes and monorails is considered to be responsible for a large proportion of accidents in this category. This results in a preponderance of finger and hand injuries which are unlikely to be preventable by personal protective equipment.		

Table 12 Key characteristics of accident grouping - Machinery

Information derived from statistical analysis of accident data		
Contribution to hazard	1,4% of allocated days lost	
Frequency of incidents	2,4% of number of accidents	
Variation by mining region	Accidents in this category account for a high percentage of the hazard in surface operations.	
Principal activities of personnel injured	Equipping, installing or maintaining (cleaning equipment, installing and connecting or uncoupling equipment) Miscellaneous activities (removing other than support, equipment or machinery) Drilling and blasting cycle Non-productive or supervisory activities (standing, climbing and walking)	28% 25% 14% 14%
Principal occupations of personnel injured	Engineering staff Labourer Driller or drilling crew Miscellaneous occupations	24% 22% 20% 12%
Experience in occupation of personnel injured	No distinctions from overall pattern	
Principal types of place for accident occurrence	Surface (including plant) Shaft Haulage, return airway, travelling way or crosscut Engineering sites Stope face	32% 15% 12% 11% 10%
Principal assigned causes	Failure to comply with good practice, standards or procedures Lack of caution or alertness Failure to comply with instructions	27% 20% 10%
Number of contraventions	Probable contraventions	15%
Principal types of injury (allocated days)	Amputation Fracture Multiple	37% 33% 21%
Principal types of injury (frequency of incidents)	Fracture Laceration Amputation Other	35% 22% 18% 15%
Principal body parts injured (allocated days)	Hand Head Trunk Arm Multiple	37% 20% 13% 11% 10%
Principal body parts injured (frequency of incidents)	Hand Foot Head Arm	62% 11% 8% 8%

Comments

The dominant item of machinery causing the hazard in this category is conveyor belts. Hand injuries in pulleys are particularly frequent in this category. Inadequate or absent guards or safety devices are not referenced as having a significant role.

Table 13 Key characteristics of accident grouping - Accidents occurring to personnel engaged in non-productive or supervisory activities

Information derived from statistical analysis of accident data		
Contribution to hazard	23,2% of allocated days lost	
Frequency of incidents	20,6% of number of accidents	
Principal activities of personnel injured	Walking Standing Sitting Supervising Climbing excavations Waiting Climbing structures, machinery or ladders	42% 20% 14% 10% 4% 3% 3%
Principal occupations of personnel injured	Team leader Labourer Winch driver Driller or drilling crew	19% 19% 14% 12%
Experience in occupation of personnel injured	No distinction from average pattern	
Variation by mining region	No departure from overall pattern	
Principal types of place for accident occurrence	Stope face Haulage, return airway or travelling way Shaft Strike gully Centre gully or tip Crosscut	25% 15% 13% 8% 7% 7%
Principal agencies	Fall of ground Falling or slipping and falling Trackbound vehicle Rockburst or strainburst Scraper winch Falling rock or material Explosives Dust, gas or fumes Monorope or monorail	26% 12% 11% 11% 7% 6% 4% 4% 3%
Principal assigned causes	Failure to comply with recognized good practice, standards or procedure Inadequate examination, inspection or test Failure to comply with instructions Lack of suitable systems or facilities Lack of caution or alertness Inadequate fencing or guarding	25% 20% 16% 11% 11% 3%
Number of contraventions	Probable contraventions	22%
Principal types of injury	Multiple Fracture Amputation Crushing	46% 23% 10% 8%
Principal body parts injured	Multiple Unspecified Head Trunk Leg Hand	28% 19% 18% 15% 8% 7%

Comments

The pattern of accidents for personnel engaged in this grouping of activities is extremely diverse, and is similar to the overall pattern of accidents. Nevertheless, as the activities grouping contributing the largest hazard component, attention should be given to identifying means of reducing hazard in this area. It would be important to consider which accident types falling into this grouping would be influenced when assessing the probable impact of innovation.

Table 14 Key characteristics of accident grouping - Accidents occurring to personnel engaged in activities concerned with transportation of ore and materials

Information derived from statistical analysis of accident data		
Contribution to hazard	14,4% of allocated days lost	
Frequency of incidents	22,1% of number of accidents	
Principal activities of personnel injured	Transporting	22%
	Pulling	12%
	Loading or offloading	10%
	Clearing obstructions	9%
	Tramming	6%
	Pushing	6%
	Connecting or uncoupling vehicles	5%
	Handling	5%
	Raising or lowering by hand	4%
	Moving objects	4%
	Rerailing	4%
Principal occupations of personnel injured	Labourer	22%
	Locomotive driver or guard	16%
	Driller or drilling crew	13%
	Winch driver	12%
	Team leader	9%
Experience in occupation of personnel injured	No distinctions from average pattern	
Variation by mining region	More common in Bushveld Igneous Complex and Central Rand	
Principal types of place for accident occurrence	Shaft	19%
	Stope face	19%
	Haulage, return airway or travelling way	15%
	Crosscut	11%
Principal agencies	Fall of ground	18%
	Manual handling or hand trammed	16%
	Trackbound vehicle	12%
	Rockburst or strainburst	8%
	Falling or slipping and falling	8%
	Falling rock or material	7%
	Inundation or drowning	5%
	Travelling in shaft	5%
	Scraper winch	3%
	Monorope or monorail	3%
Principal assigned causes	Failure to comply with recognized good practice, standards or procedure	31%
	Lack of caution or alertness	16%
	Inadequate examination, inspection or test	14%
	Lack of suitable systems or facilities	11%
	Failure to comply with instructions	8%
	Use of unsuitable or defective equipment, machinery or facilities	4%
	Failure to use safety or protective devices, equipment or systems	4%
Number of contraventions	Probable contraventions	15%
Principal types of injury	Multiple	35%
	Fracture	22%
	Amputation	22%
Principal body parts injured	Hand	24%
	Unspecified	21%
	Multiple	19%
	Head	16%
	Trunk	9%
	Leg	6%
Comments		
Accidents falling into this grouping are generally less severe than average, in line with the low incidence of rock related accidents. Hand injuries are especially prevalent.		

Table 15 Key characteristics of accident grouping - Activities occurring to personnel engaged in activities of the drilling and blasting cycle

Information derived from statistical analysis of accident data		
Contribution to hazard	12,7% of allocated days lost	
Frequency of incidents	12,7% of number of accidents	
Principal activities of personnel injured	Pneumatic drilling Charging up Blasting Hydraulic drilling	79% 11% 4% 3%
Principal occupations of personnel injured	Driller or drilling crew Miner's assistant	85% 5%
Experience in occupation of personnel injured	Affects more personnel with greater experience than the average pattern	
Variation by mining region	More common in the Far West Rand, and less common in the Orange Free State	
Principal types of place for accident occurrence	Stope face Development end Crosscut Haulage, return airway or travelling way Shaft	58% 7% 7% 6% 5%
Principal agencies	Rockburst or strainburst Fall of ground Explosives Falling rock or material	40% 39% 8% 4%
Principal assigned causes	Lack of suitable systems or facilities Inadequate examination, inspection or test Failure to comply with recognized good practice, standards or procedure Failure to comply with instructions	37% 32% 13% 6%
Number of contraventions	Probable contraventions	12%
Principal types of injury	Multiple Fracture	61% 20%
Principal body parts injured	Multiple Unspecified Head Trunk Hand	39% 24% 13% 9% 5%

Comments

In the majority of cases, being the rock related incidents, the activity at the time of the accident was not causative to the accident taking place. The unusually high percentage of rockburst and strainburst accidents in this grouping is interpreted of being indicative of the location close to the stope face where drilling operations take place.

Table 16 Key characteristics of accident grouping - Accidents occurring to personnel engaged in activities of the cleaning cycle

Information derived from statistical analysis of accident data		
Contribution to hazard	10,6% of allocated days lost	
Frequency of incidents	7,2% of number of accidents	
Principal activities of personnel injured	Lashing or shovelling Cleaning footwall Reclaiming, sweeping or vamping Cleaning other than equipment machinery or footwall	52% 22% 11% 9%
Principal occupations of personnel injured	Labourer Winch driver Driller or drilling crew Lasher Team leader	23% 23% 16% 13% 8%
Experience in occupation of personnel injured	No major departures from average pattern	
Variation by mining region	More common in Far West Rand and less common in Klerksdorp	
Principal types of place for accident occurrence	Stope face Crosscut Stope back area, reclamation area or stope entrance Strike gully Haulage, return airway or travelling way Shaft	61% 6% 6% 6% 5% 5%
Principal agencies	Fall of ground Rockburst or strainburst Falling rock or material Scraper winch Falling or slipping and falling Explosives	41% 35% 4% 3% 3% 3%
Principal assigned causes	Lack of suitable systems or facilities Inadequate examination, inspection or test Failure to comply with recognized good practice, standards or procedure Failure to comply with instructions	37% 28% 10% 9%
Number of contraventions	Probable contraventions	13%
Principal types of injury	Multiple Fracture	58% 21%
Principal body parts injured	Multiple Unspecified Trunk Head	31% 24% 18% 15%

Comments

In the majority of cases, being the rock related incidents, the activity at the time of the accident was not causative to the accident taking place. The unusually high percentage of rockburst and strainburst accidents in this grouping is interpreted of being indicative of the location close to the stope face where hand lashing takes place.

Table 17 Key characteristics of accident grouping - Accidents occurring to personnel engaged in equipping, installing, maintaining or operating machinery

Information derived from statistical analysis of accident data		
Contribution to hazard	8,8% of allocated days lost	
Frequency of incidents	10,1% of number of accidents	
Principal activities of personnel injured	Installing equipment or machinery Repairing, servicing or maintaining Rigging Connecting or uncoupling equipment, machinery or hoses Removing equipment or machinery Driving or operating stationary machinery Inspecting equipment, machinery or vehicles	16% 13% 9% 9% 8% 7% 6%
Principal occupations of personnel injured	Winch driver Engineering staff Labourer Driller or drilling crew Team leader	32% 18% 13% 10% 8%
Experience in occupation of personnel injured	No departures from overall pattern	
Variation by mining region	No distinctions from average pattern	
Principal types of place for accident occurrence	Stope face Strike gully Shaft Centre gully or tip Haulage, return airway or travelling way Crosscut	26% 12% 12% 9% 8% 7%
Principal agencies	Fall of ground Rockburst or strainburst Scraper winch Falling or slipping and falling Monorope or monorail Falling rock or material Explosives Machinery Dust, gas or fumes Inundation or drowning Electrical equipment Manual handling or hand trammed	22% 14% 8% 7% 6% 5% 5% 4% 4% 3% 3% 3%
Principal assigned causes	Failure to comply with recognized good practice, standards or procedure Lack of suitable systems or facilities Inadequate examination, inspection or test Failure to comply with instructions Lack of caution or alertness Use of unsuitable or defective equipment, machinery or facilities Failure to use safety or protective devices, equipment or systems Inadequate fencing or guarding	24% 16% 16% 12% 9% 6% 6% 4%
Number of contraventions	Probable contraventions	21%
Principal types of injury	Multiple Fracture Amputation	41% 19% 16%
Principal body parts injured	Multiple Head Hand Unspecified Trunk	27% 20% 17% 16% 9%
Comments		
It appears that a substantially greater hazard is incurred while equipping, installing or maintaining than when operating machinery. Winch drivers are probably at greatest risk due to the location where they are required to work.		

Table 18 Key characteristics of accident grouping - Accidents occurring to personnel engaged in working place preparation

Information derived from statistical analysis of accident data		
Contribution to hazard	7,8% of allocated days lost	
Frequency of incidents	6,6% of number of accidents	
Principal activities of personnel injured	Barring Preparing face Checking, inspecting or examining other than equipment, machinery or vehicle Inspecting or examining hanging, side or footwall	59% 18% 13% 6%
Principal occupations of personnel injured	Driller or drilling crew Team leader Managerial or supervisory (miner upwards) Winch driver Miner's assistant	28% 20% 9% 8% 7%
Experience in occupation of personnel injured	Tends to affect personnel with greater than 2 years experience more frequently than on average	
Variation by mining region	No major departures from overall pattern	
Principal types of place for accident occurrence	Stope face Haulage, return airway or travelling way Crosscut Reef drive Development end	60% 9% 9% 4% 4%
Principal agencies	Fall of ground Rockburst or strainburst Heat sickness Falling or slipping and falling Falling rock or material Explosives	58% 24% 3% 2% 2% 2%
Principal assigned causes	Inadequate examination, inspection or test Lack of suitable systems or facilities Lack of caution or alertness Failure to comply with recognized good practice, standards or procedure	38% 23% 16% 9%
Number of contraventions	Probable contraventions	9%
Principal types of injury	Multiple Fracture Crushing	52% 22% 8%
Principal body parts injured	Multiple Unspecified Head Trunk	34% 24% 19% 11%

Comments

It is interpreted that the majority of accidents in this category, being rock related accidents during barring operations, are caused directly by the way in which the barring is carried out. In most cases, according to the case study results, this is interpreted as being a result of failure to recognize hazardous hangingwall conditions appropriately prior to deciding where to stand and where to bar.

Table 19 Key characteristics of accident grouping - Activities occurring to personnel engaged in supporting excavations

Information derived from statistical analysis of accident data		
Contribution to hazard	7,2% of allocated days lost	
Frequency of incidents	5,7% of number of accidents	
Principal activities of personnel injured	Installing support Removing support Backfilling	87% 8% 3%
Principal occupations of personnel injured	Labourer Lasher Driller or drilling crew Support installation manpower Team leader Winch driver	29% 17% 13% 12% 11% 9%
Experience in occupation of personnel injured	No major departures from overall pattern	
Variation by mining region	More common than average in Far West Rand, but less common in Orange Free State	
Principal types of place for accident occurrence	Stope face Strike gully Stope back area, reclamation area or stope entrance	74% 6% 6%
Principal agencies	Fall of ground Rockburst or strainburst Inundation or drowning Falling rock or material Falling or slipping and falling	52% 35% 3% 3% 3%
Principal assigned causes	Lack of suitable systems or facilities Inadequate examination, inspection or test Failure to comply with recognized good practice, standards or procedure	41% 35% 9%
Number of contraventions	Probable contraventions	7%
Principal types of injury	Multiple Fracture	64% 21%
Principal body parts injured	Multiple Unspecified Head Trunk	42% 19% 15% 13%
Comments		
The lower percentage of rockburst and strainburst accidents than for personnel engaged in drilling or cleaning is interpreted to be a result of the distance from the stope face at which support installation tends to take place.		

Table 20 Key characteristics of accident grouping - Accidents occurring to personnel engaged in riding or driving vehicles

Information derived from statistical analysis of accident data		
Contribution to hazard	5,3% of allocated days lost	
Frequency of incidents	3,0% of number of accidents	
Principal activities of personnel injured	Driving or operating trackbound vehicle Riding trackbound vehicle Driving or operating trackless vehicle Riding vehicles other than tracked or tyred	38% 26% 19% 14%
Principal occupations of personnel injured	Locomotive driver or guard Surface personnel, service department staff and other miscellaneous Team leader Engineering staff Boesman operator	42% 13% 10% 10% 6%
Experience in occupation of personnel injured	No major departures from overall pattern	
Variation by mining region	More common than average in Central Rand and Bushveld Igneous Complex	
Principal types of place for accident occurrence	Haulage, return airway or travelling way Shaft Crosscut Surface	35% 21% 14% 12%
Principal agencies	Trackbound vehicles Travelling in shaft Transporter Mechanical loader Fall of ground Rockburst or strainburst Motor vehicles Explosives Falling or slipping and falling	63% 8% 6% 5% 5% 5% 3% 3% 3%
Principal assigned causes	Failure to comply with recognized good practice, standards or procedure Failure to comply with instructions Lack of caution or alertness Lack of suitable systems or facilities Inadequate examination, inspection or test Use of unsuitable or defective equipment, machinery or facilities	42% 20% 14% 6% 5% 5%
Number of contraventions	Probable contraventions	39%
Principal types of injury	Multiple Fracture Amputation Crushing	49% 20% 14% 14%
Principal body parts injured	Multiple Unspecified Head Trunk Leg Hand	28% 18% 18% 16% 9% 6%

Comments

A high incidence of contraventions is noted in this category, although it is not known on whose part the contravention occurred.
Although they are subsidiary contributors, driving trackless vehicles and riding incline shaft conveyances incur significant levels of hazard.

Table 21 Key characteristics of accident grouping - Accidents occurring at the stope face

Information derived from statistical analysis of accident data		
Contribution to hazard	35,1% of allocated days lost	
Frequency of incidents	26,8% of number of accidents	
Principal activities of personnel injured	Drilling and blasting cycle (drilling, charging up)	19%
	Cleaning (lashing, cleaning footwall)	18%
	Non-productive or supervisory activities (walking, sitting, supervising, standing)	16%
	Support cycle (installing support)	14%
	Working place preparation (barring, preparing face)	13%
Principal agencies	Fall of ground	46%
	Rockburst or strainburst	37%
	Scraper winch	4%
Principal assigned causes	Lack of or unsuitable system or facilities (majority of lost days due to this cause resulting from agency rockburst or strainburst)	35%
	Inadequate examination, inspection or test (majority of lost days due to this cause resulting from agency fall of ground)	34%
	Failure to comply with recognized good practice, standards or procedure	11%
Comments		
The percentage of hazard occurring to personnel not directly engaged in physical mining activities is relatively low.		

Table 22 Key characteristics of accident grouping - Accidents occurring in haulages, return airways and travelling ways

Information derived from statistical analysis of accident data		
Contribution to hazard	12,1% of allocated days lost	
Frequency of incidents	15,2% of number of accidents	
Principal activities of personnel injured	Non-productive or supervisory activities (Walking, standing)	30%
	Activities associated with transportation (Connecting or uncoupling vehicles, transporting, tramming)	17%
	Riding or driving trackbound vehicles	16%
	Miscellaneous activities	11%
Principal agencies	Trackbound vehicles	39%
	Fall of ground	13%
	Manual handling or hand trammed	7%
	Falling rock or material	5%
	Rockburst or strainburst	5%
	Fires	4%
	Explosives	4%
Principal assigned causes	Failure to comply with recognized good practice, standards or procedure	31%
	Lack of caution or alertness	14%
	Failure to comply with instructions	12%
	Inadequate examination, inspection or test	11%
	Lack of or unsuitable systems or facilities	7%
	Failure to use safety or protective devices or equipment	5%
Comments		
Although referred to frequently in the case studies as a significant factor in the occurrence of trackbound vehicle accidents while walking or standing, lack of clearance is not assigned as a cause of accidents in this category.		

Table 23 Key characteristics of accident grouping - Accident occurring in shafts

Information derived from statistical analysis of accident data		
Contribution to hazard	11,5% of allocated days lost	
Frequency of incidents	12,2% of number of accidents	
Principal activities of personnel injured	Non-productive or supervisory activities (standing, walking, sitting)	27%
	Activities associated with transportation (pushing, pulling, riding on vehicles other than track or tyre)	21%
	Miscellaneous activities	15%
	Equipping, installing or maintaining (repairing, servicing or maintaining)	10%
Principal agencies	Falling or slipping and falling	21%
	Struck by shaft equipment	11%
	Falling rock or material	9%
	Travelling in shaft	9%
	Trackbound vehicle	7%
	Manual handling or hand trammed	7%
	Fall of ground	7%
	Explosives	6%
	Conveyance malfunction	5%
	Inundation or drowning	5%
Principal assigned causes	Failure to comply with recognized good practice, standards or procedure	27%
	Failure to comply with instructions	20%
	Lack of caution or alertness	15%
	Inadequate examination, inspection or test	10%
	Use of unsuitable or defective equipment or facilities	7%
	Failure to use safety or protective devices or equipment	5%
Information derived from accident case studies		
Relatively small percentages of the hazard in shafts arise from personnel working in the shaft itself or from travelling in the shaft. Hand tramming operations and waiting are the dominant hazardous activity types.		

Table 24 Key characteristics of accident grouping - Accidents occurring in strike gullies, centre gullies and tips

Information derived from statistical analysis of accident data		
Contribution to hazard	10,7% of allocated days lost (strike gully 57%; centre gully and tip 43%)	
Frequency of incidents	11,7% of number of accidents	
Principal activities of personnel injured	Non-productive or supervisory activities (sitting, standing, walking)	34%
	Equipping, installing or maintaining (rigging)	17%
	Miscellaneous activities (breaking ore)	12%
	Activities associated with transportation (transporting)	9%
	Cleaning (scraping, clearing obstructions)	9%
Principal agencies	Fall of ground	34%
	Scraper winch	18%
	Rockburst or strainburst (generally in strike gully)	16%
	Monorope or monorail (more frequent in centre gully)	6%
	Falling rock or material	6%
	Falling or slipping and falling (generally in centre gully)	6%
	Manual handling or hand trammed (generally in centre gully)	4%
Principal assigned causes	Inadequate examination, inspection or test	27%
	Failure to comply with recognized good practice, standards or procedure	22%
	Lack of or unsuitable systems or facilities	13%
	Lack of caution or alertness	8%
	Failure to comply with instructions	8%
Comments		
Gullies are often congested being used for men, rock and material transport. Communication systems are frequently ineffective.		

Table 25 Key characteristics of accident grouping - Accidents occurring in crosscuts

Information derived from statistical analysis of accident data		
Contribution to hazard	8,2% of allocated days lost	
Frequency of incidents	12,0% of number of accidents	
Principal activities of personnel injured	Activities associated with transportation	21%
	Non-productive or supervisory activities	21%
	Miscellaneous activities	11%
	Drilling and blasting cycle	10%
	Riding or driving trackbound vehicles	9%
	Working place preparation (barring)	9%
	Cleaning (lashing)	9%
	Equipping, installing or maintaining	8%
Principal agencies	Fall of ground	25%
	Trackbound vehicle	21%
	Inundation or drowning	11%
	Manual handling or hand trammed	8%
	Rockburst or strainburst	7%
	Falling rock or material	5%
Principal assigned causes	Failure to comply with recognized good practice, standards or procedure	25%
	Inadequate examination, inspection or test	22%
	Lack of caution or alertness	15%
	Failure to comply with instructions	8%
	Lack of or unsuitable system or facilities	7%
Comments		
The storage of materials in a limited space coupled with variety or operations carried out and the tendency for mineworkers to wait in crosscuts are significant factors.		

Table 26 Key characteristics of accident grouping - Hand injuries

Information derived from statistical analysis of accident data		
Contribution to hazard	10,1% of allocated days lost (Finger 43%; Multiple fingers 42%; Thumb 11%; Hand 3%)	
Frequency of incidents	31,0% of number of accidents (Finger 63%; Multiple fingers 16%; Thumb 12%; Hand 8%)	
Principal agencies	Manual handling or hand trammed Monorope or monorail Trackbound vehicle Fall of ground Falling rock or material Scraper winch Machinery Falling or slipping and falling	20% 19% 10% 9% 9% 8% 6% 3%
Principal activities of personnel injured	Activities associated with transportation (Transporting, loading/offloading, pushing) Non-productive or supervisory activities (Walking, standing) Miscellaneous activities (Removing other than support, equipment or machinery, opening/closing doors etc) Equipping, installing and maintaining (Cutting with tool, installing equipment or machinery)	32% 17% 15% 15%
Principal occupations of personnel injured	Labourer Driller/drilling crew Winch driver Loco driver or guard Team leader	21% 13% 12% 12% 10%
Principal types of place for accident occurrence	Stope face Haulage, return airway or travelling way Crosscut Shaft	20% 17% 13% 12%
Principal assigned causes	Failure to comply with recognized good practice, standards or procedure Lack of caution or alertness (32% of days lost due to this cause in manual handling or hand trammed category) Lack of fencing or guarding (77% of days lost due to this cause in monorope or monorail category) Inadequate examination, inspection or test (78% of days lost due to this cause in fall of ground category) Failure to use safety or protective devices or equipment (32% of days lost due to this cause in manual handling or hand trammed category)	30% 24% 10% 9% 7%
Principal types of injury	Amputation Fracture Laceration	78% 13% 5%
Comments		
Finger injuries are a particularly common part of this grouping with amputations accounting for a dominant portion of the hazard. However, lack of fencing or guarding and non-use of protective devices are referred to as factors in respect of less than 20% of the hazard in this grouping.		

Table 27 Key characteristics of accident grouping - Head injuries

Information derived from statistical analysis of accident data		
Contribution to hazard	9,5% of allocated days lost	
Frequency of incidents	2,0% of number of accidents	
Principal agencies	Fall of ground	38%
	Rockburst or strainburst	12%
	Falling or slipping and falling	9%
	Trackbound vehicle	8%
	Falling rock or material	7%
	Scraper winch	4%
Principal activities of personnel injured	Non-productive or supervisory activities (Walking, standing, sitting)	28%
	Activities associated with transportation (Pulling, loading/offloading, connecting or uncoupling vehicles)	12%
	Equipping, installing or maintaining	11%
	Drilling and blasting cycle	8%
	Working place preparation (Barring, checking, inspecting, examining)	8%
	Cleaning (Lashing)	8%
Principal occupations of personnel injured	Driller or drilling crew	25%
	Winch driver	16%
	Labourer	12%
	Team leader	9%
Principal types of place for accident occurrence	Stope face	25%
	Shaft	16%
	Haulage, return airway or travelling way	12%
	Crosscut	9%
Principal assigned causes	Inadequate examination, inspection or test (86% of days lost due to this cause in fall of ground category)	26%
	Failure to comply with recognized good practice, standards or procedure (22% of days lost due to this cause in trackbound vehicles category)	20%
	Lack of suitable systems or facilities (71% of days lost due to this cause in trackbound vehicles category)	13%
	Failure to comply with instructions	12%
	Lack of caution or alertness	8%
Principal types of injury	Fracture	60%
	Multiple	20%
	Crushing	17%

Comments

Accidents in this grouping tend to be extremely severe. Non-use or failure of personal protective equipment is not considered to be a contributory factor in head injuries.

Table 28 Key characteristics of accident grouping - Foot injuries

Information derived from statistical analysis of accident data		
Contribution to hazard	2,7% of allocated days lost (Ankle 36%; Foot 43%; Toes 20%)	
Frequency of incidents	17,3% of number of accidents (Ankle 30%; Foot 49%; Toes 22%)	
Principal agencies	Fall of ground Falling rock or material Trackbound vehicle Manual handling or hand trammed Slipping and falling Scraper winch	30% 16% 13% 13% 6% 6%
Principal activities of personnel injured	Non-productive or supervisory activities (Walking, standing, sitting) Activities associated with transportation (Loading/offloading, transporting) Drilling and blasting cycle Working place preparation (Barring)	27% 17% 10% 9%
Principal occupations of personnel injured	Driller or drilling crew Labourer Winch driver Team leader	22% 17% 12% 9%
Principal types of place for accident occurrence	Stope face (52% of days lost in this type of place due to falls of ground) Haulage, return airway, travelling way (38% of days lost in this type of place due to trackbound vehicles) Crosscut (29% of days lost in this type of place due to trackbound vehicles) Shaft (31% of days lost in this type of place due to manual handling or hand tramming)	23% 16% 14% 11%
Principal assigned causes	Failure to comply with recognized good practice, standards or procedure Inadequate examination, inspection or test (90% of days lost due to this cause in case of fall of ground category) Lack of caution or alertness	29% 26% 20%
Principal types of injury	Fracture Amputation Laceration Contusion (bruise) Multiple	47% 39% 6% 3% 3%
Comments		
Although foot injuries tend to be relatively minor, footwear is not referred to as a significant contributory factor in this accident grouping. The high incidence of ankle and foot injuries as opposed to toe injuries would need to be carefully considered in assessing those injuries which could be avoided through alternative footwear.		

Table 29 Key characteristics of accident grouping - Eye injuries

Information derived from statistical analysis of accident data		
Contribution to hazard	1,1% of allocated days lost	
Frequency of incidents	2,4% of number of accidents	
Principal agencies	Splinters	51%
	Miscellaneous	13%
	Falling rock or materials	7%
	Scraper winch	6%
	Manual handling or hand trammed	5%
	Fall of ground	5%
Principal activities of personnel injured	Miscellaneous activities (Breaking ore, grouting, removing other than support, equipment or machinery)	20%
	Equipping, installing and maintaining (Cutting with tool, hammering, installing equipment, operating equipment)	19%
	Non-productive or supervisory activities (standing, walking, sitting, supervising)	16%
	Drilling and blasting (Drilling, collaring hole)	15%
	Cleaning (Cleaning footwall, lashing)	11%
	Activities associated with transportation (Transporting, loading/offloading, raising or lowering)	9%
Principal occupations of personnel injured	Driller or drilling crew	21%
	Labourer	17%
	Winch driver	17%
	Team leader	10%
Principal types of place for accident occurrence	Stope face	28%
	Centre gully or tip	13%
	Haulage, return airway or travelling way	12%
	Strike gully	10%
	Shaft	9%
	Crosscut	9%
Principal assigned causes	Failure to use safety or protective devices or equipment (87% of days lost due to this cause in splinters category)	32%
	Lack of caution or alertness	22%
	Failure to comply with recognized good practice, standards or procedure	21%
	Inadequate examination, inspection or test (53% of days lost due to this cause in fall of ground category)	7%
	Use of unsuitable or defective equipment (35% of days lost due to this cause in scraper winch category)	6%
Principal types of injury	Other	39%
	Fracture	20%
	Laceration	20%
	Multiple	20%

Comments

The most frequent cause assigned to eye injuries is failure to use protective equipment. This is interpreted as being at least partly a result of the unergonomic nature of eye protectors which become scratched and reduce vision, thereby leading to resistance to the use of eye protectors. It is apparent that eye injuries are considerably more prevalent within certain well defined activity groupings.

APPENDIX 1 STATISTICAL ANALYSIS OF ACCIDENT DATA FROM THE SOUTH AFRICAN GOLD AND PLATINUM MINING INDUSTRIES - 1988 TO 1992

DATA SOURCES

A database has been established from the records stored on the Government Mining Engineer's data recording system, SAMRASS. The data items available for each accident reported, and for each individual killed or injured in the accident, are summarized in Table 1 below. This information has been used as the basis for the statistical analysis of accident causes as reported below.

Table 1 Data items obtained from the SAMRASS system

DATA ITEMS OBTAINED FROM SAMRASS SYSTEM
Data stored per accident
Accident number (Year/region/sequence number/type)
Accident date
Date reported
Day of week
Time of day
Commodity (gold or platinum)
Technical manager
Mine
Number of fatalities
Number of injuries
Accident classification
Class of place
Assessed cause (eg failure to comply with instructions, lack of systems/facilities, inadequate examination)
Type of inquiry/inspector/contravention/regulation
Data stored per worker killed or injured
Identification (ID number/PF number/company number)
Personal details (Age/race/home/sex)
Occupation
Experience in occupation
Activity at time of accident
Type of injury/body part injured
Allocated days lost
Date of death

MEASURE OF HAZARD

The question of what variable to use as the most appropriate index of hazard is one which needs to be clarified at the outset.

Total hazard in any particular circumstance may be decomposed into three factors which, when multiplied together, give total hazard. These are:

- number of personnel exposed to the circumstance,
- duration of exposure per individual exposed and
- risk level inherent in the circumstance.

Intuitively, those circumstances which exhibit high risk levels are perceived as most dangerous, and by implication the perception can easily be developed that they warrant most attention. However, it should be apparent that the maximum impact on safety can be achieved by addressing those areas where the product of the three hazard components is greatest provided that the effort required to obtain a solution is equivalent.

In the data available from SAMRASS, three measures are available which may be considered to be most suitable for measuring hazard. These are number of fatalities, number of reportable injuries and number of allocated days lost. Unfortunately, directly from SAMRASS, there is no way to decompose the total hazard as measured by any of these three indicators into the three components referred to above. However, in terms of identifying accident causes, this is not considered to be a major obstacle although potential solutions may address any or all of the three risk constituents to reduce overall hazard.

In this report, primary attention has been focused on allocated days lost as the best available measure of hazard for the following reasoning. Although there may be considerable justifiable argument to question the basis for allocating a particular number of days to a particular type of injury, the number of days allocated tends to provide a reliable indication of the severity of the injury. Table 2 below (still to be included), shows the number of days allocated to each type of injury sorted by number of allocated days in support of this statement. It is therefore argued that, as a relative measure of hazard, the number of allocated days is the best available measure to use in analysing hazard.

Nevertheless, where practical, in the statistical analysis of the data, the number of fatalities and reportable injuries has also been tabulated.

STATISTICAL ANALYSIS OF ACCIDENT DATA

Summary data analyses

Table 3 provides a summary of the variation in number of accidents over the period considered in this report (1988 to 1992). It is apparent that the number of incidents, fatalities, reportable injuries and allocated days have all declined over time in gold mining. This is interpreted as being largely a result of contraction in the size of the industry, and not necessarily indicative of a reduction in the level of risk incurred per employee. Indeed, while the long term trend for injury and fatality rates per thousand employees per annum is downward, over the time period considered there is no evidence indicating a departure from this trend. However, the magnitude of the reduction in risk over a five year period is extremely small, and represents a subsidiary factor in terms of the reduction in accident hazard.

Table 4 shows the distribution of accidents by mining region. Defined surface installations such as slimes dam reclamation or engineering operations have been treated as a separate region. This table predominantly reflects the total level of mining activity in the different mining regions. However, it is noteworthy that the Far West Rand, Central Rand, Bushveld Igneous Complex and Eastern Transvaal regions incur a greater proportion of accidents resulting in fatalities than average. In these three regions, 6,8% of incidents result in fatalities, in contrast to an average figure of 5,7%. In the case of the Far West Rand, this is indoubtedly due to the high incidence of rockbursts which frequently result in fatalities.

In Table 5, an analysis of the types of inquiry is presented. It is readily apparent that inquiries tend to be held more frequently in severe accidents. Inquiries were only held in 51% of all accidents, with only 6% resulting in written reports. When considered in terms of allocated days lost, 87% of allocated days were accounted for by inquiries and in the case of 68% of allocated days a written report was produced. It is considered that this analysis should engender confidence in the source data, and hence in the conclusions reached in this analysis.

Tables 6 and 7 provide the distributions of accidents by the day of the week and the time of day. The patterns of accident identified in both these tables are closely related to the number of mineworkers underground. It is possibly noteworthy that the proportion of accidents resulting in fatalities is somewhat greater on a Sunday than on other days of the week, whereas the proportion of accidents resulting in fatalities is lowest on Saturdays.

A second observation arising from these tables is that a sharp peak in the number of reportable injuries, although not in number of fatalities, occurs between 10 and 12 in the morning. While this corresponds to the time when the greatest number of personnel are underground, it could be

proposed that the increase in number of injuries is greater than proportional to the number of personnel exposed. An implication could be that the level of risk to relatively minor injuries increases during the working shift, possibly as a result of fatigue. Alternatively, it could be a result of changes in the activities being undertaken by mineworkers during this time period.

Analysis of accidents by classification

Table 8 provides the distribution of accidents by classification sorted in descending order by total hazard as measured by allocated days lost. In most cases, the classifications presented represent combinations from the classes used in SAMRASS selected to provide maximum insight into accident causes.

Rock related accidents predominate with 47% of all allocated days lost. Of these days lost, 29% arise from falls of ground with 18% resulting from rockbursts and strainbursts. Of the remaining accidents, locomotives and locomotive drawn vehicles, falling, falling materials, winches, manual handling, explosives, inundation/drowning and monoropes/monorails are the most serious classifications.

Tables 9a and b shows how the distribution of accident classifications has been changing over the period considered. Table 9a provides the number of allocated days for each year in each classification, whereas Table 9b provides, for each year, the percentage of allocated days falling into each classification. There appears to have been a tendency for the proportion of allocated days arising from rockbursts to increase over the five year period, although there are no clear trends. This probably results from an increased percentage of total mining being conducted in the Far West Rand region.

The distribution of allocated days in each mining region by accident classification is presented in Tables 10a, b and c. Table 10a gives the total number of allocated days for each classification in each region, Table 10b provides the distribution of accident classifications for each region separately and Table 10c provides the percentage of allocated days occurring in each region for each accident classification separately.

For example, from Table 10b, 33,3% of the allocated days occurring in the Far West Rand region result from rockbursts. This compares with an average percentage across all regions for rockburst accident of 14,8%.

Table 10c shows that 77,1% of all allocated days lost due to rockbursts occur in the Far West Rand. This contrasts with an average percentage of all allocated days for the Far West Rand of 34,3%.

By comparing percentages for each region with the overall distribution quoted in Table 10b, or by comparing percentages for each classification with the overall distribution in Figure 10c, anomalously high incidences of specific combinations of accident classification and region can be identified.

As expected, it is evident from the data that accidents resulting from rockbursts are a phenomenon predominantly occurring in the Far West Rand. Strainbursts are much more uniformly distributed across the mining regions. By contrast, falls of ground account for a substantially greater proportion of allocated days than average in the platinum mines of the Bushveld Igneous Complex and in the Evander, Klerksdorp and Orange Free State regions.

Unexpectedly high accident classifications in the platinum mines of the Bushveld Igneous Complex are accident types concerned with shafts including struck by shaft equipment, conveyance malfunctions and travelling in shaft. This could be a result of the number of incline shafts in use in the platinum mines.

In the Orange Free State and Evander regions, falling rock and materials account for a anomalously large proportion of allocated days lost.

Apart from these observations, the majority of accident classifications exhibit a relatively uniform pattern across the different mining regions.

Analysis of accidents by place

Table 11 provides the occurrence of accidents in different types of place. The stope face, transport routes, shafts and crosscuts rank as the four types of place incurring greatest hazard.

Analogous to Tables 10a, b and c, Tables 12a, b and c provide an analysis of how different classifications of accident occur in different types of place. As would be expected, an anomalously high proportion of allocated days due to rock related accidents occur in the stope face area. Compared with the average statistic of 29,4% for rockbursts and 14,8% for falls of ground, 45,8% and 32,6% of stope face allocated days arise in these classifications (ref. Table 12b).

In haulages, return airways, travelling ways, crosscuts and on surface transport routes, the hazard arising from locomotives and locomotive drawn vehicles is considerably higher than the overall distribution. In strike gullies and centre gullies accidents due to scraper winches account for a significantly greater proportion of allocated days than average.

While shafts experience a greater quantity of allocated days than average due to falling rock and materials, the spread of this type of accident over the various parts of the mine is perhaps surprising.

In addition, in shafts, falling in shafts, travelling in shaft and struck by shaft equipment are classifications which give rise to significant levels of hazard. Falling is also a classification which is a dominant contributor to hazard in boxholes and orepasses.

Inundation or drowning is also a classification which is particularly prevalent in crosscuts, boxholes, orepasses and shafts.

Although several other anomalously high percentages are noted in Tables 12b and c, none of these account for a large quantity of allocated days (ref. Table 12a).

Analysis of accidents by assigned causes

Table 13 shows the distribution of causes as assigned by the Regional Mining Engineer. In cases where there was an inquiry, the finding of the Regional Mining Engineer is based on the proceedings of the inquiry, whereas where no inquiry took place, the assigned cause would be based on the MD16A form covering the accident report. As noted above under Table 5, inquiries tend to take place more frequently for more serious accidents and 87% of allocated days lost are subject to an inquiry. By contrast, less than half of the reportable injuries are subject to an inquiry.

It is apparent from Table 13 that five causes predominate, between them accounting for 81% of allocated days. These are:

- inadequate examination/inspection/test,
- failure to comply with recognized good practice/standards/procedure,
- lack of (or unsuitable) system(s)/facilities,
- failure to comply with instructions and
- lack of caution/alertness.

It is noteworthy that the causes, lack of systems or facilities and failure to comply with instructions, are generally assigned to more serious accidents, with both of them accounting for a disproportionate number of fatalities. By contrast, lack of caution or alertness is invoked in a large number of less serious cases with this cause accounting for some 20% of incidents but only 6% of fatalities.

Consideration of the other twelve causes which may be used by the Regional Mining Engineer is also instructive in terms of assessing issues which are not regarded as problem areas in gold and platinum mining. In particular, a number of these causes address the issues of safety devices and defective equipment, lack of training, inadequate standards or lack of illumination.

In assessing these assigned causes, of the five most commonly assigned ones, it is apparent that

four of them, with the exception of lack of or unsuitable systems or facilities, would generally represent human failures in one sense or another. Inadequate examination, inspection or test would in most cases represent a human failure resulting only indirectly in an accident, in many cases to another mineworker than the one responsible for the examination; however, this cause could also be assigned in cases where the technology available to conduct examination is inadequate. Failure to comply with good practice, failure to comply with instructions and lack of caution or alertness would normally represent human failures resulting immediately in an accident; however, in these cases, there may well have been inherently unsafe factors in the mining circumstance as a result of which these failures caused an accident, for example lack of guarding. As noted by Simpson (reference), among others, accidents tend not to result from a single assigned cause, but rather through the unfortuitous combination of a number of events; accordingly the selection of a single cause to be assigned to an accident may result in a bias to identification of the factor immediately preceding the accident. Nevertheless, it may be stated that, as concluded by a number of other authors (Peake (reference), Simpson (reference), Raath (reference), Wagner (reference), Lawrence (reference), Fewell (reference)), about 80% of the hazard incurred on gold and platinum mines arises from human causes.

In order to assess any variations over time in the assignation of cause to accidents, the distribution of allocated days per year is shown in Table 14a as the number of days and in Table 14b on a percentage basis. It is evident that failure to comply with recognized good practice and lack of or unsuitable systems are becoming more commonly assigned causes. Failure to comply with instructions and inadequate examination, inspection or test have tended to become less commonly assigned.

Tables 15a, b and c provide cross tabulations of allocated days lost by accident classification and assigned cause. Analogous to the description for Tables 10a, b and c above, Table 15b shows the percentage distribution of accident classifications for each causes separately, while Table 15c shows the percentage distribution of assigned causes for each classification separately. In Table 15, the causes have been referred to by number according to the coding scheme in Table 2 below.

It is striking that 65,8% of allocated days (Table 15c) due to falls of ground are attributed to the cause inadequate examination, inspection or test. As evidenced from Table 15b, this cause is seldom used outside the falls of ground category. Equally striking in Table 15c is the statistic that 82,5% of rockbursts and 57,7% of strainbursts are assigned to the cause, lack of or inadequate systems or facilities. Again, apart from these two classifications, this cause is seldom used as shown in Table 15b.

The causes assigned to the remaining accident classifications are most commonly failure to comply with recognized good practice, failure to comply with instructions and lack of caution or alertness. It

is noteworthy that these causes generally represent human failures immediately resulting in an accident; unfortunately, the data does not permit an assessment of those factors through which such a failure resulted in an accident; this is one of the important objectives of the accident case studies reported in Appendix 2.

Table 2 Coding scheme for assigned causes

Code	Cause
01	Failure to comply with instructions
02	Failure to comply with recognized good practice, standards or procedure
03	Failure to use safety or protective devices, equipment of systems
04	Failure to supply safety or protective devices, equipment of systems
05	Failure to supply proper tools or equipment
06	Lack of, or unsuitable, systems or facilities
07	Lack of, or inadequate, standards or procedures
08	Lack of caution or alertness
09	Lack of clearance (obstruction)
10	Lack of illumination or visibility
11	Lack of adequate or suitable training or instruction
12	Inadequate supervision or discipline
13	Inadequate examination, inspection or test
14	Inadequate, or lack of, fencing or guarding
15	Inadequate preventive maintenance
16	Use of unsuitable or defective equipment, materials or facilities
17	Rendering safety device ineffective

Of the causes not included in the top five, the following observations are noteworthy:

- 38,1% of allocated days lost due to monorope and monorail accidents, 10,1% of days lost due to falling in excavations and 5,9% of days lost due to falling rock or materials result from inadequate fencing or guarding;
- failure to use protective equipment gives rise to 11,4% of the allocated days lost due to falling in excavations, 15,8% of the days lost due to falling from structures, 9,7% of the days lost due to falling in shafts, 32,2% of the days lost due to conveyance malfunction and 48,6% of the days lost due to splinters;
- 16,2% of allocated days lost due to falling in shafts result from inadequate preventive maintenance;
- failure to supply protective equipment accounts for 14,0% of allocated days lost due to strainbursts and 13,4% of days lost due to dust, gas or fumes;
- 8,6% of allocated days lost due to locomotive drawn vehicles are assigned to lack of clearance;

- use of unsuitable or defective equipment accounts for 7,3% of days lost due to falling rocks or materials, 7,6% of days lost due tc scraper winches and 11,2% of days lost due to inundation or drowning.

Table 16a provides a summary of Tables 15 a, b and c with the classifications of accident being grouped by common features, and only the more commonly assigned causes being reported. This permits a more detailed examination of the more commonly assigned causes.

As noted above, the predominance of inadequate examination, inspection or testing in the case of falls of ground, and of lack of systems or facilities in the case of rockbursts and strainbursts is evident.

As noted above, allocated days lost due to falling and falling materials tend to be assigned more frequently to some of the less commonly used causes. In the cases of trackbound vehicles (locomotives and loco drawn vehicles), scraper winches, inundation or drowning and falling materials, failure to comply with good practice or standards is the most commonly assigned cause. For explosives accidents, failure to comply with instructions is most commonly assigned. In the case of manual handling, lack of caution or alertness is most frequently used.

Tables 16b to l provide the classification cause matrix for each region, as defined in Table 4, separately. In addition to the analysis of Tables 10a, b and c where the distribution of classifications in the different regions was examined, the following points are of relevance where discrepancies from the overall pattern are noted.

Bushveld Igneous Complex

Allocated days resulting from falling materials accidents are attributed more frequently to the cause, inadequate examination, inspection or test than on average. In addition, allocated days arising from the explosives category are often attributed to failure to comply with recognized good practice, standards or procedures.

Central Rand

Apart from the observation that allocated days arising from explosives accidents are assigned more frequently to other causes than on average, the distribution of causes in each classification is quite similar to the overall pattern.

Eastern Transvaal

Allocated days arising from fall of ground accidents are shared almost equally between the causes inadequate examination, inspection or test and failure to comply with good practice or standards. In addition, the hazard arising from trackbound vehicles is also more frequently assigned to the cause

failure to comply with good practice or standards than on average. Although there are many other substantial differences between the pattern for the Eastern Transvaal and the overall pattern, these are in accident classifications where there are too few incidents for the differences to be meaningful.

Evander

Falling incidents tend to be assigned more frequently to the causes failure to comply with good practice, standards or procedures and failure to comply with instructions than for the overall data. Allocated days lost due to falling materials and scraper winches tend to be assigned to other causes more frequently than on average. Accidents due to explosives are more frequently assigned to the cause failure, to comply with good practice, standards or procedures.

Far West Rand

Apart from a few minor deviations, the distribution of assigned causes for each classification is substantially similar.

Klerksdorp

Rockbursts and strainbursts tend to be assigned more frequently in this region to other causes than is the overall case. Allocated days arising from accidents concerned with explosives, which are particularly common in this region, are attributed to failure to comply with instructions more frequently than on average.

Orange Free State

In the rockburst and strainburst accident classification, a larger proportion than average of accidents are attributed to inadequate examination, inspection or test and failure to comply with good practice, standards or procedures than on average. The cause failure to comply with good practice, standards or procedures is invoked more frequently for manual handling accidents than on average for this region.

Surface installations

Accidents in the category trackbound vehicles tend to be attributed to the cause failure to comply with instructions and other causes, instead of to the cause failure to comply with good practice, standards or procedures. Allocated days due to falling, which are the most common for surface installations, due to falling materials and due to manual handling are more frequently assigned to other causes than overall.

Tables 17a, b and c provide the distribution of allocated days by type of place and assigned cause. As discussed previously, the percentage of allocated days arising in each type of place for each assigned cause separately is shown in Table 17b, and the distribution of assigned causes for each type of place separately is shown in Table 17c.

It should be considered that the analysis of Tables 12a, b and c presented earlier demonstrated the non-uniform incidence of different accident classifications in different types of place. Considering also that different classifications of accident exhibit different patterns of assigned cause as presented in Tables 16a, b and c, it is not surprising that different causes tend to be assigned in the various types of place. The following points arising from consideration of Table 17c are considered to be of particular relevance.

As would be expected from the location of the majority of rock related accidents, the causes inadequate examination, inspection or test and lack of, or unsuitable, systems or facilities tend to dominate in types of place in the stoping horizon and in development ends. However, in gullies, raises and winzes, probably as a result of the incidence of scraper accidents, failure to comply with good practice, standards or procedures becomes a more important assigned cause. The same cause is also frequently assigned to accidents occurring in crosscuts, probably due to the trackbound vehicle accidents occurring in this type of location. In other types of location, this cause is also frequently used.

In boxholes, orepasses, shafts, raises, winzes and surface sites failure to comply with instructions is more commonly assigned than average. Lack of caution or alertness is a particularly prevalent cause in surface locations and engineering sites, although these types of location account for few allocated days lost.

From Table 17b, it is apparent that despite the above noted variations in the pattern of cause assignation, for all causes the first four types of place tabulated (stope face, haulage route, shaft and crosscut) are generally the largest contributors to hazard.

Analysis of accidents by contravention

Table 18 provides a summary of the incidence of contraventions as factors in accidents. It is apparent that in only a small percentage of accidents a contravention is either proven or suspected. However, the incidents where a contravention is suspected or proven (6% of the total number) account for 17% of fatalities, thereby indicating that contraventions are identified more frequently in the case of more serious accidents. It should also be noted that, from Table 5, the level of inquiry, and hence the identification of contraventions, is more rigorous in the case of more severe accidents.

Tables 19a and b show how contraventions are distributed in the different accident classifications. It is apparent that contraventions are particularly prevalent in the following accident classifications; locomotives, falling in excavations, dust, gas or fumes, explosives, falling in shafts and conveyance malfunction.

Tables 20a and b provide the incidence of contraventions by assigned cause. It is apparent that failure to comply with instructions is the assigned cause where contraventions occur most frequently, with failure to use protective devices, inadequate fencing or guarding, inadequate supervision or discipline and rendering safety device ineffective also contributing significantly to the number of contraventions.

Analysis of accidents by experience

Table 21 provides the distribution of accidents by experience of the employees injured or killed in their occupation. In analysing experience data, only 1992 was considered as prior to this year information on experience was not captured. In considering this table, it should also be borne in mind that the employee affected by the accident is not necessarily the employee causing the accident.

It is immediately evident that employees with less than 1 year experience account for the largest number of incidents, fatalities, reportable injuries and allocated days lost. It is noteworthy that the accidents incurred by employees in this experience category are generally less serious as they account for 20% of allocated days and only 18% of fatalities. While to a large extent the level of total hazard experienced by workers in this experience band is due to the large number of mineworkers with less than one year in their occupation, it is probable that inexperience contributes to the hazard level per worker. This is also evidence that experience assists workers in avoiding minor injury, but does less to protect them from fatal or serious injury.

Over the next four years of experience, there is a very gradual reduction in the number of incidents which employees are involved in. Since it is probable that the number of employees with greater experience reduces (an employee with 5 years experience in an occupation had to have had 4 years experience the previous year), it appears likely that the risk level per employee increases when moving from 1 year to 5 years experience.

Beyond 5 years, there is a steady reduction in the level of total hazard experienced per year experience.

Tables 22a, b and c show the distribution of experience bands for the various accident classifications. It is apparent that as workers gain greater experience they incur a smaller percentage of accidents arising from falls of ground, whereas they are at greater risk due to rockbursts. Most other accident classifications follow the average pattern of hazard experienced for each experience band.

The implication of the above observation is that in the case of fall of ground type accidents,

xperience provides mineworkers with some ability to avoid accidents; in the case of most other classifications, experience contributes but is less effective, whereas in rockbursts experience does not contribute an ability to avoid accidents.

Tables 23a, b and c provide an analysis of assigned causes by years experience. It is readily apparent that, in parallel with the above observation that greater experience reduces exposure to fall of ground accidents, the incidence of accidents due to the cause inadequate examination, inspection or test reduces with experience. There is also a reduction with experience in the incidence of the cause failure to comply with good practice, standards or procedure. However, as was the case for rockburst accidents, the incidence of cause lack of, or unsuitable, systems or facilities increases with experience as a percentage of the total hazard.

Table 24 provides a breakdown of accident statistics by age of personnel involved. A broad peak, probably closely related to the number of employees in service, occurs between the ages of 25 and 40.

Analysis of accidents by activity

Table 25 provides the distribution of accidents by the activity being undertaken at the time of the accident. All activities accounting for at least 1% of allocated days have been tabulated, but the great variety of activities included in SAMRASS is evidenced by the fact that 35% of all incidents arise from activities contributing less than 1% of allocated days each. It is noteworthy that among the activities incurring greatest total hazard, there is a mix of mining activities (drilling, installing support, lashing, barring) and other necessary functions not directly associated with mining (walking, standing, sitting, supervising).

In Table 26, the detailed activities have been grouped into logical elements of the mining cycle. As noted above, non-productive and supervisory activities account for the largest single category, with ore and material transportation excluding riding or driving vehicles and the drilling and blasting cycle representing the second and third most important groupings.

An analysis of the type of place where mineworkers are injured while engaged in different activity types is provided in Tables 27a, b and c. Not surprisingly, a dominant amount, 62%, of the hazard occuring to mineworkers engaged in mining cycle activities occurs in the stope face environment. Other types of place on the reef horizon, particularly strike and centre gullies account for subsidiary proportions. In addition, significant percentages of the hazard for these types of activity occurs in haulages, return airways, travelling ways and crosscuts. Perhaps surprisingly low is the proportion of the hazard associated with mining cycle activities in development ends, although it is considered possible that sometimes a developing end may have been classified as haulage or crosscut.

Accdents occuring to personnel engaged in ore and materials transportation tend ot occur with similar importance in the stope face, haulage, return airway or travelling way, shaft and crosscut environments. Surprisingly, relatively few of this type of accidents occur in strike or centre gullies.

The hazard occurring to personnel engaged in riding or driving vehicles predominantly occurs in haulages, return airways, travelling ways, crosscuts and shafts. In the latter case, the major hazard is associated with riding conveyances in incline shafts.

For personnel engaged in non-productive or supervisory activities, the stope face accounts for the largest percentage of hazard, with the distribution of type of place closely following the overall pattern.

Tables 28a, b and c provide the distribution of allocated days by accident classification and activity type. 80% of the hazard from accidents occuring to personnel engaged in activities belonging directly in the mining cycle are rock related (working place preparation 82%; activities associated with supporting excavations 86%; drilling and blasting cycle 79% and cleaning cycle 77%). These activities, however, account for only 61% of the hazard arising from rock related accidents; of the remaining 39%, 44% is accounted for by personnel engaged in non-productive (generally travelling or waiting) or supervisory activities. Other predominant hazards while engaged in mining cycle activities are falling rock or material throughout the mining cycle, explosives during the drilling and blasting cycle and scraper winches during the cleaning cycle.

Locomotives and locomotive drawn vehicles and travelling in shafts (particularly incline shafts) are important accident classifications while engaged in riding or driving vehicles. Similarly, manual handling and locomotive drawn vehicle are major classifications for personnel engaged in activities associated with ore or materials transportation.

The distribution of accident classifications for personnel engaged in non-productive and supervisory activities is similar to the overall pattern.

Turning to the analysis of activities by assigned cause, mirroring the correlation between accident classification and cause as noted in Tables 15a, b and c, it is apparent from Tables 29a, b and c that the two causes frequently assigned to rock related accidents (inadequate examination, inspection or test and lack of, or unsuitable, systems or facilities) tend to be assigned in the case of activities directly associated with mining. Failure to comply with good practice, standards or procedure, inadequate examination, inspection or test and failure to comply with instructions are the main contributory causes in the case of necessary functions not directly associated with mining. It is also noteworthy that for the activities driving or riding trackbound vehicle and for activities associated with ore or materials transportation, failure to comply with good practice, standards or procedure is a

dominant cause.

Tables 30a and b identify the incidence of contraventions for personnel engaged in the different activity types. In the case of mining cycle activities, where the predominant accident classifications are rock related, the percentage of contraventions is low. This agrees with the findings deduced from Tables 15 and 16. It is however noteworthy that in the case of 39% of the hazard resulting from accidents while driving or riding vehicles a contravention is indicated; this compares with an average of 17%.

Although not directly reflecting activity at the time of the accident, information is also available on the occupation of the mineworker injured. Table 31 provides the distribution of occupations of those involved in accidents sorted by descending number of allocated days. The existence of different occupation descriptions for essentially similar jobs somewhat distorts the analysis presented in this table, and those occupations where common terminology is used throughout industry accordingly appear high on the list. In Table 32, the occupations have been organized into logical groupings as best possible. In general the occurence of accidents to the different occupation groupings appears to be in reasonable accordance with the number of personnel employed in each grouping. However, especially in the case of manual labourer level, some mining groups appear to employ personnel in specific job categories, eg pinch bar user, stope timber or lasher, whereas other mining groups adopt a multiskilling approach where personnel employed in the job category mining team or mine labourer would fulfil the responsibilities of barring, lashing or installing support. This aspect detracts from the value of the analysis presented in Table 32.

Tables 33a, b and c show the activity types which the different occupation groupings are involved in at the time they are injured. The distributions confirm that, in the specific elements of the mining and transportation cycles, occupations closely relate to activity types. In addition, all occupation groupings suffer a significant hazard while undertaking non-productive or supervisory activities, with team leader and managerial or supervisory posts having particularly high percentages in this area.

Through this analysis of the occupation groupings, it is concluded that the activity type at the time of the accident is a far more insightful parameter to employ, and that a more detailed study of occupation groupings would not yield any more clarity on the occurence of accidents.

Analysis of accident by nature of injury

Table 34 provides the distribution of body parts injured sorted by descending number of days lost. Multiple body parts, unspecified and head, face and neck account for a large proportion of fatal injuries (84%), while only accounting for 15% of incidents. By contrast, finger and multiple finger injuries are extremely common (23% of all incidents), while only accounting for a total of 9% of

allocated days lost. Lower leg and foot injuries are also relatively common (20% of incidents) while accounting for 4% of allocated days.

Tables 35a, b and c provide the cross tabulation of body part injured by accident classification. From Table 35c, it is apparent that the body part injured as a result of falls of ground is distributed in accordance with the overall distribution. However, in the case of rockbursts and strainbursts and falling, multiple body parts tend to be most frequently damaged.

It is also apparent that, as a result of accidents due to trackbound vehicles, a greater than expected proportion of the hazard is due to leg and foot injuries. The classifications manual handling and monorope or monorail give rise to a large proportion of finger, thumb and hand injuries, with the former category also contributing a significant number of toe and foot injuries.

While the major hazard arising from the falling materials classification is from multiple or head injuries, this classification also accounts for a large percentage of injuries to extremities.

Turning now to an analysis of types of injury, Table 36 provides the distribution. Not surprisingly, multiple injuries account for 45% of all allocated days and 58% of fatalities. While individually less serious, fractures, amputations, crushing and laceration account for many incidents and between them contribute a further 43% of hazard as measured by allocated days.

Tables 37a, b and c provide the distribution of types of injury by accident classification. Fall of ground accidents exhibit the overall distribution of types of injury with the exception of amputations which occur infrequently. By contrast, rockbursts and strainbursts, falling and explosives tend to result most commonly in multiple injuries. Amputations arise more commonly than average from the trackbound vehicles, winches, manual handling and monorope or monorail classifications. Trackbound vehicles also contribute a substantial percentage of crushing injuries.

Table 3
Variation of accident occurence over time

Year	Incidents	Fatalities	Reportable injuries	Allocated days
Gold mining				
1988	10278	509	9520	4631306
1989	9622	560	8960	4849067
1990	8739	531	8234	4527246
1991	7261	459	6866	3905689
1992	7965	407	7588	3639801
Platinum mining				
1988	506	38	455	329978
1989	395	36	355	294632
1990	429	24	388	220628
1991	361	37	290	287083
1992	487	41	428	350396
Total				
1988	10784	547	9975	4961284
1989	10017	596	9315	5143699
1990	9168	555	8622	4747874
1991	7622	496	7156	4192772
1992	8452	448	8016	3990197

Table 4
Distribution of accidents by mining region

Commodity	Region	Total number				Percentage			
		Incidents	Fatalities	Reportable injuries	Allocated days	Incidents	Fatalities	Reportable injuries	Allocated days
Gold	Central Rand	3775	266	3300	2236829	8.2%	10.0%	7.6%	9.6%
	Eastern Transvaal	282	21	261	185666	0.6%	0.8%	0.6%	0.8%
	Evander	1492	59	1419	626216	3.2%	2.2%	3.3%	2.7%
	Far West Rand	14197	933	13614	7952017	30.7%	35.1%	31.4%	34.3%
	Klerksdorp	9708	486	9274	4283193	21.0%	18.3%	21.4%	18.5%
	Orange Free State	14056	687	12985	6125227	30.4%	25.8%	30.0%	26.4%
	Surface installations	355	14	315	143961	0.8%	0.5%	0.7%	0.6%
	Sub Total	43865	2466	41168	21553109	94.8%	92.7%	95.1%	93.0%
Platinum	Bushveld Igneous Complex	2366	191	2090	1597352	5.1%	7.2%	4.8%	6.9%
	Surface installations	61	3	52	35060	0.1%	0.1%	0.1%	0.2%
	Sub Total	2427	194	2142	1632412	5.2%	7.3%	4.9%	7.0%
TOTAL		46292	2660	43310	23185521	100.0%	100.0%	100.0%	100.0%

Table 5

Type of accident inquiries

Type of inquiry	Total number				Percentage			
	Incidents	Fatalities	Reportable injuries	Allocated days	Incidents	Fatalities	Reportable injuries	Allocated days
No inquiry	22789	17	22550	2980975	49.2%	0.6%	52.1%	12.9%
Inquiry, but no written report	20739	77	19437	4349322	44.8%	2.9%	44.9%	18.8%
Inquiry and written report, but not typed	577	21	320	278165	1.2%	0.8%	0.7%	1.2%
Inquiry, written report and typed	2186	2545	1002	15577059	4.7%	95.7%	2.3%	67.2%
TOTAL	46291	2660	43309	23185521	100.0%	100.0%	100.0%	100.0%

Table 6

Distribution of accidents by day of the week

Day of week	Total number				Percentage			
	Incidents	Fatalities	Reportable injuries	Allocated days	Incidents	Fatalities	Reportable injuries	Allocated days
Sunday	1155	75	949	623686	2.5%	2.8%	2.2%	2.7%
Monday	8277	434	7759	3910678	17.9%	16.3%	17.9%	16.9%
Tuesday	8206	467	7758	4084958	17.7%	17.6%	17.9%	17.6%
Wednesday	8146	508	7695	4297831	17.6%	19.1%	17.8%	18.5%
Thursday	8094	484	7644	4170212	17.5%	18.2%	17.6%	18.0%
Friday	7904	484	7360	4144794	17.1%	18.2%	17.0%	17.9%
Saturday	4510	208	4145	1953362	9.7%	7.8%	9.6%	8.4%
TOTAL	46292	2660	43310	23185521	100.0%	100.0%	100.0%	100.0%

Table 7
Distribution of accidents by hour of the day

Hour of day	Total number				Percentage			
	Incidents	Fatalities	Reportable injuries	Allocated days	Incidents	Fatalities	Reportable injuries	Allocated days
0	917	89	780	695361	2.0%	3.3%	1.8%	3.0%
1	1303	75	1182	639747	2.8%	2.8%	2.7%	2.8%
2	1286	92	1160	742752	2.8%	3.5%	2.7%	3.2%
3	1204	81	1086	670038	2.6%	3.0%	2.5%	2.9%
4	997	56	942	509769	2.2%	2.1%	2.2%	2.2%
5	866	51	774	440774	1.9%	1.9%	1.8%	1.9%
6	1405	121	1239	952959	3.0%	4.5%	2.9%	4.1%
7	2386	211	2236	1641366	5.2%	7.9%	5.2%	7.1%
8	3575	255	3411	2112367	7.7%	9.6%	7.9%	9.1%
9	4712	263	4558	2328381	10.2%	9.9%	10.5%	10.0%
10	6934	274	6768	2667489	15.0%	10.3%	15.6%	11.5%
11	6564	270	6435	2592236	14.2%	10.2%	14.9%	11.2%
12	4266	186	4190	1849020	9.2%	7.0%	9.7%	8.0%
13	2552	151	2373	1334954	5.5%	5.7%	5.5%	5.8%
14	1462	70	1305	641030	3.2%	2.6%	3.0%	2.8%
15	906	51	770	444220	2.0%	1.9%	1.8%	1.9%
16	591	34	450	299239	1.3%	1.3%	1.0%	1.3%
17	487	27	385	234698	1.1%	1.0%	0.9%	1.0%
18	446	25	334	208212	1.0%	0.9%	0.8%	0.9%
19	427	21	330	191559	0.9%	0.8%	0.8%	0.8%
20	456	20	377	172826	1.0%	0.8%	0.9%	0.7%
21	593	42	510	329751	1.3%	1.6%	1.2%	1.4%
22	854	94	754	709592	1.8%	3.5%	1.7%	3.1%
23	1103	101	961	777181	2.4%	3.8%	2.2%	3.4%
TOTAL	46292	2660	43310	23185521	100.0%	100.0%	100.0%	100.0%

Table 8

Hazard arising from different accident classifications

Classification	Total number				Percentage			
	Incidents	Fatalities	Reportable injuries	Allocated days	Incidents	Fatalities	Reportable injuries	Allocated days
Fall of ground	11081	876	10605	6813145	23.9%	32.9%	24.5%	29.4%
Rockburst	1147	524	1444	3436075	2.5%	19.7%	3.3%	14.8%
Locomotive drawn vehicle	2772	111	2678	1231340	6.0%	4.2%	6.2%	5.3%
Falling rock/material	5409	82	5387	1120984	11.7%	3.1%	12.4%	4.8%
Scraper winch	2106	65	2046	845702	4.5%	2.4%	4.7%	3.6%
Locomotive	986	93	926	798647	2.1%	3.5%	2.1%	3.4%
Manual handling	5158	22	5151	755330	11.1%	0.8%	11.9%	3.3%
Falling in excavations	298	114	210	722306	0.6%	4.3%	0.5%	3.1%
Inundation or drowning	184	106	114	663474	0.4%	4.0%	0.3%	2.9%
Strainburst	881	79	916	631693	1.9%	3.0%	2.1%	2.7%
Monorope/monorail	1217	5	1216	562759	2.6%	0.2%	2.8%	2.4%
Miscellaneous	2096	41	2072	542952	4.5%	1.5%	4.8%	2.3%
Dust, gas or fumes	160	54	203	424755	0.3%	2.0%	0.5%	1.8%
Slipping and falling	2962	11	2959	393938	6.4%	0.4%	6.8%	1.7%
Nitroglycerine	76	60	108	384320	0.2%	2.3%	0.2%	1.7%
Falling in shafts	66	61	21	370254	0.1%	2.3%	0.0%	1.6%
Machinery	1122	20	1119	335113	2.4%	0.8%	2.6%	1.4%
Struck by shaft equipment	291	44	257	327515	0.6%	1.7%	0.6%	1.4%
Explosives (not nitroglycerine)	147	41	150	321656	0.3%	1.5%	0.3%	1.4%
Transporter	318	33	290	265522	0.7%	1.2%	0.7%	1.1%
Travelling in shaft	153	32	223	259014	0.3%	1.2%	0.5%	1.1%
Falling from structures	471	27	451	230725	1.0%	1.0%	1.0%	1.0%
Hand trammed	1246	6	1243	207189	2.7%	0.2%	2.9%	0.9%
Mechanical loader	593	18	576	195941	1.3%	0.7%	1.3%	0.8%
Electrical equipment	165	21	161	170967	0.4%	0.8%	0.4%	0.7%
Conveyance malfunction	26	27	36	170452	0.1%	1.0%	0.1%	0.7%
Fires	33	24	57	164105	0.1%	0.9%	0.1%	0.7%
Heat sickness	111	19	94	155356	0.2%	0.7%	0.2%	0.7%
Splinters	876	1	875	154397	1.9%	0.0%	2.0%	0.7%
Other transport/mining equipment	455	11	448	141133	1.0%	0.4%	1.0%	0.6%
Motor vehicles	88	14	137	122855	0.2%	0.5%	0.3%	0.5%
Struck by vent door	372	6	367	97607	0.8%	0.2%	0.8%	0.4%
Winch (not scraper winch)	126	8	118	85371	0.3%	0.3%	0.3%	0.4%
Burning and scalding	255	4	266	69989	0.6%	0.2%	0.6%	0.3%
Occupational diseases	385	0	386	12940	0.8%	0.0%	0.9%	0.1%
Non – casualty	2460	0	0	0	5.3%	0.0%	0.0%	0.0%
TOTAL	46292	2660	43310	23185521	100.0%	100.0%	100.0%	100.0%

Table 9a

Analysis of allocated days lost by accident classification and year

Number of days divided by 1000

Accident classification	Total days divided by 1000	Year				
		1988	1989	1990	1991	1992
Fall of ground	6751	1467	1467	1203	1499	1115
Rockburst	3436	548	700	822	566	799
Locomotive drawn vehicle	1228	254	269	289	229	187
Falling rock/material	1118	246	243	225	213	191
Scraper winch	843	152	199	197	139	155
Locomotive	798	218	148	141	128	162
Manual handling	753	164	186	125	150	128
Falling in excavations	704	186	183	144	96	94
Inundation or drowning	663	154	166	106	106	131
Strainburst	631	118	159	148	87	119
Monorope/monorail	563	150	109	102	100	101
Miscellaneous	541	119	105	91	172	55
Dust, gas or fumes	420	50	96	112	113	50
Slipping and falling	393	107	101	65	63	57
Nitroglycerine	384	39	28	249	23	45
Falling in shafts	370	114	98	73	67	18
Machinery	334	97	66	65	45	61
Struck by shaft equipment	321	104	64	66	41	46
Explosives (not nitroglycerine)	303	58	109	70	24	41
Transporter	259	71	62	41	47	38
Travelling in shaft	259	54	9	23	117	56
Falling from structures	231	43	53	59	46	29
Hand trammed	207	51	70	34	32	20
Mechanical loader	196	58	53	39	28	18
Conveyance malfunction	170	31	72	49	18	0
Electrical equipment	165	51	35	41	13	25
Fires	164	72	76	8	7	1
Heat sickness	155	20	39	26	32	38
Splinters	154	30	28	38	21	37
Other transport/mining equipment	141	29	23	18	32	38
Motor vehicles	123	16	68	21	8	9
Struck by vent door	98	23	27	29	9	9
Winch (not scraper winch)	84	36	20	11	1	17
Burning and scalding	69	24	10	14	14	7
Occupational diseases	13	4	3	2	3	1
Non-casualty	0	0	0	0	0	0
Total days divided by 1000	23042	4961	5144	4748	4289	3901

Table 9b

Analysis of allocated days lost by accident classification and year

Distribution of accident classifications in each year compared with overall distribution

Accident classification	Overall distribution	Year				
		1988	1989	1990	1991	1992
Fall of ground	29.3%	29.6%	28.5%	25.3%	35.0%	28.6%
Rockburst	14.9%	11.1%	13.6%	17.3%	13.2%	20.5%
Locomotive drawn vehicle	5.3%	5.1%	5.2%	6.1%	5.3%	4.8%
Falling rock/material	4.9%	5.0%	4.7%	4.7%	5.0%	4.9%
Scraper winch	3.7%	3.1%	3.9%	4.2%	3.2%	4.0%
Locomotive	3.5%	4.4%	2.9%	3.0%	3.0%	4.2%
Manual handling	3.3%	3.3%	3.6%	2.6%	3.5%	3.3%
Falling in excavations	3.1%	3.7%	3.6%	3.0%	2.2%	2.4%
Inundation or drowning	2.9%	3.1%	3.2%	2.2%	2.5%	3.4%
Strainburst	2.7%	2.4%	3.1%	3.1%	2.0%	3.0%
Monorope/monorail	2.4%	3.0%	2.1%	2.2%	2.3%	2.6%
Miscellaneous	2.3%	2.4%	2.0%	1.9%	4.0%	1.4%
Dust, gas or fumes	1.8%	1.0%	1.9%	2.4%	2.6%	1.3%
Slipping and falling	1.7%	2.1%	2.0%	1.4%	1.5%	1.5%
Nitroglycerine	1.7%	0.8%	0.5%	5.2%	0.5%	1.2%
Falling in shafts	1.6%	2.3%	1.9%	1.5%	1.6%	0.5%
Machinery	1.4%	2.0%	1.3%	1.4%	1.0%	1.6%
Struck by shaft equipment	1.4%	2.1%	1.2%	1.4%	1.0%	1.2%
Explosives (not nitroglycerine)	1.3%	1.2%	2.1%	1.5%	0.6%	1.1%
Transporter	1.1%	1.4%	1.2%	0.9%	1.1%	1.0%
Travelling in shaft	1.1%	1.1%	0.2%	0.5%	2.7%	1.4%
Falling from structures	1.0%	0.9%	1.0%	1.2%	1.1%	0.7%
Hand trammed	0.9%	1.0%	1.4%	0.7%	0.7%	0.5%
Mechanical loader	0.8%	1.2%	1.0%	0.8%	0.7%	0.5%
Conveyance malfunction	0.7%	0.6%	1.4%	1.0%	0.4%	0.0%
Electrical equipment	0.7%	1.0%	0.7%	0.9%	0.3%	0.6%
Fires	0.7%	1.5%	1.5%	0.2%	0.2%	0.0%
Heat sickness	0.7%	0.4%	0.8%	0.6%	0.7%	1.0%
Splinters	0.7%	0.6%	0.5%	0.8%	0.5%	0.9%
Other transport/mining equipment	0.6%	0.6%	0.5%	0.4%	0.7%	1.0%
Motor vehicles	0.5%	0.3%	1.3%	0.5%	0.2%	0.2%
Struck by vent door	0.4%	0.5%	0.5%	0.6%	0.2%	0.2%
Winch (not scraper winch)	0.4%	0.7%	0.4%	0.2%	0.0%	0.4%
Burning and scalding	0.3%	0.5%	0.2%	0.3%	0.3%	0.2%
Occupational diseases	0.1%	0.1%	0.1%	0.0%	0.1%	0.0%
Non-casualty	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total days divided by 1000	23042	4961	5144	4748	4289	3901

Table 10a

Analysis of allocated days by accident classification and mining region

Number of days divided by 1000

Accident classification	Total days	Mining region							
		Bushveld Igneous Complex	Central Rand	Eastern Transvaal	Evander	Far West Rand	Klerksdorp	Orange Free State	Surface
Fall of ground	6813	549	601	14	226	1516	1439	2468	0
Rockburst	3436	0	210	0	0	2650	326	250	0
Locomotive drawn vehicle	1231	82	104	14	48	396	206	382	0
Falling rock/material	1121	91	94	9	46	236	184	450	10
Scraper winch	846	68	78	1	32	336	119	212	0
Locomotive	799	37	121	2	18	192	187	229	14
Manual handling	755	71	72	10	27	256	169	137	14
Falling in excavations	722	57	61	13	19	256	124	186	7
Inundation or drowning	663	30	82	12	24	229	92	187	6
Strainburst	632	3	95	0	0	237	173	124	0
Monorope/monorail	563	7	20	0	16	204	100	216	0
Miscellaneous	543	70	58	7	20	122	116	124	25
Dust, gas or fumes	425	40	77	11	15	118	89	62	13
Slipping and falling	394	31	39	10	11	92	97	108	5
Nitroglycerine	384	17	23	0	1	25	217	100	0
Falling in shafts	370	26	43	6	6	114	48	127	0
Machinery	335	24	44	6	3	99	64	70	25
Struck by shaft equipment	328	48	43	0	26	98	26	87	0
Explosives (not nitroglycerine)	322	69	22	7	21	91	9	100	2
Transporter	266	50	59	1	2	83	24	44	2
Travelling in shaft	259	55	5	0	14	63	100	22	0
Falling from structures	231	38	17	6	3	66	30	45	26
Hand trammed	207	5	23	3	9	72	25	71	0
Mechanical loader	196	15	44	1	7	52	37	37	4
Electrical equipment	171	20	27	0	6	50	17	42	8
Conveyance malfunction	170	42	64	0	0	56	1	7	0
Fires	164	3	1	6	0	56	85	13	0
Heat sickness	155	0	8	0	6	25	54	62	0
Splinters	154	12	13	0	3	46	44	37	0
Other transport/mining equipment	141	13	38	1	5	28	22	30	3
Motor vehicles	123	11	20	41	1	11	2	31	7
Struck by vent door	98	0	12	0	6	29	22	29	0
Winch (not scraper winch)	85	7	10	0	3	30	9	26	0
Burning and scalding	70	8	9	1	1	15	22	8	6
Occupational diseases	13	0	1	0	0	3	5	4	0
Non-casualty	0	0	0	0	0	0	0	0	0
Total days	23186	1597	2237	186	626	7952	4283	6125	179

Table 10b

Analysis of allocated days by accident classification and mining region

Distribution of accident classifications in each mining region compared with overall distribution

Accident classification	Overall Distribution	Mining region							
		Bushveld Igneous Complex	Central Rand	Eastern Transvaal	Evander	Far West Rand	Klerksdorp	Orange Free State	Surface
Fall of ground	29.4%	34.4%	26.8%	7.5%	36.1%	19.1%	33.6%	40.3%	0.0%
Rockburst	14.8%	0.0%	9.4%	0.0%	0.1%	33.3%	7.6%	4.1%	0.0%
Locomotive drawn vehicle	5.3%	5.1%	4.6%	7.5%	7.7%	5.0%	4.8%	6.2%	0.1%
Falling rock/material	4.8%	5.7%	4.2%	5.0%	7.4%	3.0%	4.3%	7.3%	5.7%
Scraper winch	3.6%	4.3%	3.5%	0.7%	5.1%	4.2%	2.8%	3.5%	0.0%
Locomotive	3.4%	2.3%	5.4%	0.9%	2.9%	2.4%	4.4%	3.7%	7.6%
Manual handling	3.3%	4.4%	3.2%	5.5%	4.3%	3.2%	3.9%	2.2%	7.9%
Falling in excavations	3.1%	3.6%	2.7%	7.2%	3.0%	3.2%	2.9%	3.0%	3.7%
Inundation or drowning	2.9%	1.9%	3.7%	6.7%	3.9%	2.9%	2.2%	3.1%	3.4%
Strainburst	2.7%	0.2%	4.2%	0.3%	0.1%	3.0%	4.0%	2.0%	0.0%
Monorope/monorail	2.4%	0.4%	0.9%	0.0%	2.5%	2.6%	2.3%	3.5%	0.0%
Miscellaneous	2.3%	4.4%	2.6%	3.9%	3.1%	1.5%	2.7%	2.0%	14.2%
Dust, gas or fumes	1.8%	2.5%	3.4%	5.7%	2.3%	1.5%	2.1%	1.0%	7.3%
Slipping and falling	1.7%	2.0%	1.8%	5.2%	1.8%	1.2%	2.3%	1.8%	2.9%
Nitroglycerine	1.7%	1.0%	1.0%	0.3%	0.2%	0.3%	5.1%	1.6%	0.0%
Falling in shafts	1.6%	1.6%	1.9%	3.2%	1.0%	1.4%	1.1%	2.1%	0.0%
Machinery	1.4%	1.5%	1.9%	3.4%	0.4%	1.2%	1.5%	1.2%	13.9%
Struck by shaft equipment	1.4%	3.0%	1.9%	0.0%	4.2%	1.2%	0.6%	1.4%	0.0%
Explosives (not nitroglycerine)	1.4%	4.3%	1.0%	4.0%	3.4%	1.1%	0.2%	1.6%	0.8%
Transporter	1.1%	3.2%	2.6%	0.4%	0.3%	1.0%	0.6%	0.7%	1.1%
Travelling in shaft	1.1%	3.5%	0.2%	0.0%	2.2%	0.8%	2.3%	0.4%	0.0%
Falling from structures	1.0%	2.3%	0.8%	3.5%	0.4%	0.8%	0.7%	0.7%	14.7%
Hand trammed	0.9%	0.3%	1.0%	1.7%	1.5%	0.9%	0.6%	1.2%	0.1%
Mechanical loader	0.8%	0.9%	2.0%	0.3%	1.1%	0.7%	0.9%	0.6%	2.0%
Electrical equipment	0.7%	1.2%	1.2%	0.0%	1.0%	0.6%	0.4%	0.7%	4.7%
Conveyance malfunction	0.7%	2.6%	2.9%	0.3%	0.1%	0.7%	0.0%	0.1%	0.0%
Fires	0.7%	0.2%	0.0%	3.4%	0.0%	0.7%	2.0%	0.2%	0.0%
Heat sickness	0.7%	0.0%	0.4%	0.0%	1.0%	0.3%	1.3%	1.0%	0.0%
Splinters	0.7%	0.7%	0.6%	0.1%	0.4%	0.6%	1.0%	0.6%	0.0%
Other transport/mining equipment	0.6%	0.8%	1.7%	0.8%	0.8%	0.3%	0.5%	0.5%	1.9%
Motor vehicles	0.5%	0.7%	0.9%	22.0%	0.2%	0.1%	0.0%	0.5%	4.0%
Struck by vent door	0.4%	0.0%	0.5%	0.1%	1.0%	0.4%	0.5%	0.5%	0.0%
Winch (not scraper winch)	0.4%	0.5%	0.4%	0.0%	0.5%	0.4%	0.2%	0.4%	0.2%
Burning and scalding	0.3%	0.5%	0.4%	0.4%	0.2%	0.2%	0.5%	0.1%	3.5%
Occupational diseases	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%
Non-casualty	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total days divided by 1000	23186	1597	2237	186	626	7952	4283	6125	179

Table 10c

Analysis of allocated days by accident classification and mining region

Distribution across the mining regions for each accident classification compared with overall distribution

Accident classification	Total days divided by 1000	Mining region							
		Bushveld Igneous Complex	Central Rand	Eastern Transvaal	Evander	Far West Rand	Klerksdorp	Orange Free State	Surface
Fall of ground	6813	8.1%	8.8%	0.2%	3.3%	22.3%	21.1%	36.2%	0.0%
Rockburst	3436	0.0%	6.1%	0.0%	0.0%	77.1%	9.5%	7.3%	0.0%
Locomotive drawn vehicle	1231	6.7%	8.4%	1.1%	3.9%	32.2%	16.7%	31.0%	0.0%
Falling rock/material	1121	8.1%	8.4%	0.8%	4.1%	21.1%	16.4%	40.1%	0.9%
Scraper winch	846	8.0%	9.2%	0.2%	3.8%	39.7%	14.1%	25.1%	0.0%
Locomotive	799	4.6%	15.2%	0.2%	2.2%	24.0%	23.5%	28.6%	1.7%
Manual handling	755	9.4%	9.6%	1.3%	3.6%	33.9%	22.3%	18.1%	1.9%
Falling in excavations	722	7.9%	8.4%	1.8%	2.6%	35.4%	17.1%	25.8%	0.9%
Inundation or drowning	663	4.6%	12.4%	1.9%	3.6%	34.5%	13.9%	28.3%	0.9%
Strainburst	632	0.4%	15.0%	0.1%	0.1%	37.5%	27.4%	19.6%	0.0%
Monorope/monorail	563	1.2%	3.5%	0.0%	2.8%	36.3%	17.8%	38.4%	0.0%
Miscellaneous	543	12.9%	10.8%	1.3%	3.6%	22.4%	21.4%	22.9%	4.7%
Dust, gas or fumes	425	9.4%	18.1%	2.5%	3.4%	27.8%	21.1%	14.6%	3.1%
Slipping and falling	394	7.9%	10.0%	2.4%	2.8%	23.4%	24.6%	27.4%	1.3%
Nitroglycerine	384	4.4%	6.1%	0.1%	0.3%	6.6%	56.6%	26.0%	0.0%
Falling in shafts	370	6.9%	11.6%	1.6%	1.7%	30.8%	13.0%	34.3%	0.0%
Machinery	335	7.2%	13.0%	1.9%	0.8%	29.5%	19.1%	21.0%	7.4%
Struck by shaft equipment	328	14.6%	13.1%	0.0%	8.1%	29.8%	7.9%	26.5%	0.0%
Explosives (not nitroglycerine)	322	21.4%	7.0%	2.3%	6.7%	28.4%	2.7%	31.1%	0.5%
Transporter	266	19.0%	22.0%	0.3%	0.7%	31.4%	9.0%	16.7%	0.8%
Travelling in shaft	259	21.3%	1.8%	0.0%	5.4%	24.3%	38.7%	8.5%	0.0%
Falling from structures	231	16.3%	7.5%	2.8%	1.1%	28.6%	12.8%	19.5%	11.4%
Hand trammed	207	2.3%	11.2%	1.5%	4.4%	34.6%	11.8%	34.1%	0.1%
Mechanical loader	196	7.7%	22.4%	0.3%	3.4%	26.4%	18.9%	19.0%	1.8%
Electrical equipment	171	11.5%	16.0%	0.0%	3.6%	29.3%	10.1%	24.4%	5.0%
Conveyance malfunction	170	24.7%	37.6%	0.3%	0.2%	32.7%	0.4%	4.1%	0.0%
Fires	164	1.6%	0.3%	3.9%	0.0%	34.2%	52.0%	8.1%	0.0%
Heat sickness	155	0.0%	5.4%	0.0%	3.9%	16.2%	34.8%	39.7%	0.0%
Splinters	154	7.6%	8.2%	0.1%	1.7%	29.9%	28.8%	23.7%	0.1%
Other transport/mining equipment	141	9.3%	27.1%	1.0%	3.7%	19.5%	15.4%	21.4%	2.5%
Motor vehicles	123	8.8%	15.9%	33.3%	0.8%	9.1%	1.4%	25.0%	5.8%
Struck by vent door	98	0.5%	11.9%	0.1%	6.2%	29.7%	22.3%	29.3%	0.0%
Winch (not scraper winch)	85	8.6%	11.5%	0.0%	3.5%	35.4%	10.4%	30.4%	0.4%
Burning and scalding	70	11.0%	12.5%	1.0%	1.8%	22.1%	31.5%	11.3%	8.9%
Occupational diseases	13	1.2%	10.2%	0.0%	1.5%	21.7%	37.8%	27.5%	0.0%
Overall distribution	23186	6.9%	9.6%	0.8%	2.7%	34.3%	18.5%	26.4%	0.8%

Table 11

Occurence of accidents in different types of place

Category of place	Total number				Percentage			
	Incidents	Fatalities	Reportable injuries	Allocated days	Incidents	Fatalities	Reportable injuries	Allocated days
Stope face	12390	1034	12172	8138248	26.8%	38.9%	28.1%	35.1%
Haulage, Return airway, Travelling way	7032	266	6784	2800988	15.2%	10.0%	15.7%	12.1%
Shaft (Vertical/Incline/Sinking)	5651	322	4501	2671502	12.2%	12.1%	10.4%	11.5%
Crosscut	5547	182	5359	1896857	12.0%	6.8%	12.4%	8.2%
Strike gully	2779	155	2674	1415264	6.0%	5.8%	6.2%	6.1%
Centre gully/Tip	2618	102	2527	1064920	5.7%	3.8%	5.8%	4.6%
Boxhole/Orepass	1051	108	960	765348	2.3%	4.1%	2.2%	3.3%
Stope worked out area/reclamation area/entrance	1144	87	896	740264	2.5%	3.3%	2.1%	3.2%
Raise/Winze	1552	81	1493	725553	3.4%	3.0%	3.4%	3.1%
Reef drive	1388	67	1326	624140	3.0%	2.5%	3.1%	2.7%
Development end	1127	65	1066	541321	2.4%	2.4%	2.5%	2.3%
Conveyors/Surface transport	329	52	348	414285	0.7%	2.0%	0.8%	1.8%
Surface sites	1372	36	1283	403196	3.0%	1.4%	3.0%	1.7%
Engineering locations	972	41	739	372011	2.1%	1.5%	1.7%	1.6%
Plant locations	758	29	698	312302	1.6%	1.1%	1.6%	1.3%
Other locations	582	33	484	299322	1.3%	1.2%	1.1%	1.3%
TOTAL	46292	2660	43310	23185521	100.0%	100.0%	100.0%	100.0%

Table 12a

Analysis of allocated days by accident classification and type of place

Number of days divided by 1000

Accident classification	Total days	Type of place																
		Stope face	Haulage, Return airway, Travelling way	Cross-cut	Strike gully	Centre gully/ Tip	Boxhole/ Orepass	Raise/ Winze	Reef drive	Development end	Stope worked out area/ reclamation/ entrance	Shaft (Vertical/ Incline/ Sinking)	Conveyors/ Surface transport	Engineering locations	Plant locations	Surface sites	Other locations
Fall of ground	6813	3729	372	480	540	309	66	178	233	243	423	176	7	27	0	0	28
Rockburst	3436	2656	138	99	283	30	2	94	52	31	12	15	23	0	0	0	0
Locomotive drawn vehicle	1231	6	633	290	0	1	4	0	97	31	0	112	31	1	0	14	10
Falling rock/material	1121	214	142	101	62	79	49	40	29	9	46	252	3	20	23	32	22
Scraper winch	846	324	3	9	237	219	1	11	13	0	24	2	0	3	0	0	0
Locomotive	799	0	453	116	0	0	6	0	22	1	0	61	91	11	0	17	19
Manual handling	755	99	125	99	22	81	27	39	16	10	4	116	5	25	30	41	17
Falling in excavations	722	53	20	2	9	87	363	31	0	0	8	97	6	6	6	19	13
Inundation or drowning	663	21	14	200	6	31	81	30	1	0	36	130	18	36	18	36	7
Strainburst	632	394	9	33	51	29	7	18	29	51	3	8	0	0	0	0	0
Monorope/monorail	563	130	78	52	53	94	0	35	6	0	110	0	0	0	0	0	4
Miscellaneous	543	52	61	44	23	12	15	15	16	12	23	106	1	21	25	39	77
Dust, gas or fumes	425	57	40	51	1	7	76	86	8	15	14	16	0	2	33	11	10
Slipping and falling	394	64	66	40	16	21	13	22	6	4	7	50	14	14	13	29	14
Nitroglycerine	384	14	82	12	22	0	34	20	31	19	0	143	6	0	0	0	0
Falling in shafts	370	0	0	0	0	0	0	0	0	0	0	370	0	0	0	0	0
Machinery	335	34	18	20	5	2	4	2	6	11	1	49	25	35	59	47	15
Struck by shaft equipment	328	0	1	0	0	0	0	26	0	0	0	299	0	0	0	0	1
Explosives (not nitroglycerine)	322	119	22	44	35	1	0	7	4	38	8	13	12	6	2	8	3
Transporter	266	7	69	12	8	1	1	7	5	6	0	59	54	7	2	19	9
Travelling in shaft	259	0	9	0	0	0	0	6	0	0	0	237	0	6	0	0	1
Falling from structures	231	15	9	10	1	1	16	9	5	2	0	40	7	22	55	24	14
Hand trammed	207	1	62	46	1	0	0	0	5	1	1	81	1	2	0	4	1
Mechanical loader	196	0	37	49	0	0	0	0	22	50	0	17	6	2	7	2	3
Electrical equipment	171	7	23	1	2	7	0	1	1	0	1	30	0	73	10	9	6
Conveyance malfunction	170	0	31	0	0	0	0	19	0	0	0	121	0	0	0	0	0
Fires	164	7	121	14	1	0	0	1	0	0	6	7	1	8	0	0	0
Heat sickness	155	53	34	12	8	10	0	15	6	2	6	0	0	0	0	0	8
Splinters	154	40	11	15	9	26	1	6	5	4	3	16	0	2	2	13	0
Other transport/mining equipment	141	14	38	6	7	4	0	1	2	0	1	20	22	3	3	16	3
Motor vehicles	123	0	1	1	0	0	0	0	0	0	0	6	79	13	0	20	3
Struck by vent door	98	0	59	32	0	0	0	0	4	0	0	2	0	1	0	0	0
Winch (not scraper winch)	85	21	8	0	11	12	0	7	0	0	3	8	0	3	6	0	6
Burning and scalding	70	1	10	5	0	0	0	0	0	0	0	9	1	21	15	4	4
Occupational diseases	13	7	2	1	0	0	0	0	0	0	0	1	0	0	0	0	0
Non-casualty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total days	23186	8138	2801	1897	1415	1065	765	726	624	541	740	2672	414	372	312	403	299

Table 12b

Analysis of allocated days by accident classification and type of place

Distribution of accident classifications for each type of place compared with overall distribution

Accident classification	Overall distribution	Type of place															
		Stope face	Haulage, Return airway, Travelling way	Cross-cut	Strike gully	Centre gully/ Tip	Boxhole/ Orepass	Raise/ Winze	Reef drive	Development end	Stope worked out area/ reclamation/ entrance	Shaft (Vertical/ Incline/ Sinking)	Conveyors/ Surface transport	Engineering locations	Plant locations	Surface sites	Other locations
Fall of ground	29.4%	45.8%	13.3%	25.3%	38.2%	29.0%	8.6%	24.6%	37.3%	44.9%	57.1%	6.6%	1.8%	7.4%	0.0%	0.1%	9.5%
Rockburst	14.8%	32.6%	4.9%	5.2%	20.0%	2.8%	0.3%	12.9%	8.4%	5.8%	1.6%	0.6%	5.6%	0.0%	0.0%	0.0%	0.0%
Locomotive drawn vehicle	5.3%	0.1%	22.6%	15.3%	0.0%	0.1%	0.5%	0.0%	15.6%	5.7%	0.1%	4.2%	7.5%	0.3%	0.0%	3.5%	3.4%
Falling rock/material	4.8%	2.6%	5.1%	5.3%	4.4%	7.4%	6.4%	5.5%	4.6%	1.7%	6.2%	9.4%	0.7%	5.3%	7.4%	7.8%	7.4%
Scraper winch	3.6%	4.0%	0.1%	0.5%	16.7%	20.6%	0.2%	1.5%	2.0%	0.0%	3.2%	0.1%	0.1%	0.7%	0.0%	0.1%	0.1%
Locomotive	3.4%	0.0%	16.2%	6.1%	0.0%	0.0%	0.8%	0.0%	3.5%	0.2%	0.0%	2.3%	22.0%	3.0%	0.1%	4.2%	6.3%
Manual handling	3.3%	1.2%	4.5%	5.2%	1.6%	7.6%	3.5%	5.3%	2.5%	1.8%	0.6%	4.4%	1.3%	6.6%	9.7%	10.2%	5.7%
Falling in excavations	3.1%	0.7%	0.7%	0.1%	0.6%	8.2%	47.4%	4.3%	0.0%	0.1%	1.1%	3.6%	1.5%	1.7%	2.0%	4.6%	4.5%
Inundation or drowning	2.9%	0.3%	0.5%	10.5%	0.4%	2.9%	10.6%	4.1%	0.1%	0.0%	4.9%	4.9%	4.3%	9.7%	5.8%	9.0%	2.2%
Strainburst	2.7%	4.8%	0.3%	1.7%	3.6%	2.7%	0.9%	2.5%	4.6%	9.4%	0.4%	0.3%	0.1%	0.1%	0.0%	0.0%	0.0%
Monorope/monorail	2.4%	1.6%	2.8%	2.7%	3.7%	8.9%	0.0%	4.9%	0.9%	0.0%	14.9%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%
Miscellaneous	2.3%	0.6%	2.2%	2.3%	1.7%	1.1%	1.9%	2.0%	2.5%	2.3%	3.1%	4.0%	0.3%	5.7%	8.1%	9.6%	25.9%
Dust, gas or fumes	1.8%	0.7%	1.4%	2.7%	0.1%	0.7%	9.9%	11.9%	1.3%	2.7%	1.9%	0.6%	0.0%	0.6%	10.4%	2.6%	3.2%
Slipping and falling	1.7%	0.8%	2.4%	2.1%	1.2%	1.9%	1.7%	3.0%	1.0%	0.7%	0.9%	1.9%	3.5%	3.8%	4.1%	7.1%	4.8%
Nitroglycerine	1.7%	0.2%	2.9%	0.6%	1.6%	0.0%	4.4%	2.7%	5.0%	3.6%	0.0%	5.4%	1.4%	0.1%	0.0%	0.0%	0.0%
Falling in shafts	1.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	13.9%	0.0%	0.0%	0.0%	0.0%	0.0%
Machinery	1.4%	0.4%	0.7%	1.1%	0.4%	0.2%	0.5%	0.3%	1.0%	2.1%	0.1%	1.8%	6.0%	9.4%	19.0%	11.8%	5.0%
Struck by shaft equipment	1.4%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	3.5%	0.0%	0.0%	0.0%	11.2%	0.0%	0.0%	0.0%	0.0%	0.3%
Explosives (not nitroglycerine)	1.4%	1.5%	0.8%	2.3%	2.4%	0.1%	0.0%	1.0%	0.6%	7.0%	1.1%	0.5%	2.9%	1.6%	0.6%	1.9%	0.9%
Transporter	1.1%	0.1%	2.5%	0.6%	0.5%	0.1%	0.2%	0.9%	0.7%	1.1%	0.0%	2.2%	13.1%	1.9%	0.6%	4.8%	3.1%
Travelling in shaft	1.1%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.8%	0.0%	0.0%	0.0%	8.9%	0.0%	1.6%	0.0%	0.0%	0.2%
Falling from structures	1.0%	0.2%	0.3%	0.5%	0.1%	0.1%	2.1%	1.3%	0.8%	0.3%	0.0%	1.5%	1.7%	6.0%	17.7%	6.0%	4.6%
Hand trammed	0.9%	0.0%	2.2%	2.4%	0.1%	0.0%	0.0%	0.0%	0.9%	0.2%	0.1%	3.0%	0.1%	0.6%	0.1%	1.0%	0.2%
Mechanical loader	0.8%	0.0%	1.3%	2.6%	0.0%	0.0%	0.0%	0.0%	3.5%	9.3%	0.0%	0.6%	1.5%	0.5%	2.1%	0.5%	1.1%
Electrical equipment	0.7%	0.1%	0.8%	0.1%	0.1%	0.6%	0.0%	0.1%	0.1%	0.0%	0.1%	1.1%	0.0%	19.7%	3.3%	2.2%	2.1%
Conveyance malfunction	0.7%	0.0%	1.1%	0.0%	0.0%	0.0%	0.0%	2.7%	0.0%	0.0%	0.0%	4.5%	0.0%	0.0%	0.0%	0.0%	0.0%
Fires	0.7%	0.1%	4.3%	0.7%	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.8%	0.3%	0.2%	2.0%	0.0%	0.0%	0.0%
Heat sickness	0.7%	0.7%	1.2%	0.6%	0.6%	1.0%	0.0%	2.0%	1.0%	0.4%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	2.8%
Splinters	0.7%	0.5%	0.4%	0.8%	0.7%	2.4%	0.2%	0.9%	0.9%	0.7%	0.4%	0.6%	0.1%	0.5%	0.8%	3.1%	0.1%
Other transport/mining equipment	0.6%	0.2%	1.4%	0.3%	0.5%	0.3%	0.1%	0.1%	0.4%	0.1%	0.2%	0.7%	5.2%	0.9%	1.1%	4.0%	1.0%
Motor vehicles	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	19.0%	3.4%	0.2%	5.0%	0.9%
Struck by vent door	0.4%	0.0%	2.1%	1.7%	0.0%	0.0%	0.0%	0.0%	0.6%	0.0%	0.0%	0.1%	0.0%	0.2%	0.0%	0.0%	0.1%
Winch (not scraper winch)	0.4%	0.3%	0.3%	0.0%	0.8%	1.2%	0.0%	1.0%	0.0%	0.0%	0.4%	0.3%	0.0%	0.8%	2.0%	0.0%	2.0%
Burning and scalding	0.3%	0.0%	0.4%	0.3%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.3%	0.2%	5.6%	4.8%	0.9%	1.5%
Occupational diseases	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%	0.0%	0.0%	0.1%	0.0%	0.1%	0.1%
Non-casualty	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total days divided by 1000	23186	8138	2801	1897	1415	1065	765	726	624	541	740	2672	414	372	312	403	299

Table 12c

Analysis of allocated days by accident classification and type of place

Distribution of types of place for each accident classification compared with overall distribution

Accident classification	Total days divided by 1000	Type of place															
		Stope face	Haulage, Return airway, Travelling way	Cross-cut	Strike gully	Centre gully/ Tip	Boxhole/ Orepass	Raise/ Winze	Reef drive	Development end	Stope worked out area/ reclamation/ entrance	Shaft (Vertical/ Incline/ Sinking)	Conveyors/ Surface transport	Engineering locations	Plant locations	Surface sites	Other locations
Fall of ground	6813	54.7%	5.5%	7.0%	7.9%	4.5%	1.0%	2.6%	3.4%	3.6%	6.2%	2.6%	0.1%	0.4%	0.0%	0.0%	0.4%
Rockburst	3436	77.3%	4.0%	2.9%	8.2%	0.9%	0.1%	2.7%	1.5%	0.9%	0.4%	0.4%	0.7%	0.0%	0.0%	0.0%	0.0%
Locomotive drawn vehicle	1231	0.5%	51.4%	23.6%	0.0%	0.1%	0.3%	0.0%	7.9%	2.5%	0.0%	9.1%	2.5%	0.1%	0.0%	1.1%	0.8%
Falling rock/material	1121	19.1%	12.6%	9.0%	5.5%	7.0%	4.3%	3.6%	2.5%	0.8%	4.1%	22.5%	0.2%	1.8%	2.1%	2.8%	2.0%
Scraper winch	846	38.3%	0.4%	1.0%	28.0%	25.9%	0.1%	1.3%	1.5%	0.0%	2.8%	0.2%	0.0%	0.3%	0.0%	0.0%	0.0%
Locomotive	799	0.0%	56.7%	14.6%	0.0%	0.0%	0.8%	0.0%	2.7%	0.1%	0.0%	7.7%	11.4%	1.4%	0.0%	2.1%	2.4%
Manual handling	755	13.2%	16.5%	13.1%	3.0%	10.7%	3.5%	5.1%	2.1%	1.3%	0.5%	15.4%	0.7%	3.3%	4.0%	5.4%	2.3%
Falling in excavations	722	7.4%	2.7%	0.3%	1.3%	12.1%	50.3%	4.3%	0.0%	0.1%	1.2%	13.5%	0.8%	0.9%	0.9%	2.6%	1.9%
Inundation or drowning	663	3.1%	2.1%	30.1%	0.9%	4.7%	12.2%	4.5%	0.1%	0.0%	5.4%	19.6%	2.7%	5.4%	2.7%	5.5%	1.0%
Strainburst	632	62.4%	1.4%	5.2%	8.2%	4.6%	1.0%	2.8%	4.5%	8.1%	0.4%	1.3%	0.0%	0.0%	0.0%	0.0%	0.0%
Monorope/monorail	563	23.1%	13.9%	9.2%	9.4%	16.8%	0.0%	6.3%	1.1%	0.0%	19.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%
Miscellaneous	543	9.6%	11.2%	8.2%	4.3%	2.1%	2.7%	2.7%	2.9%	2.3%	4.2%	19.6%	0.2%	3.9%	4.6%	7.1%	14.3%
Dust, gas or fumes	425	13.4%	9.3%	11.9%	0.2%	1.6%	17.9%	20.3%	1.9%	3.4%	3.3%	3.7%	0.0%	0.6%	7.7%	2.5%	2.2%
Slipping and falling	394	16.3%	16.8%	10.2%	4.1%	5.3%	3.2%	5.5%	1.6%	1.0%	1.7%	12.8%	3.7%	3.6%	3.3%	7.2%	3.7%
Nitroglycerine	384	3.6%	21.4%	3.2%	5.7%	0.1%	8.8%	5.1%	8.2%	5.0%	0.0%	37.2%	1.6%	0.1%	0.0%	0.0%	0.0%
Falling in shafts	370	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Machinery	335	10.1%	5.5%	6.0%	1.5%	0.6%	1.1%	0.7%	1.9%	3.4%	0.2%	14.7%	7.4%	10.5%	17.7%	14.1%	4.4%
Struck by shaft equipment	328	0.0%	0.4%	0.1%	0.0%	0.0%	0.0%	7.8%	0.0%	0.0%	0.0%	91.4%	0.0%	0.0%	0.0%	0.0%	0.2%
Explosives (not nitroglycerine)	322	37.1%	6.9%	13.8%	10.7%	0.3%	0.0%	2.2%	1.3%	11.8%	2.5%	4.0%	3.7%	1.9%	0.6%	2.4%	0.8%
Transporter	266	2.5%	25.9%	4.5%	2.8%	0.4%	0.5%	2.6%	1.7%	2.3%	0.0%	22.2%	20.5%	2.6%	0.8%	7.2%	3.5%
Travelling in shaft	259	0.0%	3.4%	0.0%	0.0%	0.0%	0.0%	2.3%	0.0%	0.0%	0.0%	91.7%	0.0%	2.3%	0.0%	0.0%	0.2%
Falling from structures	231	6.4%	4.0%	4.2%	0.6%	0.4%	6.8%	4.0%	2.2%	0.7%	0.0%	17.6%	3.0%	9.6%	24.0%	10.5%	5.9%
Hand trammed	207	0.5%	30.0%	22.0%	0.7%	0.0%	0.0%	0.1%	2.6%	0.6%	0.5%	39.2%	0.3%	1.1%	0.2%	1.9%	0.4%
Mechanical loader	196	0.1%	18.8%	25.2%	0.0%	0.2%	0.0%	0.1%	11.0%	25.7%	0.0%	8.6%	3.1%	1.0%	3.4%	1.0%	1.7%
Electrical equipment	171	4.0%	13.6%	0.7%	0.9%	3.9%	0.0%	0.4%	0.4%	0.0%	0.4%	17.8%	0.0%	42.9%	6.0%	5.2%	3.6%
Conveyance malfunction	170	0.0%	17.9%	0.0%	0.0%	0.0%	0.0%	11.3%	0.0%	0.0%	0.0%	70.8%	0.0%	0.0%	0.0%	0.0%	0.0%
Fires	164	4.0%	73.7%	8.4%	0.6%	0.0%	0.0%	0.4%	0.0%	0.0%	3.7%	4.2%	0.4%	4.6%	0.0%	0.1%	0.0%
Heat sickness	155	34.2%	22.1%	7.7%	5.2%	6.7%	0.1%	9.4%	3.9%	1.3%	3.9%	0.0%	0.0%	0.0%	0.0%	0.0%	5.4%
Splinters	154	25.8%	7.3%	9.9%	6.1%	16.5%	0.9%	4.0%	3.5%	2.5%	1.8%	10.5%	0.2%	1.1%	1.6%	8.1%	0.2%
Other transport/mining equipment	141	10.2%	27.0%	4.3%	4.9%	2.6%	0.3%	0.4%	1.6%	0.2%	0.9%	14.0%	15.3%	2.4%	2.5%	11.3%	2.1%
Motor vehicles	123	0.4%	0.6%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.1%	64.0%	10.3%	0.4%	16.6%	2.3%
Struck by vent door	98	0.1%	60.5%	32.3%	0.0%	0.0%	0.0%	0.0%	4.0%	0.0%	0.0%	2.0%	0.0%	0.7%	0.0%	0.1%	0.3%
Winch (not scraper winch)	85	24.3%	8.8%	0.2%	13.1%	14.4%	0.0%	8.3%	0.0%	0.0%	3.1%	9.6%	0.1%	3.6%	7.4%	0.0%	7.0%
Burning and scalding	70	0.7%	14.7%	7.4%	0.3%	0.2%	0.0%	0.1%	0.7%	0.2%	0.0%	12.3%	0.9%	29.5%	21.4%	5.3%	6.3%
Occupational diseases	13	51.7%	13.2%	6.7%	2.5%	1.5%	0.0%	1.7%	3.5%	0.9%	2.9%	8.3%	0.0%	2.1%	1.1%	2.4%	1.5%
Overall distribution	23186	35.1%	12.1%	8.2%	6.1%	4.6%	3.3%	3.1%	2.7%	2.3%	3.2%	11.5%	1.8%	1.6%	1.3%	1.7%	1.3%

Table 13

Accident causes as assigned by Regional Mining Engineer

Cause	Total number				Percentage			
	Incidents	Fatalities	Reportable injuries	Allocated days	Incidents	Fatalities	Reportable injuries	Allocated days
Inadequate examination/inspection/test	10691	646	10172	5338643	23.1%	24.3%	23.5%	23.0%
Failure to comply with recognized good practice/standards/procedure	11934	460	11203	4713063	25.8%	17.3%	25.9%	20.3%
Lack of (or unsuitable) system(s)/facilities	2243	598	2250	4031230	4.8%	22.5%	5.2%	17.4%
Failure to comply with instructions	1489	341	1074	2342500	3.2%	12.8%	2.5%	10.1%
Lack of caution/alertness	9419	173	9145	2326538	20.3%	6.5%	21.1%	10.0%
Failure to use safety or protective devices/equipment/systems	2634	75	2513	847402	5.7%	2.8%	5.8%	3.7%
Use of unsuitable/defective equipment/materials/facilities	1575	83	1286	752176	3.4%	3.1%	3.0%	3.2%
Inadequate (lack of) fencing/guarding	1078	38	1032	559101	2.3%	1.4%	2.4%	2.4%
Lack of (or inadequate) standards/procedures	746	66	654	524566	1.6%	2.5%	1.5%	2.3%
Failure to supply safety or protective devices/equipment/systems	671	48	668	419211	1.4%	1.8%	1.5%	1.8%
Inadequate supervision/discipline	940	30	840	312503	2.0%	1.1%	1.9%	1.3%
Inadequate preventive maintenance	829	26	634	254754	1.8%	1.0%	1.5%	1.1%
Lack of clearance (obstruction)	993	17	889	240959	2.1%	0.6%	2.1%	1.0%
Rendering safety device ineffective	264	26	202	209840	0.6%	1.0%	0.5%	0.9%
Lack of adequate/suitable training/instruction	587	15	577	172521	1.3%	0.6%	1.3%	0.7%
Failure to supply proper tools/equipment	136	18	136	135025	0.3%	0.7%	0.3%	0.6%
Lack of illumination/visibility	62	0	34	5489	0.1%	0.0%	0.1%	0.0%
TOTAL	46291	2660	43309	23185521	100.0%	100.0%	100.0%	100.0%

Table 14a

Time variations in accident cause assigned by Regional Mining Engineer

Number of days divided by 1000

Cause	Overall distribution	Year				
		1988	1989	1990	1991	1992
Inadequate examination/inspection/test	5280	1239	1170	966	1057	848
Failure to comply with recognized good practice/standards/procedure	4676	830	1043	938	1031	834
Lack of (or unsuitable) system(s)/facilities	4031	460	840	1004	749	978
Failure to comply with instructions	2330	510	521	650	358	290
Lack of caution/alertness	2324	706	422	343	362	491
Failure to use safety or protective devices/equipment/systems	845	223	215	195	129	82
Use of unsuitable/defective equipment/materials/facilities	726	170	194	154	119	89
Inadequate (lack of) fencing/guarding	559	102	173	98	121	66
Lack of (or inadequate) standards/procedures	524	148	93	55	136	93
Failure to supply safety or protective devices/equipment/systems	419	125	92	104	81	17
Inadequate supervision/discipline	312	123	52	66	48	22
Inadequate preventive maintenance	255	136	43	53	14	9
Lack of clearance (obstruction)	241	65	54	64	30	28
Rendering safety device ineffective	210	58	75	13	37	27
Lack of adequate/suitable training/instruction	172	59	51	37	9	17
Failure to supply proper tools/equipment	135	8	102	9	7	9
Lack of illumination/visibility	5	2	3	0	0	0
Total number of days	23042	4961	5144	4748	4289	3901

Table 14b

Time variations in accident cause assigned by Regional Mining Engineer

Distribution of causes for each year compared with overall distribution

Cause	Overall distribution	Year				
		1988	1989	1990	1991	1992
Inadequate examination/inspection/test	22.9%	25.0%	22.7%	20.3%	24.6%	21.7%
Failure to comply with recognized good practice/standards/procedure	20.3%	16.7%	20.3%	19.8%	24.0%	21.4%
Lack of (or unsuitable) system(s)/facilities	17.5%	9.3%	16.3%	21.1%	17.5%	25.1%
Failure to comply with instructions	10.1%	10.3%	10.1%	13.7%	8.4%	7.4%
Lack of caution/alertness	10.1%	14.2%	8.2%	7.2%	8.4%	12.6%
Failure to use safety or protective devices/equipment/systems	3.7%	4.5%	4.2%	4.1%	3.0%	2.1%
Use of unsuitable/defective equipment/materials/facilities	3.1%	3.4%	3.8%	3.2%	2.8%	2.3%
Inadequate (lack of) fencing/guarding	2.4%	2.1%	3.4%	2.1%	2.8%	1.7%
Lack of (or inadequate) standards/procedures	2.3%	3.0%	1.8%	1.2%	3.2%	2.4%
Failure to supply safety or protective devices/equipment/systems	1.8%	2.5%	1.8%	2.2%	1.9%	0.4%
Inadequate supervision/discipline	1.4%	2.5%	1.0%	1.4%	1.1%	0.6%
Inadequate preventive maintenance	1.1%	2.7%	0.8%	1.1%	0.3%	0.2%
Lack of clearance (obstruction)	1.0%	1.3%	1.1%	1.3%	0.7%	0.7%
Rendering safety device ineffective	0.9%	1.2%	1.5%	0.3%	0.9%	0.7%
Lack of adequate/suitable training/instruction	0.7%	1.2%	1.0%	0.8%	0.2%	0.4%
Failure to supply proper tools/equipment	0.6%	0.2%	2.0%	0.2%	0.2%	0.2%
Lack of illumination/visibility	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%
Total number of days (divided by 1000)	23042	4961	5144	4748	4289	3901

Table 15a

Analysis of allocated days lost by accident classification and assigned cause

Number of days divided by 1000

Accident classification	Total days	Accident cause																
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
Fall of ground	6813	360	727	96	63	7	461	184	273	13	0	38	44	4481	14	24	9	19
Rockburst	3436	0	131	13	53	86	2834	19	20	0	0	0	0	235	12	0	12	21
Locomotive drawn vehicle	1231	162	483	64	19	3	24	22	155	107	0	19	33	10	4	24	64	38
Falling rock/material	1121	85	347	49	28	2	41	45	165	11	0	18	20	135	66	17	82	9
Scraper winch	846	127	342	47	3	0	14	23	106	13	2	5	23	24	38	5	64	9
Locomotive	799	170	376	19	2	0	17	14	132	23	0	4	6	1	7	10	18	0
Manual handling	755	11	199	59	9	10	11	23	269	13	0	11	15	59	22	6	31	6
Falling in excavations	722	220	148	82	8	0	20	28	48	0	0	0	13	19	73	7	8	48
Inundation or drowning	663	104	225	6	6	0	49	21	139	0	0	6	0	25	6	1	74	0
Strainburst	632	12	9	1	89	1	364	13	11	7	0	0	1	121	0	1	0	0
Monorope/monorail	563	39	113	21	33	3	4	8	67	8	0	4	2	11	215	2	31	2
Miscellaneous	543	21	184	26	1	2	15	16	152	5	0	15	30	37	4	4	25	6
Dust, gas or fumes	425	159	97	18	57	0	22	3	16	0	0	0	7	7	12	8	18	1
Slipping and falling	394	17	84	10	4	0	5	5	199	4	0	3	15	6	8	7	26	1
Nitroglycerine	384	243	54	0	0	0	6	0	7	0	0	6	13	32	18	0	6	0
Falling in shafts	370	72	79	36	6	0	30	0	12	0	0	6	12	6	12	60	24	12
Machinery	335	32	89	25	2	1	16	19	67	2	1	10	3	3	21	3	24	18
Struck by shaft equipment	328	68	122	7	7	0	1	7	69	7	0	0	8	12	1	6	13	0
Explosives (not nitroglycerine)	322	111	85	0	0	6	25	2	15	0	0	2	18	42	0	0	14	0
Transporter	266	33	86	14	0	0	1	3	56	5	0	9	7	6	0	6	34	7
Travelling in shaft	259	52	149	0	0	0	1	6	21	0	0	0	7	14	0	0	7	1
Falling from structures	231	14	69	36	0	0	19	8	46	0	0	0	1	2	14	2	18	1
Hand trammed	207	15	80	19	8	0	1	10	49	9	0	3	4	1	3	1	3	1
Mechanical loader	196	19	64	11	0	2	0	2	70	9	0	3	3	3	1	2	10	0
Electrical equipment	171	8	61	16	2	1	1	1	26	0	0	6	1	1	0	0	41	6
Conveyance malfunction	170	64	7	55	0	6	0	0	0	0	0	0	6	25	0	1	7	0
Fires	164	20	68	0	6	0	6	6	7	0	0	0	1	1	0	47	3	0
Heat sickness	155	18	45	18	4	0	37	10	1	0	0	0	8	8	6	0	0	0
Splinters	154	3	39	75	5	2	1	0	16	0	0	0	1	5	0	1	6	0
Other transport/mining equipment	141	25	38	3	1	1	0	3	42	1	0	2	3	2	2	6	13	0
Motor vehicles	123	30	17	1	0	0	0	0	20	0	0	0	6	0	0	0	48	0
Struck by vent door	98	0	46	2	1	0	4	7	26	2	0	0	1	0	0	1	7	0
Winch (not scraper winch)	85	20	30	7	0	0	0	7	9	1	0	0	2	2	2	1	1	1
Burning and scalding	70	7	15	7	0	0	1	11	13	1	0	1	1	1	1	2	10	0
Occupational diseases	13	0	4	3	0	0	1	0	3	0	0	0	1	0	0	0	0	0
Non-casualty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total da	23186	2343	4713	847	419	135	4031	525	2327	241	5	173	313	5339	559	255	752	210

Table 15b

Analysis of allocated days lost by accident classification and assigned cause

Distribution of accident classifications for each assigned cause compared with overall distribution

Accident classification	Overall distribution	Accident cause																
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
Fall of ground	29.4%	15.4%	15.4%	11.3%	15.1%	5.1%	11.4%	35.0%	11.7%	5.4%	0.9%	22.0%	14.0%	83.9%	2.6%	9.6%	1.2%	9.0%
Rockburst	14.8%	0.0%	2.8%	1.5%	12.7%	63.5%	70.3%	3.5%	0.9%	0.1%	0.0%	0.0%	0.0%	4.4%	2.2%	0.0%	1.7%	9.9%
Locomotive drawn vehicle	5.3%	6.9%	10.3%	7.6%	4.5%	2.6%	0.6%	4.2%	6.7%	44.2%	1.2%	11.2%	10.4%	0.2%	0.6%	9.5%	8.5%	18.2%
Falling rock/material	4.8%	3.6%	7.4%	5.8%	6.7%	1.4%	1.0%	8.5%	7.1%	4.6%	7.5%	10.5%	6.3%	2.5%	11.7%	6.7%	10.9%	4.5%
Scraper winch	3.6%	5.4%	7.3%	5.5%	0.8%	0.3%	0.3%	4.5%	4.5%	5.5%	28.5%	3.1%	7.4%	0.4%	6.8%	1.9%	8.5%	4.4%
Locomotive	3.4%	7.3%	8.0%	2.3%	0.4%	0.0%	0.4%	2.7%	5.7%	9.5%	0.0%	2.2%	2.0%	0.0%	1.2%	3.8%	2.4%	0.0%
Manual handling	3.3%	0.5%	4.2%	7.0%	2.2%	7.5%	0.3%	4.4%	11.6%	5.4%	0.0%	6.2%	4.8%	1.1%	3.9%	2.4%	4.1%	3.0%
Falling in excavations	3.1%	9.4%	3.1%	9.7%	1.9%	0.0%	0.5%	5.4%	2.0%	0.0%	4.5%	0.0%	4.0%	0.4%	13.1%	2.6%	1.1%	23.1%
Inundation or drowning	2.9%	4.5%	4.8%	0.8%	1.5%	0.0%	1.2%	3.9%	6.0%	0.2%	0.0%	3.5%	0.0%	0.5%	1.1%	0.2%	9.8%	0.0%
Strainburst	2.7%	0.5%	0.2%	0.1%	21.2%	1.1%	9.0%	2.4%	0.5%	2.8%	0.0%	0.3%	0.5%	2.3%	0.0%	0.5%	0.1%	0.2%
Monorope/monorail	2.4%	1.7%	2.4%	2.5%	7.8%	2.4%	0.1%	1.6%	2.9%	3.2%	1.1%	2.4%	0.6%	0.2%	38.4%	0.8%	4.1%	1.1%
Miscellaneous	2.3%	0.9%	3.9%	3.1%	0.2%	1.4%	0.4%	3.0%	6.5%	1.9%	7.5%	8.7%	9.5%	0.7%	0.8%	1.6%	3.3%	3.1%
Dust, gas or fumes	1.8%	6.8%	2.1%	2.1%	13.6%	0.0%	0.5%	0.5%	0.7%	0.0%	0.0%	0.0%	2.2%	0.1%	2.1%	3.2%	2.4%	0.5%
Slipping and falling	1.7%	0.7%	1.8%	1.2%	1.0%	0.2%	0.1%	0.9%	8.5%	1.8%	7.9%	1.7%	4.7%	0.1%	1.4%	2.7%	3.4%	0.6%
Nitroglycerine	1.7%	10.4%	1.1%	0.0%	0.0%	0.0%	0.2%	0.0%	0.3%	0.0%	0.0%	3.5%	4.0%	0.6%	3.2%	0.0%	0.8%	0.0%
Falling in shafts	1.6%	3.1%	1.7%	4.2%	1.5%	0.3%	0.7%	0.0%	0.5%	0.1%	0.0%	3.5%	4.0%	0.1%	2.1%	23.6%	3.2%	5.7%
Machinery	1.4%	1.4%	1.9%	2.9%	0.4%	0.9%	0.4%	3.6%	2.9%	1.0%	25.5%	5.6%	0.8%	0.1%	3.7%	1.1%	3.1%	8.4%
Struck by shaft equipment	1.4%	2.9%	2.6%	0.8%	1.6%	0.0%	0.0%	1.4%	3.0%	2.7%	3.4%	0.1%	2.7%	0.2%	0.1%	2.4%	1.8%	0.1%
Explosives (not nitroglycerine)	1.4%	4.8%	1.8%	0.0%	0.0%	4.4%	0.6%	0.4%	0.7%	0.0%	0.0%	1.0%	5.9%	0.8%	0.0%	0.0%	1.9%	0.0%
Transporter	1.1%	1.4%	1.8%	1.6%	0.1%	0.0%	0.0%	0.6%	2.4%	1.9%	0.0%	5.2%	2.2%	0.1%	0.0%	2.5%	4.5%	3.2%
Travelling in shaft	1.1%	2.2%	3.2%	0.0%	0.0%	0.0%	0.0%	1.2%	0.9%	0.2%	5.5%	0.0%	2.3%	0.3%	0.1%	0.1%	0.9%	0.2%
Falling from structures	1.0%	0.6%	1.5%	4.3%	0.1%	0.2%	0.5%	1.4%	2.0%	0.0%	0.0%	0.3%	0.4%	0.0%	2.5%	0.8%	2.4%	0.3%
Hand trammed	0.9%	0.6%	1.7%	2.2%	1.9%	0.0%	0.0%	1.9%	2.1%	3.9%	5.5%	1.5%	1.2%	0.0%	0.5%	0.6%	0.4%	0.4%
Mechanical loader	0.8%	0.8%	1.4%	1.3%	0.1%	1.1%	0.0%	0.4%	3.0%	3.6%	0.3%	1.5%	0.8%	0.1%	0.1%	0.6%	1.3%	0.0%
Electrical equipment	0.7%	0.3%	1.3%	1.9%	0.5%	0.5%	0.0%	0.3%	1.1%	0.0%	0.3%	3.6%	0.2%	0.0%	0.0%	0.1%	5.4%	3.0%
Conveyance malfunction	0.7%	2.7%	0.1%	6.5%	0.1%	4.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.9%	0.5%	0.0%	0.2%	0.9%	0.0%
Fires	0.7%	0.9%	1.4%	0.0%	1.4%	0.0%	0.1%	1.2%	0.3%	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	18.3%	0.4%	0.2%
Heat sickness	0.7%	0.8%	1.0%	2.1%	1.0%	0.0%	0.9%	1.9%	0.0%	0.0%	0.5%	0.1%	2.6%	0.2%	1.1%	0.0%	0.0%	0.0%
Splinters	0.7%	0.1%	0.8%	8.9%	1.1%	1.8%	0.0%	0.0%	0.7%	0.1%	0.0%	0.2%	0.3%	0.1%	0.0%	0.3%	0.8%	0.1%
Other transport/mining equipment	0.6%	1.1%	0.8%	0.4%	0.2%	0.5%	0.0%	0.5%	1.8%	0.3%	0.0%	1.0%	0.8%	0.0%	0.3%	2.4%	1.8%	0.2%
Motor vehicles	0.5%	1.3%	0.4%	0.1%	0.0%	0.0%	0.0%	0.0%	0.8%	0.0%	0.0%	0.2%	2.1%	0.0%	0.0%	0.0%	6.4%	0.0%
Struck by vent door	0.4%	0.0%	1.0%	0.2%	0.2%	0.0%	0.1%	1.3%	1.1%	1.0%	0.0%	0.2%	0.2%	0.0%	0.0%	0.6%	0.9%	0.1%
Winch (not scraper winch)	0.4%	0.9%	0.6%	0.9%	0.0%	0.1%	0.0%	1.4%	0.4%	0.5%	0.0%	0.0%	0.7%	0.0%	0.3%	0.5%	0.2%	0.6%
Burning and scalding	0.3%	0.3%	0.3%	0.8%	0.1%	0.0%	0.0%	2.2%	0.6%	0.3%	0.0%	0.8%	0.2%	0.0%	0.1%	0.6%	1.3%	0.0%
Occupational diseases	0.1%	0.0%	0.1%	0.3%	0.1%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.2%	0.2%	0.0%	0.0%	0.1%	0.0%	0.0%
Non - casualty	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total days divided by 1000	23186	2343	4713	847	419	135	4031	525	2327	241	5	173	313	5339	559	255	752	210

Table 15c

Analysis of allocated days lost by accident classification and assigned cause

Distribution of assigned causes for each accident classification compared with overall distribution

Accident classification	Total days divided by 1000	Accident cause																
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
Fall of ground	6813	5.3%	10.7%	1.4%	0.9%	0.1%	6.8%	2.7%	4.0%	0.2%	0.0%	0.6%	0.6%	65.8%	0.2%	0.4%	0.1%	0.3%
Rockburst	3436	0.0%	3.8%	0.4%	1.6%	2.5%	82.5%	0.5%	0.6%	0.0%	0.0%	0.0%	0.0%	6.8%	0.4%	0.0%	0.4%	0.6%
Locomotive drawn vehicle	1231	13.2%	39.2%	5.2%	1.5%	0.3%	2.0%	1.8%	12.6%	8.6%	0.0%	1.6%	2.6%	0.8%	0.3%	2.0%	5.2%	3.1%
Falling rock/material	1121	7.6%	31.0%	4.4%	2.5%	0.2%	3.6%	4.0%	14.7%	1.0%	0.0%	1.6%	1.8%	12.1%	5.9%	1.5%	7.3%	0.8%
Scraper winch	846	15.0%	40.5%	5.5%	0.4%	0.1%	1.6%	2.8%	12.5%	1.6%	0.2%	0.6%	2.7%	2.8%	4.5%	0.6%	7.6%	1.1%
Locomotive	799	21.3%	47.1%	2.4%	0.2%	0.0%	2.2%	1.8%	16.6%	2.9%	0.0%	0.5%	0.8%	0.1%	0.8%	1.2%	2.2%	0.0%
Manual handling	755	1.4%	26.3%	7.9%	1.2%	1.3%	1.5%	3.1%	35.7%	1.7%	0.0%	1.4%	2.0%	7.9%	2.9%	0.8%	4.1%	0.8%
Falling in excavations	722	30.4%	20.5%	11.4%	1.1%	0.0%	2.8%	3.9%	6.6%	0.0%	0.0%	0.0%	1.7%	2.6%	10.1%	0.9%	1.1%	6.7%
Inundation or drowning	663	15.7%	34.0%	1.0%	1.0%	0.0%	7.4%	3.1%	20.9%	0.1%	0.0%	0.9%	0.0%	3.8%	0.9%	0.1%	11.2%	0.0%
Strainburst	632	1.9%	1.4%	0.2%	14.0%	0.2%	57.7%	2.0%	1.7%	1.1%	0.0%	0.1%	0.2%	19.2%	0.0%	0.2%	0.1%	0.1%
Monorope/monorail	563	6.9%	20.1%	3.7%	5.8%	0.6%	0.7%	1.5%	12.0%	1.4%	0.0%	0.7%	0.4%	1.9%	38.1%	0.4%	5.5%	0.4%
Miscellaneous	543	3.8%	33.9%	4.8%	0.2%	0.4%	2.8%	2.9%	28.1%	0.9%	0.1%	2.8%	5.4%	6.8%	0.8%	0.7%	4.6%	1.2%
Dust, gas or fumes	425	37.5%	22.8%	4.2%	13.4%	0.0%	5.1%	0.6%	3.8%	0.0%	0.0%	0.0%	1.7%	1.6%	2.8%	1.9%	4.3%	0.2%
Slipping and falling	394	4.4%	21.3%	2.6%	1.0%	0.1%	1.2%	1.1%	50.5%	1.1%	0.1%	0.7%	3.7%	1.6%	1.9%	1.8%	6.5%	0.3%
Nitroglycerine	384	63.3%	14.0%	0.0%	0.0%	0.0%	1.6%	0.0%	1.7%	0.0%	0.0%	1.6%	3.3%	8.3%	4.7%	0.0%	1.6%	0.0%
Falling in shafts	370	19.6%	21.4%	9.7%	1.7%	0.1%	8.1%	0.0%	5.4%	0.1%	0.0%	1.6%	3.4%	1.7%	3.2%	16.2%	6.5%	3.2%
Machinery	335	9.6%	26.7%	7.4%	0.5%	0.3%	4.9%	5.6%	19.9%	0.7%	0.4%	2.9%	0.8%	0.9%	6.2%	0.8%	7.0%	5.3%
Struck by shaft equipment	328	20.8%	37.3%	2.0%	2.0%	0.0%	0.2%	2.2%	21.1%	2.0%	0.1%	0.1%	2.5%	3.7%	0.2%	1.8%	4.1%	0.0%
Explosives (not nitroglycerine)	322	34.6%	26.5%	0.1%	0.1%	1.9%	7.8%	0.7%	4.7%	0.0%	0.0%	0.6%	5.7%	13.1%	0.0%	0.0%	4.3%	0.0%
Transporter	266	12.3%	32.4%	5.1%	0.1%	0.0%	0.2%	1.1%	21.2%	1.7%	0.0%	3.4%	2.6%	2.3%	0.0%	2.4%	12.6%	2.5%
Travelling in shaft	259	20.1%	57.5%	0.2%	0.0%	0.0%	0.2%	2.3%	8.1%	0.1%	0.1%	0.0%	2.8%	5.4%	0.2%	0.1%	2.7%	0.2%
Falling from structures	231	5.9%	29.7%	15.8%	0.1%	0.1%	8.4%	3.3%	20.0%	0.0%	0.0%	0.2%	0.5%	0.9%	6.1%	0.8%	7.9%	0.2%
Hand trammed	207	7.0%	38.7%	9.0%	3.9%	0.0%	0.7%	4.7%	23.7%	4.5%	0.1%	1.2%	1.8%	0.7%	1.2%	0.7%	1.6%	0.4%
Mechanical loader	196	9.4%	32.7%	5.7%	0.2%	0.8%	0.1%	1.0%	35.7%	4.4%	0.0%	1.3%	1.3%	1.7%	0.3%	0.8%	4.9%	0.0%
Electrical equipment	171	4.7%	35.8%	9.3%	1.2%	0.4%	0.5%	0.8%	15.1%	0.0%	0.0%	3.6%	0.3%	0.7%	0.1%	0.1%	23.8%	3.7%
Conveyance malfunction	170	37.5%	3.9%	32.2%	0.3%	3.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.5%	14.7%	0.0%	0.3%	4.0%	0.0%
Fires	164	12.2%	41.4%	0.1%	3.7%	0.0%	3.7%	3.7%	4.1%	0.0%	0.0%	0.0%	0.3%	0.3%	0.0%	28.3%	2.0%	0.3%
Heat sickness	155	11.6%	29.2%	11.7%	2.7%	0.0%	23.7%	6.5%	0.4%	0.0%	0.0%	0.1%	5.2%	5.2%	3.9%	0.0%	0.0%	0.0%
Splinters	154	2.0%	25.0%	48.6%	2.9%	1.6%	0.4%	0.0%	10.3%	0.2%	0.0%	0.2%	0.6%	3.2%	0.2%	0.6%	4.1%	0.1%
Other transport/mining equipment	141	17.5%	26.8%	2.3%	0.5%	0.5%	0.2%	1.9%	29.9%	0.5%	0.0%	1.3%	1.8%	1.4%	1.3%	4.4%	9.5%	0.3%
Motor vehicles	123	24.5%	14.0%	0.8%	0.0%	0.0%	0.1%	0.0%	16.0%	0.1%	0.0%	0.3%	5.3%	0.0%	0.0%	0.0%	39.0%	0.0%
Struck by vent door	98	0.2%	47.2%	2.0%	1.0%	0.1%	3.8%	6.8%	26.9%	2.4%	0.0%	0.4%	0.7%	0.1%	0.0%	1.5%	6.9%	0.2%
Winch (not scraper winch)	85	23.5%	35.5%	8.7%	0.1%	0.2%	0.4%	8.5%	10.3%	1.5%	0.0%	0.0%	2.5%	2.5%	1.9%	1.4%	1.6%	1.4%
Burning and scalding	70	10.6%	21.1%	10.2%	0.3%	0.0%	1.0%	16.3%	18.7%	1.0%	0.0%	1.9%	1.0%	1.1%	1.0%	2.2%	13.8%	0.0%
Occupational diseases	13	1.8%	32.9%	21.9%	3.5%	0.0%	6.1%	1.9%	19.4%	0.0%	0.0%	2.7%	4.6%	1.8%	0.0%	2.6%	0.5%	0.0%
Overall distribution	23186	10.1%	20.3%	3.7%	1.8%	0.6%	17.4%	2.3%	10.0%	1.0%	0.0%	0.7%	1.3%	23.0%	2.4%	1.1%	3.2%	0.9%

Table 16a

Analysis of allocated days lost by classification and cause

Number of days divided by 1000

Accident classification	Total days	Accident cause					
		Inadequate examination/ inspection/ test	Failure to comply with practice/ standards/ procedures	Lack of (or unsuitable) system(s)/ facilities	Failure to comply with instructions	Lack of caution/ alertness	Other causes
Fall of ground	6813	4481	727	461	360	273	512
Rockburst/strainburst	4068	356	140	3198	12	31	331
Trackbound vehicle	2030	11	859	41	333	287	498
Falling	1323	27	296	70	306	106	518
Falling materials	1121	135	347	41	85	165	347
Scrapers/winches	931	26	373	14	147	114	257
Manual handling	755	59	199	11	11	269	206
Inundation or drowning	663	25	225	49	104	139	121
Explosives	706	74	139	31	355	22	85
Other classifications	4774	144	1409	115	630	920	1558
TOTAL	23186	5339	4713	4031	2343	2327	4434

Distribution of causes for each accident classification compared with overall distribution

Accident classification	Total days (divided by 1000)	Accident cause					
		Inadequate examination/ inspection/ test	Failure to comply with practice/ standards/ procedures	Lack of (or unsuitable) system(s)/ facilities	Failure to comply with instructions	Lack of caution/ alertness	Other causes
Fall of ground	6813	65.8%	10.7%	6.8%	5.3%	4.0%	7.5%
Rockburst/strainburst	4068	8.7%	3.4%	78.6%	0.3%	0.8%	8.1%
Trackbound vehicle	2030	0.6%	42.3%	2.0%	16.4%	14.2%	24.5%
Falling	1323	2.1%	22.4%	5.3%	23.1%	8.0%	39.2%
Falling materials	1121	12.1%	31.0%	3.6%	7.6%	14.7%	31.0%
Scrapers/winches	931	2.8%	40.0%	1.5%	15.8%	12.3%	27.6%
Manual handling	755	7.9%	26.3%	1.5%	1.4%	35.7%	27.3%
Inundation or drowning	663	3.8%	34.0%	7.4%	15.7%	20.9%	18.2%
Explosives	706	10.5%	19.7%	4.4%	50.2%	3.1%	12.1%
Other classifications	4774	3.0%	29.5%	2.4%	13.2%	19.3%	32.6%
TOTAL	23186	23.0%	20.3%	17.4%	10.1%	10.0%	19.1%

Table 16b

Analysis of allocated days lost by classification and cause (Bushveld Igneous Complex)

Number of days divided by 1000

Accident classification	Total days	Accident cause					
		Inadequate examination/ inspection/ test	Failure to comply with practice/ standards/ procedures	Lack of (or unsuitable) system(s)/ facilities	Failure to comply with instructions	Lack of caution/ alertness	Other causes
Fall of ground	549	406	60	12	18	13	39
Rockburst/strainburst	3	1	0	0	0	0	0
Trackbound vehicle	119	6	63	1	0	28	20
Falling	120	6	34	6	19	16	38
Falling materials	91	24	35	0	12	14	6
Scrapers/winches	75	0	36	0	20	7	13
Manual handling	71	6	33	1	0	20	11
Inundation or drowning	30	6	12	0	12	0	0
Explosives	86	16	30	0	8	0	32
Other classifications	454	47	135	2	90	76	104
TOTAL	1597	518	440	24	179	174	263

Distribution of causes for each accident classification compared with overall distribution

Accident classification	Total days (divided by 1000)	Accident cause					
		Inadequate examination/ inspection/ test	Failure to comply with practice/ standards/ procedures	Lack of (or unsuitable) system(s)/ facilities	Failure to comply with instructions	Lack of caution/ alertness	Other causes
Fall of ground	549	73.9%	11.0%	2.2%	3.3%	2.4%	7.2%
Rockburst/strainburst	3	52.2%	7.9%	17.2%	0.0%	5.6%	17.2%
Trackbound vehicle	119	5.1%	53.5%	1.1%	0.4%	23.4%	16.7%
Falling	120	5.2%	28.5%	5.3%	15.6%	13.4%	32.0%
Falling materials	91	26.3%	38.8%	0.3%	13.3%	15.1%	6.2%
Scrapers/winches	75	0.2%	47.6%	0.0%	25.9%	9.2%	17.1%
Manual handling	71	8.5%	46.8%	1.3%	0.0%	28.2%	15.2%
Inundation or drowning	30	19.7%	40.4%	0.0%	39.4%	0.4%	0.0%
Explosives	86	18.2%	34.9%	0.0%	9.4%	0.1%	37.3%
Other classifications	454	10.3%	29.7%	0.5%	19.9%	16.7%	22.8%
TOTAL	1597	32.4%	27.5%	1.5%	11.2%	10.9%	16.5%

Table 16c

Analysis of allocated days lost by classification and cause (Central Rand)

Number of days divided by 1000

Accident classification	Total days	Accident cause					
		Inadequate examination/ inspection/ test	Failure to comply with practice/ standards/ procedures	Lack of (or unsuitable) system(s)/ facilities	Failure to comply with instructions	Lack of caution/ alertness	Other causes
Fall of ground	601	337	68	25	32	55	85
Rockburst/strainburst	305	30	31	216	0	1	28
Trackbound vehicle	225	1	114	0	44	39	27
Falling	121	7	23	6	19	9	58
Falling materials	94	5	26	2	7	20	34
Scrapers/winches	88	7	44	3	2	10	22
Manual handling	72	2	14	3	8	29	17
Inundation or drowning	82	0	14	6	18	18	26
Explosives	46	0	12	0	6	2	25
Other classifications	604	9	175	17	107	150	146
TOTAL	2237	397	521	277	243	332	467

Distribution of causes for each accident classification compared with overall distribution

Accident classification	Total days (divided by 1000)	Accident cause					
		Inadequate examination/ inspection/ test	Failure to comply with practice/ standards/ procedures	Lack of (or unsuitable) system(s)/ facilities	Failure to comply with instructions	Lack of caution/ alertness	Other causes
Fall of ground	601	56.2%	11.3%	4.1%	5.2%	9.1%	14.1%
Rockburst/strainburst	305	9.7%	10.1%	70.7%	0.0%	0.2%	9.3%
Trackbound vehicle	225	0.4%	50.6%	0.2%	19.5%	17.3%	12.1%
Falling	121	5.5%	18.6%	5.1%	15.6%	7.3%	48.0%
Falling materials	94	5.3%	27.6%	1.7%	7.9%	21.7%	35.9%
Scrapers/winches	88	7.5%	50.5%	3.4%	2.1%	11.6%	24.9%
Manual handling	72	2.6%	19.6%	4.0%	11.2%	39.5%	23.1%
Inundation or drowning	82	0.6%	16.9%	7.3%	22.0%	22.0%	31.3%
Explosives	46	0.2%	27.1%	0.4%	13.6%	4.3%	54.4%
Other classifications	604	1.4%	29.0%	2.8%	17.7%	24.8%	24.2%
TOTAL	2237	17.7%	23.3%	12.4%	10.8%	14.8%	20.9%

Table 16d

Analysis of allocated days lost by classification and cause (Eastern Transvaal)

Number of days divided by 1000

Accident classification	Total days	Accident cause					
		Inadequate examination/ inspection/ test	Failure to comply with practice/ standards/ procedures	Lack of (or unsuitable) system(s)/ facilities	Failure to comply with instructions	Lack of caution/ alertness	Other causes
Fall of ground	14	7	6	0	0	0	1
Rockburst/strainburst	1	0	0	0	0	0	0
Trackbound vehicle	16	0	14	0	0	0	2
Falling	26	0	12	0	6	0	7
Falling materials	9	0	1	1	0	1	7
Scrapers/winches	1	0	0	1	0	0	0
Manual handling	10	1	7	0	0	1	1
Inundation or drowning	12	0	6	0	6	0	0
Explosives	8	0	6	0	1	0	0
Other classifications	89	1	25	1	6	4	52
TOTAL	186	10	77	3	20	6	70

Distribution of causes for each accident classification compared with overall distribution

Accident classification	Total days (divided by 1000)	Accident cause					
		Inadequate examination/ inspection/ test	Failure to comply with practice/ standards/ procedures	Lack of (or unsuitable) system(s)/ facilities	Failure to comply with instructions	Lack of caution/ alertness	Other causes
Fall of ground	14	49.3%	43.1%	0.0%	0.0%	2.5%	5.0%
Rockburst/strainburst	1	92.0%	0.0%	0.0%	0.0%	0.0%	8.0%
Trackbound vehicle	16	0.0%	86.2%	1.6%	0.0%	0.2%	12.0%
Falling	26	0.0%	48.0%	0.0%	23.3%	0.0%	28.8%
Falling materials	9	0.0%	12.9%	6.4%	0.0%	8.2%	72.4%
Scrapers/winches	1	0.0%	0.0%	92.6%	0.0%	0.0%	7.4%
Manual handling	10	8.2%	71.3%	2.5%	2.4%	8.8%	6.8%
Inundation or drowning	12	0.0%	48.5%	0.0%	48.5%	0.0%	3.0%
Explosives	8	5.9%	75.6%	0.0%	18.5%	0.0%	0.0%
Other classifications	89	1.3%	27.9%	0.6%	7.1%	4.3%	58.8%
TOTAL	186	5.3%	41.6%	1.5%	10.8%	3.1%	37.7%

Table 16e

Analysis of allocated days lost by classification and cause (Evander)

Number of days divided by 1000

Accident classification	Total days	Accident cause					
		Inadequate examination/ inspection/ test	Failure to comply with practice/ standards/ procedures	Lack of (or unsuitable) system(s)/ facilities	Failure to comply with instructions	Lack of caution/ alertness	Other causes
Fall of ground	226	136	33	1	12	40	4
Rockburst/strainburst	1	0	0	0	0	0	0
Trackbound vehicle	66	1	36	0	4	4	21
Falling	28	0	13	0	6	7	2
Falling materials	46	4	4	1	0	4	33
Scrapers/winches	35	2	6	0	3	5	19
Manual handling	27	0	2	1	1	12	10
Inundation or drowning	24	0	6	0	0	18	0
Explosives	23	0	16	0	7	0	0
Other classifications	151	14	37	2	21	44	33
TOTAL	626	157	152	6	54	135	123

Distribution of causes for each accident classification compared with overall distribution

Accident classification	Total days (divided by 1000)	Accident cause					
		Inadequate examination/ inspection/ test	Failure to comply with practice/ standards/ procedures	Lack of (or unsuitable) system(s)/ facilities	Failure to comply with instructions	Lack of caution/ alertness	Other causes
Fall of ground	226	60.1%	14.4%	0.4%	5.4%	17.8%	1.9%
Rockburst/strainburst	1	5.6%	0.0%	42.8%	0.0%	51.6%	0.0%
Trackbound vehicle	66	1.0%	55.1%	0.0%	5.5%	6.6%	31.8%
Falling	28	0.1%	46.4%	0.0%	21.8%	24.4%	7.3%
Falling materials	46	9.2%	8.0%	2.6%	0.1%	8.2%	71.9%
Scrapers/winches	35	5.0%	16.3%	1.0%	8.9%	13.3%	55.5%
Manual handling	27	1.5%	9.1%	2.6%	4.2%	46.0%	36.5%
Inundation or drowning	24	0.0%	24.9%	0.1%	0.3%	74.6%	0.1%
Explosives	23	0.9%	69.1%	0.0%	29.1%	0.0%	0.8%
Other classifications	151	9.4%	24.2%	1.3%	13.9%	29.3%	21.9%
TOTAL	626	25.1%	24.2%	0.9%	8.6%	21.5%	19.6%

Table 15

Analysis of allocated days lost by classification and cause (Far West Rand)

Number of days divided by 1000

Accident classification	Total days	Accident cause					
		Inadequate examination/ inspection/ test	Failure to comply with practice/ standards/ procedures	Lack of (or unsuitable) system(s)/ facilities	Failure to comply with instructions	Lack of caution/ alertness	Other causes
Fall of ground	1516	1138	12	215	38	46	67
Rockburst/strainburst	2886	250	38	2474	0	19	106
Trackbound vehicle	588	1	182	7	93	129	175
Falling	436	7	69	19	110	38	194
Falling materials	236	46	44	9	8	46	83
Scrapers/winches	366	2	117	2	61	56	127
Manual handling	256	47	40	2	0	95	71
Inundation or drowning	229	1	48	31	14	84	51
Explosives	117	14	26	30	27	12	7
Other classifications	1322	20	309	31	138	281	543
TOTAL	7952	1526	886	2820	489	806	1425

Distribution of causes for each accident classification compared with overall distribution

Accident classification	Total days (divided by 1000)	Accident cause					
		Inadequate examination/ inspection/ test	Failure to comply with practice/ standards/ procedures	Lack of (or unsuitable) system(s)/ facilities	Failure to comply with instructions	Lack of caution/ alertness	Other causes
Fall of ground	1516	75.1%	0.8%	14.2%	2.5%	3.0%	4.4%
Rockburst/strainburst	2886	8.6%	1.3%	85.7%	0.0%	0.7%	3.7%
Trackbound vehicle	588	0.2%	31.0%	1.2%	15.8%	22.0%	29.8%
Falling	436	1.6%	15.8%	4.3%	25.2%	8.6%	44.4%
Falling materials	236	19.6%	18.7%	3.9%	3.2%	19.3%	35.3%
Scrapers/winches	366	0.6%	32.0%	0.6%	16.6%	15.4%	34.8%
Manual handling	256	18.3%	15.6%	0.9%	0.1%	37.2%	27.9%
Inundation or drowning	229	0.2%	21.0%	13.4%	6.1%	36.8%	22.4%
Explosives	117	12.4%	22.1%	26.1%	23.2%	10.3%	5.9%
Other classifications	1322	1.5%	23.4%	2.3%	10.4%	21.3%	41.1%
TOTAL	7952	19.2%	11.1%	35.5%	6.1%	10.1%	17.9%

Table 16g

Analysis of allocated days lost by classification and cause (Klerksdorp)

Number of days divided by 1000

Accident classification	Total days	Accident cause					
		Inadequate examination/ inspection/ test	Failure to comply with practice/ standards/ procedures	Lack of (or unsuitable) system(s)/ facilities	Failure to comply with instructions	Lack of caution/ alertness	Other causes
Fall of ground	1439	923	105	97	80	85	148
Rockburst/strainburst	499	16	20	295	0	11	157
Trackbound vehicle	393	3	142	21	48	49	129
Falling	201	0	45	18	48	21	69
Falling materials	184	13	27	7	7	45	85
Scrapers/winches	128	5	57	0	14	25	27
Manual handling	169	1	28	3	0	90	46
Inundation or drowning	92	18	42	0	0	6	25
Explosives	226	31	21	0	161	6	6
Other classifications	952	8	324	32	102	212	274
TOTAL	4283	1017	813	475	461	550	967

Distribution of causes for each accident classification compared with overall distribution

Accident classification	Total days (divided by 1000)	Accident cause					
		Inadequate examination/ inspection/ test	Failure to comply with practice/ standards/ procedures	Lack of (or unsuitable) system(s)/ facilities	Failure to comply with instructions	Lack of caution/ alertness	Other causes
Fall of ground	1439	64.1%	7.3%	6.8%	5.6%	5.9%	10.3%
Rockburst/strainburst	499	3.2%	4.0%	59.2%	0.0%	2.2%	31.5%
Trackbound vehicle	393	0.7%	36.2%	5.4%	12.2%	12.6%	32.9%
Falling	201	0.0%	22.5%	8.9%	24.0%	10.3%	34.3%
Falling materials	184	6.8%	14.8%	4.0%	3.7%	24.5%	46.0%
Scrapers/winches	128	3.6%	44.3%	0.1%	11.1%	19.4%	21.5%
Manual handling	169	0.8%	16.8%	1.7%	0.2%	53.2%	27.4%
Inundation or drowning	92	19.5%	46.0%	0.5%	0.0%	6.9%	27.1%
Explosives	226	13.6%	9.4%	0.2%	71.4%	2.7%	2.8%
Other classifications	952	0.9%	34.0%	3.3%	10.7%	22.3%	28.7%
TOTAL	4283	23.7%	19.0%	11.1%	10.8%	12.8%	22.6%

Table 17a

Analysis of allocated days lost by type of place and assigned cause

Number of days divided by 1000

Type of place	Total days	Assigned cause					
		Inadequate examination/ inspection/ test	Failure to comply with practice/ standards/ procedure	Lack of (or unsuitable) system(s)/ facilities	Failure to comply with instructions	Lack of caution/ alertness	Other causes
Stope face	8138	2778	864	2843	411	385	858
Haulage, Return airway, Travelling way	2801	303	873	208	331	404	682
Shaft (Vertical/Incline/Sinking)	2672	263	720	88	541	411	648
Crosscut	1897	420	481	138	146	279	433
Strike gully	1415	436	268	262	103	83	265
Centre gully/Tip	1065	225	275	67	104	127	266
Boxhole/Orepass	765	42	171	28	263	50	211
Stope worked out area/reclamation area/entrance	740	218	177	53	65	47	180
Raise/Winze	726	171	109	106	123	54	163
Reef drive	624	174	153	111	29	74	83
Development end	541	222	87	56	46	41	89
Conveyors/Surface transport	414	2	133	30	38	86	125
Surface sites	403	3	139	15	66	83	98
Engineering locations	372	29	91	8	19	94	131
Plant locations	312	2	81	9	26	59	135
Other locations	299	52	89	9	31	50	68
Total days	23186	5339	4713	4031	2343	2327	4434

Table 17b

Analysis of allocated days lost by type of place and assigned cause

Distribution of types of place for each assigned cause compared with overall distribution

Type of place	Overall distribution	Assigned cause					
		Inadequate examination/ inspection/ test	Failure to comply with practice/ standards/ procedure	Lack of (or unsuitable) system(s)/ facilities	Failure to comply with instructions	Lack of caution/ alertness	Other causes
Stope face	35.1%	52.0%	18.3%	70.5%	17.5%	16.5%	19.4%
Haulage, Return airway, Travelling way	12.1%	5.7%	18.5%	5.1%	14.1%	17.4%	15.4%
Shaft (Vertical/Incline/Sinking)	11.5%	4.9%	15.3%	2.2%	23.1%	17.7%	14.6%
Crosscut	8.2%	7.9%	10.2%	3.4%	6.2%	12.0%	9.8%
Strike gully	6.1%	8.2%	5.7%	6.5%	4.4%	3.6%	6.0%
Centre gully/Tip	4.6%	4.2%	5.8%	1.7%	4.4%	5.4%	6.0%
Boxhole/Orepass	3.3%	0.8%	3.6%	0.7%	11.2%	2.2%	4.8%
Stope worked out area/reclamation area/entrance	3.2%	4.1%	3.8%	1.3%	2.8%	2.0%	4.0%
Raise/Winze	3.1%	3.2%	2.3%	2.6%	5.3%	2.3%	3.7%
Reef drive	2.7%	3.3%	3.3%	2.8%	1.2%	3.2%	1.9%
Development end	2.3%	4.2%	1.8%	1.4%	2.0%	1.8%	2.0%
Conveyors/Surface transport	1.8%	0.0%	2.8%	0.7%	1.6%	3.7%	2.8%
Surface sites	1.7%	0.0%	3.0%	0.4%	2.8%	3.6%	2.2%
Engineering locations	1.6%	0.5%	1.9%	0.2%	0.8%	4.1%	2.9%
Plant locations	1.3%	0.0%	1.7%	0.2%	1.1%	2.5%	3.1%
Other locations	1.3%	1.0%	1.9%	0.2%	1.3%	2.1%	1.5%
Total days divided by 1000	23186	5339	4713	4031	2343	2327	4434

Table 17c

Analysis of allocated days lost by type of place and assigned cause

Distribution of assigned causes for each type of place compared with overall distribution

Type of place	Total days divided by 1000	Assigned cause					
		Inadequate examination/ inspection/ test	Failure to comply with practice/ standards/ procedure	Lack of (or unsuitable) system(s)/ facilities	Failure to comply with instructions	Lack of caution/ alertness	Other causes
Stope face	8138	34.1%	10.6%	34.9%	5.0%	4.7%	10.5%
Haulage, Return airway, Travelling way	2801	10.8%	31.2%	7.4%	11.8%	14.4%	24.3%
Shaft (Vertical/Incline/Sinking)	2672	9.9%	27.0%	3.3%	20.3%	15.4%	24.2%
Crosscut	1897	22.1%	25.4%	7.3%	7.7%	14.7%	22.8%
Strike gully	1415	30.8%	18.9%	18.5%	7.3%	5.9%	18.7%
Centre gully/Tip	1065	21.1%	25.8%	6.3%	9.8%	11.9%	25.0%
Boxhole/Orepass	765	5.5%	22.3%	3.7%	34.4%	6.6%	27.6%
Stope worked out area/reclamation area/entrance	740	29.4%	24.0%	7.2%	8.8%	6.4%	24.3%
Raise/Winze	726	23.6%	15.0%	14.7%	17.0%	7.4%	22.4%
Reef drive	624	27.8%	24.6%	17.8%	4.6%	11.9%	13.3%
Development end	541	41.1%	16.1%	10.3%	8.5%	7.6%	16.4%
Conveyors/Surface transport	414	0.5%	32.1%	7.3%	9.1%	20.8%	30.2%
Surface sites	403	0.7%	34.6%	3.7%	16.3%	20.6%	24.2%
Engineering locations	372	7.8%	24.4%	2.2%	5.0%	25.4%	35.1%
Plant locations	312	0.6%	26.1%	2.8%	8.5%	18.8%	43.3%
Other locations	299	17.2%	29.9%	3.1%	10.5%	16.7%	22.6%
Overall distribution	23186	23.0%	20.3%	17.4%	10.1%	10.0%	19.1%

Table 18

Number of contraventions assessed by the RME

Type of contravention	Total number				Percentage			
	Incidents	Fatalities	Reportable injuries	Allocated days	Incidents	Fatalities	Reportable injuries	Allocated days
Definitely no contravention	43508	2199	40932	19839165	94.0%	82.7%	94.5%	85.6%
Contravention in the opinion of RME, though inconclusive	2417	85	2197	1021989	5.2%	3.2%	5.1%	4.4%
Probable prosecution	366	376	180	2324367	0.8%	14.1%	0.4%	10.0%
TOTAL	46291	2660	43309	23185521	100.0%	100.0%	100.0%	100.0%

Table 19a

Relationship between accident classifications and contraventions

Number of days divided by 1000

Accident classification	Total	Type of contravention		
		Definitely no contravention	Contravention in opinion of RME, though evidence inconclusive	Probable prosecution
Fall of ground	6813	6161	258	395
Rockburst	3436	3408	28	0
Locomotive drawn vehicle	1231	1004	52	174
Falling rock/material	1121	999	23	99
Scraper winch	846	712	91	42
Locomotive	799	534	67	198
Manual handling	755	735	8	12
Falling in excavations	722	441	65	216
Inundation or drowning	663	577	27	60
Strainburst	632	610	15	6
Monorope/monorail	563	469	91	2
Miscellaneous	468	429	8	30
Dust, gas or fumes	425	270	43	112
Slipping and falling	394	376	12	6
Nitroglycerine	384	96	17	272
Falling in shafts	370	242	26	102
Machinery	335	286	10	39
Struck by shaft equipment	328	241	20	66
Explosives (not nitroglycerine)	322	168	60	94
Transporter	266	215	2	48
Travelling in shaft	259	196	17	46
Falling from structures	231	199	14	18
Heat sickness	230	218	0	12
Hand trammed	207	206	1	0
Mechanical loader	196	177	13	6
Electrical equipment	171	120	9	42
Conveyance malfunction	170	4	6	161
Fires	164	142	2	19
Splinters	154	154	0	0
Other transport/mining equipment	141	117	12	12
Motor vehicles	123	98	18	6
Struck by vent door	98	97	0	0
Winch (not scraper winch)	85	63	4	18
Burning and scalding	70	59	2	9
Occupational diseases	13	13	0	0
Non-casualty	0	0	0	0
Total	23186	19839	1022	2324

Table 20a

Relationship between assigned causes and contraventions

Number of days divided by 1000

Cause	Total	Type of contravention		
		Definitely no contravention	Contravention in opinion of RME, though evidence inconclusive	Probable prosecution
Inadequate examination/inspection/test	5339	5025	202	111
Failure to comply with recognized good practice/standards/procedure	4713	3959	173	581
Lack of (or unsuitable) system(s)/facilities	4031	3978	53	0
Failure to comply with instructions	2343	879	337	1127
Lack of caution/alertness	2327	2248	27	51
Failure to use safety or protective devices/equipment/systems	847	676	39	133
Use of unsuitable/defective equipment/materials/facilities	752	664	52	36
Inadequate (lack of) fencing/guarding	559	418	79	63
Lack of (or inadequate) standards/procedures	525	455	23	46
Failure to supply safety or protective devices/equipment/systems	419	383	6	30
Inadequate supervision/discipline	313	233	8	72
Inadequate preventive maintenance	255	237	5	13
Lack of clearance (obstruction)	241	213	10	18
Rendering safety device ineffective	210	168	5	37
Lack of adequate/suitable training/instruction	173	170	2	0
Failure to supply proper tools/equipment	135	128	1	6
Lack of illumination/visibility	5	5	0	0
Total	23186	19839	1022	2324

Table 20b

Relationship between assigned causes and contraventions

Distribution of contraventions for each cause compared with overall distribution

Cause	Number of days divided by 1000	Type of contravention		
		Definitely no contravention	Contravention in opinion of RME, though evidence inconclusive	Probable prosecution
Inadequate examination/inspection/test	5339	94.1%	3.8%	2.1%
Failure to comply with recognized good practice/standards/procedure	4713	84.0%	3.7%	12.3%
Lack of (or unsuitable) system(s)/facilities	4031	98.7%	1.3%	0.0%
Failure to comply with instructions	2343	37.5%	14.4%	48.1%
Lack of caution/alertness	2327	96.6%	1.2%	2.2%
Failure to use safety or protective devices/equipment/systems	847	79.8%	4.6%	15.7%
Use of unsuitable/defective equipment/materials/facilities	752	88.3%	6.9%	4.8%
Inadequate (lack of) fencing/guarding	559	74.7%	14.1%	11.2%
Lack of (or inadequate) standards/procedures	525	86.7%	4.5%	8.8%
Failure to supply safety or protective devices/equipment/systems	419	91.3%	1.5%	7.2%
Inadequate supervision/discipline	313	74.4%	2.5%	23.1%
Inadequate preventive maintenance	255	93.0%	1.9%	5.1%
Lack of clearance (obstruction)	241	88.5%	4.0%	7.5%
Rendering safety device ineffective	210	79.9%	2.5%	17.6%
Lack of adequate/suitable training/instruction	173	98.8%	1.2%	0.0%
Failure to supply proper tools/equipment	135	94.8%	0.7%	4.4%
Lack of illumination/visibility	5	100.0%	0.0%	0.0%
Overall distribution	23186	85.6%	4.4%	10.0%

Table 21

Distribution of accidents by experience in occupation – 1992 data only

Experience years	Total number				Percentage			
	Incidents	Fatalities	Reportable injuries	Allocated days	Incidents	Fatalities	Reportable injuries	Allocated days
0	1729	79	1650	781799	21.9%	17.8%	22.1%	20.0%
1	739	44	695	385297	9.4%	9.9%	9.3%	9.9%
2	744	42	702	361196	9.4%	9.4%	9.4%	9.3%
3	743	36	707	332482	9.4%	8.1%	9.5%	8.5%
4	705	33	672	296233	8.9%	7.4%	9.0%	7.6%
5	521	31	490	267121	6.6%	7.0%	6.6%	6.8%
6	585	39	546	317108	7.4%	8.8%	7.3%	8.1%
7	429	27	402	230090	5.4%	6.1%	5.4%	5.9%
8	307	23	284	180001	3.9%	5.2%	3.8%	4.6%
9	244	9	235	88534	3.1%	2.0%	3.2%	2.3%
10	234	8	226	87596	3.0%	1.8%	3.0%	2.2%
11	170	10	160	79151	2.2%	2.2%	2.1%	2.0%
12	165	16	149	121327	2.1%	3.6%	2.0%	3.1%
13	129	5	124	48888	1.6%	1.1%	1.7%	1.3%
14	120	9	111	68953	1.5%	2.0%	1.5%	1.8%
15	72	7	65	50631	0.9%	1.6%	0.9%	1.3%
16	46	5	41	34671	0.6%	1.1%	0.6%	0.9%
17	34	1	33	12514	0.4%	0.2%	0.4%	0.3%
18	32	5	27	34183	0.4%	1.1%	0.4%	0.9%
19	18	3	15	23589	0.2%	0.7%	0.2%	0.6%
20	25	1	24	8683	0.3%	0.2%	0.3%	0.2%
>20	104	12	92	90472	1.3%	2.7%	1.2%	2.3%
TOTAL	7895	445	7450	3900519	100.0%	100.0%	100.0%	100.0%

Table 22a

Analysis of allocated lost days by accident classification and experience – 1992 onl

Number of days divided by 1000

Accident classification	Total days	Experience band (years in occupation)					
		< 1	1–2	2–5	5–10	10–20	> 20
Fall of ground	1115	254	119	302	298	136	6
Rockburst	799	114	71	197	222	158	38
Falling rock/material	191	42	17	34	64	25	8
Locomotive drawn vehicle	187	53	8	58	39	28	2
Locomotive	162	44	11	3[illegible]	43	33	0
Scraper winch	155	22	15	34	61	17	7
Inundation or drowning	131	7	13	60	25	13	12
Manual handling	128	34	10	33	29	20	1
Strainburst	119	42	19	11	29	17	0
Monorope/monorail	101	20	20	28	20	13	0
Falling in excavations	94	13	18	19	20	24	0
Machinery	61	15	4	13	16	11	2
Slipping and falling	57	9	4	20	14	10	1
Travelling in shaft	56	2	3	14	20	12	6
Miscellaneous	55	12	5	10	22	5	1
Dust, gas or fumes	50	24	3	1	21	0	1
Struck by shaft equipment	46	1	7	1	31	6	0
Nitroglycerine	45	7	1	13	18	6	0
Explosives (not nitroglycerine)	41	3	0	20	16	2	0
Heat sickness	38	2	6	14	2	8	6
Other transport/mining equipment	38	13	1	14	2	7	1
Transporter	38	9	7	7	14	1	0
Splinters	37	9	8	8	9	3	1
Falling from structures	29	3	7	9	8	1	0
Electrical equipment	25	1	0	8	8	2	6
Hand trammed	20	5	3	4	6	2	0
Falling in shafts	18	6	0	0	12	0	0
Mechanical loader	18	2	1	5	9	1	0
Winch (not scraper winch)	17	9	0	8	0	0	0
Struck by vent door	9	2	1	1	6	0	0
Motor vehicles	9	0	0	7	0	1	0
Burning and scalding	7	2	2	2	1	1	0
Fires	1	1	0	1	0	0	0
Occupational diseases	1	0	0	0	0	0	0
Conveyance malfunction	0	0	0	0	0	0	0
Non–casualty	0	0	0	0	0	0	0
Total days	3901	782	385	990	1083	562	99

Table 22b

Analysis of allocated lost days by accident classification and experience – 1992 only

Distribution of accident classifications for each experience band compared with overall distribution

Accident classification	Overall distribution	Experience band (years in occupation)					
		< 1	1–2	2–5	5–10	10–20	> 20
Fall of ground	28.6%	32.5%	31.0%	30.5%	27.5%	24.2%	6.4%
Rockburst	20.5%	14.6%	18.5%	19.9%	20.5%	28.1%	38.0%
Falling rock/material	4.9%	5.4%	4.5%	3.5%	5.9%	4.4%	8.1%
Locomotive drawn vehicle	4.8%	6.7%	2.1%	5.9%	3.6%	4.9%	1.7%
Locomotive	4.2%	5.6%	2.8%	3.2%	3.9%	5.8%	0.0%
Scraper winch	4.0%	2.8%	3.8%	3.4%	5.6%	3.0%	7.3%
Inundation or drowning	3.4%	0.9%	3.4%	6.1%	2.3%	2.3%	12.3%
Manual handling	3.3%	4.4%	2.7%	3.3%	2.7%	3.6%	1.4%
Strainburst	3.0%	5.4%	4.9%	1.1%	2.7%	3.1%	0.2%
Monorope/monorail	2.6%	2.6%	5.1%	2.8%	1.9%	2.3%	0.5%
Falling in excavations	2.4%	1.7%	4.7%	1.9%	1.8%	4.3%	0.1%
Machinery	1.6%	2.0%	1.0%	1.3%	1.5%	1.9%	1.8%
Slipping and falling	1.5%	1.1%	1.0%	2.0%	1.3%	1.8%	1.0%
Travelling in shaft	1.4%	0.2%	0.7%	1.4%	1.8%	2.2%	6.1%
Miscellaneous	1.4%	1.6%	1.2%	1.0%	2.0%	0.8%	0.9%
Dust, gas or fumes	1.3%	3.0%	0.8%	0.1%	1.9%	0.0%	0.5%
Struck by shaft equipment	1.2%	0.1%	1.8%	0.1%	2.8%	1.1%	0.3%
Nitroglycerine	1.2%	0.8%	0.3%	1.3%	1.7%	1.1%	0.0%
Explosives (not nitroglycerine)	1.1%	0.3%	0.1%	2.1%	1.5%	0.4%	0.0%
Heat sickness	1.0%	0.3%	1.6%	1.4%	0.2%	1.4%	6.1%
Other transport/mining equipment	1.0%	1.7%	0.3%	1.4%	0.2%	1.2%	0.8%
Transporter	1.0%	1.1%	1.7%	0.7%	1.3%	0.2%	0.0%
Splinters	0.9%	1.1%	2.1%	0.8%	0.8%	0.5%	0.6%
Falling from structures	0.7%	0.4%	1.8%	0.9%	0.8%	0.2%	0.1%
Electrical equipment	0.6%	0.1%	0.0%	0.8%	0.7%	0.4%	6.1%
Hand trammed	0.5%	0.7%	0.8%	0.4%	0.5%	0.3%	0.1%
Falling in shafts	0.5%	0.8%	0.0%	0.0%	1.1%	0.0%	0.0%
Mechanical loader	0.5%	0.2%	0.1%	0.5%	0.8%	0.2%	0.0%
Winch (not scraper winch)	0.4%	1.2%	0.0%	0.8%	0.0%	0.0%	0.0%
Struck by vent door	0.2%	0.2%	0.2%	0.1%	0.5%	0.1%	0.0%
Motor vehicles	0.2%	0.0%	0.1%	0.7%	0.0%	0.2%	0.0%
Burning and scalding	0.2%	0.3%	0.5%	0.2%	0.1%	0.1%	0.0%
Fires	0.0%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%
Occupational diseases	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Conveyance malfunction	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Non – casualty	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total days divided by 1000	3901	782	385	990	1083	562	99

Table 22c

Analysis of allocated lost days by accident classification and experience – 1992 only

Distribution of experience for each accident classification compared with overall distribution

Accident classification	Total days divided by 1000	Experience band (years in occupation)					
		< 1	1–2	2–5	5–10	10–20	> 20
Fall of ground	1115	22.8%	10.7%	27.1%	26.7%	12.2%	0.6%
Rockburst	799	14.2%	8.9%	24.7%	27.7%	19.7%	4.7%
Falling rock/material	191	22.2%	9.2%	18.0%	33.6%	12.9%	4.2%
Locomotive drawn vehicle	187	28.1%	4.4%	31.2%	20.7%	14.7%	0.9%
Locomotive	162	27.2%	6.8%	19.5%	26.4%	20.1%	0.0%
Scraper winch	155	14.2%	9.4%	22.0%	39.0%	10.7%	4.7%
Inundation or drowning	131	5.4%	10.0%	46.2%	19.4%	9.7%	9.3%
Manual handling	128	26.8%	8.1%	25.4%	22.8%	15.8%	1.1%
Strainburst	119	35.3%	15.8%	9.4%	24.7%	14.7%	0.1%
Monorope/monorail	101	20.0%	19.4%	27.6%	19.9%	12.6%	0.5%
Falling in excavations	94	13.7%	19.3%	20.4%	20.9%	25.5%	0.2%
Machinery	61	25.0%	6.5%	21.5%	26.5%	17.5%	3.0%
Slipping and falling	57	15.4%	7.0%	34.7%	23.9%	17.3%	1.7%
Travelling in shaft	56	2.9%	4.8%	25.1%	34.8%	21.7%	10.7%
Miscellaneous	55	22.2%	8.8%	18.8%	40.2%	8.4%	1.5%
Dust, gas or fumes	50	47.5%	6.5%	2.4%	42.5%	0.1%	1.0%
Struck by shaft equipment	46	2.2%	15.1%	1.4%	67.2%	13.5%	0.6%
Nitroglycerine	45	14.6%	2.7%	29.2%	40.1%	13.3%	0.0%
Explosives (not nitroglycerine)	41	6.1%	0.5%	49.4%	39.1%	4.9%	0.0%
Heat sickness	38	5.2%	15.7%	36.8%	5.7%	20.9%	15.7%
Other transport/mining equipment	38	34.9%	3.0%	37.5%	5.4%	17.1%	2.1%
Transporter	38	22.8%	17.7%	19.4%	36.8%	3.3%	0.0%
Splinters	37	23.4%	22.2%	21.9%	23.2%	7.7%	1.5%
Falling from structures	29	11.6%	24.3%	31.5%	28.8%	3.6%	0.2%
Electrical equipment	25	3.7%	0.7%	32.6%	30.0%	9.1%	23.9%
Hand trammed	20	27.4%	14.8%	22.0%	27.5%	8.0%	0.3%
Falling in shafts	18	34.9%	0.0%	0.0%	65.1%	0.0%	0.0%
Mechanical loader	18	10.8%	2.8%	28.8%	50.7%	6.9%	0.0%
Winch (not scraper winch)	17	53.5%	0.0%	45.1%	1.1%	0.4%	0.0%
Struck by vent door	9	20.6%	9.8%	6.6%	59.6%	3.4%	0.0%
Motor vehicles	9	3.5%	5.3%	76.4%	3.8%	11.0%	0.0%
Burning and scalding	7	33.1%	25.1%	21.4%	10.0%	10.5%	0.0%
Fires	1	46.5%	5.9%	47.7%	0.0%	0.0%	0.0%
Occupational diseases	1	16.7%	19.9%	16.7%	20.4%	26.3%	0.0%
Conveyance malfunction	0	3.6%	0.0%	5.2%	47.6%	43.5%	0.0%
Overall distribution	3901	20.0%	9.9%	25.4%	27.8%	14.4%	2.5%

Table 23a

Analysis of allocated days lost by experience and assigned cause – 1992 only

Number of days divided by 1000

Years experience	Total days	Assigned cause					
		Inadequate examination/ inspection/ test	Failure to comply with practice/ standards/ procedure	Lack of (or unsuitable) system(s)/ facilities	Failure to comply with instructions	Lack of caution/ alertness	Other causes
<1	798	203	185	133	44	119	112
1–2	395	102	99	79	33	49	35
2–3	368	77	76	79	28	51	57
3–4	341	86	82	81	7	41	44
4–5	310	77	64	78	34	27	30
5–6	273	71	57	55	22	35	34
6–7	322	39	75	89	18	47	53
7–8	232	44	32	80	25	21	31
8–9	182	30	37	70	2	25	18
9–10	90	23	17	10	14	13	13
10–15	421	87	91	108	45	58	34
15–20	158	16	23	87	7	13	12
20–25	58	2	7	25	8	14	3
25–30	25	5	0	7	6	1	6
>30	17	0	9	7	0	1	1
Total days	3990	860	853	987	292	515	483

Table 23b

Analysis of allocated days lost by experience and assigned cause – 1992 only

Distribution of experience for each assigned cause compared with overall distribution

Years experience	Overall distribution	Assigned cause					
		Inadequate examination/ inspection/ test	Failure to comply with practice/ standards/ procedure	Lack of (or unsuitable) system(s)/ facilities	Failure to comply with instructions	Lack of caution/ alertness	Other causes
<1	20.0%	23.6%	21.7%	13.5%	15.2%	23.2%	23.3%
1–2	9.9%	11.8%	11.6%	8.0%	11.2%	9.5%	7.3%
2–3	9.2%	8.9%	8.9%	8.0%	9.5%	10.0%	11.8%
3–4	8.5%	9.9%	9.6%	8.2%	2.3%	7.9%	9.1%
4–5	7.8%	8.9%	7.5%	8.0%	11.5%	5.3%	6.2%
5–6	6.9%	8.3%	6.6%	5.6%	7.5%	6.8%	7.0%
6–7	8.1%	4.5%	8.7%	9.0%	6.3%	9.2%	11.0%
7–8	5.8%	5.1%	3.8%	8.1%	8.7%	4.0%	6.3%
8–9	4.6%	3.5%	4.3%	7.1%	0.7%	4.9%	3.7%
9–10	2.3%	2.7%	2.0%	1.0%	4.7%	2.5%	2.8%
10–15	2.5%	1.6%	3.0%	2.6%	1.4%	2.8%	3.0%
15–20	2.0%	0.6%	0.3%	2.5%	2.1%	6.2%	2.0%
20–25	3.1%	5.8%	2.8%	1.5%	8.4%	1.0%	0.8%
25–30	1.2%	0.3%	1.8%	2.3%	0.5%	0.6%	0.6%
>30	1.8%	1.7%	2.7%	1.9%	2.8%	0.6%	0.5%
Total (divided by 1000)	3990	860	853	987	292	515	483

Table 23c

Analysis of allocated days lost by experience and assigned cause – 1992 only

Distribution of assigned causes for each experience band compared with overall distribution

Years experience	Total days divided by 1000	Assigned cause					
		Inadequate examination/ inspection/ test	Failure to comply with practice/ standards/ procedure	Lack of (or unsuitable) system(s)/ facilities	Failure to comply with instructions	Lack of caution/ alertness	Other causes
<1	798	25.5%	23.2%	16.7%	5.6%	15.0%	14.1%
1–2	395	25.7%	25.0%	19.9%	8.2%	12.3%	8.9%
2–3	368	20.8%	20.7%	21.4%	7.6%	14.0%	15.5%
3–4	341	25.1%	24.2%	23.8%	2.0%	11.9%	13.0%
4–5	310	24.7%	20.6%	25.3%	10.8%	8.9%	9.7%
5–6	273	26.1%	20.7%	20.1%	8.0%	12.8%	12.4%
6–7	322	12.1%	23.2%	27.7%	5.7%	14.7%	16.5%
7–8	232	18.8%	13.9%	34.4%	10.9%	8.8%	13.2%
8–9	182	16.7%	20.1%	38.4%	1.2%	13.8%	9.8%
9–10	90	25.6%	19.0%	11.0%	15.1%	14.4%	14.9%
10–15	421	20.7%	21.5%	25.5%	10.6%	13.7%	8.0%
15–20	158	10.3%	14.4%	55.1%	4.4%	8.0%	7.7%
20–25	58	2.7%	12.5%	42.7%	13.7%	23.7%	4.6%
25–30	25	18.7%	1.5%	26.0%	24.4%	4.3%	25.0%
>30	17	0.3%	50.3%	37.7%	0.0%	6.7%	5.0%
Overall distribution	3990	21.6%	21.4%	24.7%	7.3%	12.9%	12.1%

Table 24

Age of personnel involved in accidents

Age	Total number				Percentage			
	Incidents	Fatalities	Reportable injuries	Allocated days	Incidents	Fatalities	Reportable injuries	Allocated days
17	9	0	9	3506	0.0%	0.0%	0.0%	0.0%
18	35	1	34	14738	0.1%	0.0%	0.1%	0.1%
19	129	7	122	87105	0.3%	0.3%	0.3%	0.4%
20	374	19	355	184212	0.8%	0.7%	0.8%	0.8%
21	634	34	600	310661	1.4%	1.3%	1.4%	1.3%
22	916	38	878	387376	2.0%	1.4%	2.0%	1.7%
23	1211	73	1138	634120	2.6%	2.7%	2.6%	2.7%
24	1473	72	1401	672049	3.2%	2.7%	3.2%	2.9%
25	1656	91	1565	824885	3.6%	3.4%	3.6%	3.6%
26	2003	115	1888	992459	4.4%	4.3%	4.4%	4.3%
27	2014	114	1900	991580	4.4%	4.3%	4.4%	4.3%
28	2207	105	2102	967493	4.8%	3.9%	4.9%	4.2%
29	2041	131	1910	1080864	4.4%	4.9%	4.4%	4.7%
30	2241	128	2113	1099603	4.9%	4.8%	4.9%	4.7%
31	2087	127	1960	1121041	4.5%	4.8%	4.5%	4.8%
32	2098	119	1979	1048918	4.6%	4.5%	4.6%	4.5%
33	1901	133	1768	1092566	4.1%	5.0%	4.1%	4.7%
34	1901	119	1782	1006691	4.1%	4.5%	4.1%	4.3%
35	1722	99	1623	905544	3.7%	3.7%	3.7%	3.9%
36	1816	98	1718	855725	4.0%	3.7%	4.0%	3.7%
37	1574	113	1461	908291	3.4%	4.2%	3.4%	3.9%
38	1643	96	1547	838004	3.6%	3.6%	3.6%	3.6%
39	1427	88	1339	748965	3.1%	3.3%	3.1%	3.2%
40	1410	73	1337	661474	3.1%	2.7%	3.1%	2.9%
41	1284	78	1206	661447	2.8%	2.9%	2.8%	2.9%
42	1232	72	1160	631230	2.7%	2.7%	2.7%	2.7%
43	1005	56	949	473251	2.2%	2.1%	2.2%	2.0%
44	884	57	827	474285	1.9%	2.1%	1.9%	2.0%
45	823	52	771	433027	1.8%	2.0%	1.8%	1.9%
46	796	54	742	447098	1.7%	2.0%	1.7%	1.9%
47	761	40	721	352600	1.7%	1.5%	1.7%	1.5%
48	755	38	717	344956	1.6%	1.4%	1.7%	1.5%
49	639	24	615	246168	1.4%	0.9%	1.4%	1.1%
50	592	22	570	235893	1.3%	0.8%	1.3%	1.0%
51	530	38	492	297065	1.2%	1.4%	1.1%	1.3%
52	424	22	402	195608	0.9%	0.8%	0.9%	0.8%
53	301	22	279	188531	0.7%	0.8%	0.6%	0.8%
54	289	18	271	147485	0.6%	0.7%	0.6%	0.6%
55	240	22	218	173245	0.5%	0.8%	0.5%	0.7%
56	197	15	182	118491	0.4%	0.6%	0.4%	0.5%
57	162	7	155	66193	0.4%	0.3%	0.4%	0.3%
58	153	5	148	55564	0.3%	0.2%	0.3%	0.2%
59	139	8	131	74325	0.3%	0.3%	0.3%	0.3%
60	81	7	74	53639	0.2%	0.3%	0.2%	0.2%
61	52	3	49	23109	0.1%	0.1%	0.1%	0.1%
62	37	4	33	28546	0.1%	0.2%	0.1%	0.1%
>62	71	3	68	25895	0.2%	0.1%	0.2%	0.1%
TOTAL	45969	2660	43309	23185521	100.0%	100.0%	100.0%	100.0%

Table 25

Distribution of accidents by activity

Activity	Total number				Percentage			
	Incidents	Fatalities	Reportable injuries	Allocated days	Incidents	Fatalities	Reportable injuries	Allocated days
Drilling (pneumatic)	2465	161	2304	1250180	10.7%	10.8%	10.7%	10.0%
Walking/travelling by foot	2158	143	2015	1219338	9.4%	9.6%	9.3%	9.7%
Installing support/barricades/stonewalls	1201	103	1098	779154	5.2%	6.9%	5.1%	6.2%
Lashing/shovelling	1066	90	976	693470	4.6%	6.0%	4.5%	5.5%
Standing	1051	65	986	586460	4.6%	4.4%	4.6%	4.7%
Barring	1269	68	1201	571137	5.5%	4.6%	5.6%	4.6%
Sitting	436	54	382	401628	1.9%	3.6%	1.8%	3.2%
Transporting	961	34	927	397094	4.2%	2.3%	4.3%	3.2%
Supervising	292	41	251	297051	1.3%	2.7%	1.2%	2.4%
Cleaning footwall	279	39	240	285850	1.2%	2.6%	1.1%	2.3%
Driving/operating track bound vehicles	276	34	242	251649	1.2%	2.3%	1.1%	2.0%
Pulling	454	24	430	209213	2.0%	1.6%	2.0%	1.7%
Installing equipment/machinery	385	19	366	176393	1.7%	1.3%	1.7%	1.4%
Loading/offloading	667	14	653	174434	2.9%	0.9%	3.0%	1.4%
Preparing face	95	27	68	173275	0.4%	1.8%	0.3%	1.4%
Charging up	211	22	189	170017	0.9%	1.5%	0.9%	1.4%
Riding track bound vehicle	225	19	206	168598	1.0%	1.3%	1.0%	1.3%
Clearing obstructions	372	18	354	161194	1.6%	1.2%	1.6%	1.3%
Reclaiming sweeping/vamping	184	21	163	147873	0.8%	1.4%	0.8%	1.2%
Repairing/servicing/maintaining	223	17	206	145504	1.0%	1.1%	1.0%	1.2%
Driving/operating trackless vehicles	79	17	62	123438	0.3%	1.1%	0.3%	1.0%
Removing other than support/equip/machinery	377	9	368	123270	1.6%	0.6%	1.7%	1.0%
Preparing other than explosives/face	86	17	69	122934	0.4%	1.1%	0.3%	1.0%
Check/inspect/examine (not equipment/mach/veh)	57	19	38	122499	0.2%	1.3%	0.2%	1.0%
Other activities (< 1% of total allocated days each)	8193	416	7777	3782428	35.5%	27.9%	36.1%	30.2%
TOTAL	23062	1491	21571	12534141	100.0%	100.0%	100.0%	100.0%

Table 26

Distribution of accidents by activity type

Activity	Total number				Percentage			
	Incidents	Fatalities	Reportable injuries	Allocated days	Incidents	Fatalities	Reportable injuries	Allocated days
Non-productive or supervisory activities	4695	351	4344	2907832	20.4%	23.5%	20.1%	23.2%
Activities associated with ore or material transportation	4563	146	4417	1587667	19.8%	9.8%	20.5%	12.7%
Drilling and blasting cycle	3018	194	2824	1524946	13.1%	13.0%	13.1%	12.2%
Miscellaneous activities	2692	146	2546	1334883	11.7%	9.8%	11.8%	10.6%
Cleaning cycle activities	1760	179	1581	1330621	7.6%	12.0%	7.3%	10.6%
Equipping, installing, maintaining or operating machinery	2276	119	2157	1102880	9.9%	8.0%	10.0%	8.8%
Working place preparation	1526	129	1397	972654	6.6%	8.7%	6.5%	7.8%
Activities concerned with supporting	1362	119	1243	897743	5.9%	8.0%	5.8%	7.2%
Riding or driving vehicles	737	83	654	661349	3.2%	5.6%	3.0%	5.3%
Activities concerned with hoisting	434	25	409	213566	1.9%	1.7%	1.9%	1.7%
TOTAL	23063	1491	21572	12534141	100.0%	100.0%	100.0%	100.0%

Table 27a

Analysis of allocated days lost by type of place and activity type

Number of days divided by 1000

Type of place	Total days (divided by 1000)	Activity group									
		Misc	Wrkng place preparation	Supporting	Drill/blast cycle	Cleaning cycle	Riding/ driving	Transport activities	Hoisting	Equip, inst, maintain	Non-prod/ supervsry
Stope face	4636	327	581	662	879	811	7	331	14	285	738
Haulage/return airway/travelling way	1469	161	84	32	95	70	236	256	8	89	440
Shaft (Vertical/incline/sinking)	1351	196	19	8	79	64	142	284	64	130	364
Crosscut	970	105	83	27	100	82	90	201	4	79	200
Strike gully	758	81	37	51	60	78	0	70	14	132	235
Centre gully/Tip	588	83	15	17	22	43	12	53	35	102	206
Raise/winze	417	76	7	22	38	28	6	33	26	40	141
Stope worked out/reclamation/entrance	401	36	21	50	0	80	0	63	1	36	113
Boxhole/orepass	389	47	25	7	50	19	6	35	13	59	129
Reef drive	376	40	43	11	66	18	14	77	0	32	73
Development end	291	34	41	5	112	14	20	22	0	1	42
Surface sites	196	28	1	0	1	1	26	49	6	19	65
Other locations	188	22	7	6	16	19	21	33	1	23	40
Conveyors/Surface transport	179	8	0	0	7	0	79	20	1	13	50
Engineering locations	169	52	7	0	1	2	2	27	6	46	25
Plant locations	155	38	1	0	0	1	0	32	22	16	45
Total days (divided by 1000)	12534	1335	973	898	1525	1331	661	1588	214	1103	2908

Table 27b

Analysis of allocated days lost by type of place and activity type

Distribution of types of place for each activity type compared with overall distribution

Type of place	Overall distribution	Activity group									
		Misc	Wrkng place preparation	Supporting	Drill/blast cycle	Cleaning cycle	Riding/ driving	Transport activities	Hoisting	Equip, inst, maintain	Non-prod/ supervsry
Stope face	37.0%	24.5%	59.8%	73.8%	57.6%	61.0%	1.1%	20.9%	6.4%	25.9%	25.4%
Haulage/return airway/travelling way	11.7%	12.0%	8.6%	3.6%	6.2%	5.3%	35.6%	16.1%	3.5%	8.1%	15.1%
Shaft (Vertical/incline/sinking)	10.8%	14.7%	1.9%	0.9%	5.2%	4.8%	21.4%	17.9%	30.0%	11.8%	12.5%
Crosscut	7.7%	7.9%	8.6%	3.0%	6.6%	6.2%	13.6%	12.6%	1.8%	7.1%	6.9%
Strike gully	6.0%	6.1%	3.8%	5.6%	3.9%	5.9%	0.1%	4.4%	6.6%	11.9%	8.1%
Centre gully/Tip	4.7%	6.2%	1.6%	1.8%	1.4%	3.2%	1.9%	3.4%	16.2%	9.2%	7.1%
Raise/winze	3.3%	5.7%	0.7%	2.4%	2.5%	2.1%	0.9%	2.1%	12.1%	3.6%	4.9%
Stope worked out/reclamation/entrance	3.2%	2.7%	2.2%	5.6%	0.0%	6.0%	0.0%	4.0%	0.3%	3.3%	3.9%
Boxhole/orepass	3.1%	3.5%	2.5%	0.8%	3.3%	1.4%	0.9%	2.2%	6.2%	5.3%	4.4%
Reef drive	3.0%	3.0%	4.4%	1.2%	4.3%	1.3%	2.1%	4.9%	0.1%	2.9%	2.5%
Development end	2.3%	2.5%	4.3%	0.6%	7.3%	1.1%	3.0%	1.4%	0.0%	0.1%	1.4%
Surface sites	1.6%	2.1%	0.1%	0.0%	0.0%	0.1%	3.9%	3.1%	2.9%	1.7%	2.2%
Other locations	1.5%	1.7%	0.7%	0.7%	1.0%	1.4%	3.2%	2.1%	0.3%	2.1%	1.4%
Conveyors/Surface transport	1.4%	0.6%	0.0%	0.0%	0.5%	0.0%	12.0%	1.2%	0.6%	1.2%	1.7%
Engineering locations	1.3%	3.9%	0.7%	0.1%	0.1%	0.1%	0.2%	1.7%	2.8%	4.2%	0.9%
Plant locations	1.2%	2.9%	0.1%	0.0%	0.0%	0.0%	0.1%	2.0%	10.2%	1.5%	1.6%
Total days (divided by 1000)	12534	1335	973	898	1525	1331	661	1588	214	1103	2908

Table 27c

Analysis of allocated days lost by type of place and activity type

Distribution of activity types for each type of place compared with overall distribution

Type of place	Total days (divided by 1000)	Activity group									
		Misc	Wrkng place preparation	Supporting	Drill/blast cycle	Cleaning cycle	Riding/ driving	Transport activities	Hoisting	Equip, inst, maintain	Non-prod/ supervsry
Stope face	4636	7.0%	12.5%	14.3%	19.0%	17.5%	0.2%	7.1%	0.3%	6.2%	15.9%
Haulage/return airway/travelling way	1469	10.9%	5.7%	2.2%	6.5%	4.8%	16.0%	17.4%	0.5%	6.1%	29.9%
Shaft (Vertical/incline/sinking)	1351	14.5%	1.4%	0.6%	5.9%	4.7%	10.5%	21.1%	4.7%	9.7%	26.9%
Crosscut	970	10.8%	8.6%	2.8%	10.4%	8.5%	9.2%	20.7%	0.4%	8.1%	20.6%
Strike gully	758	10.7%	4.9%	6.7%	7.9%	10.3%	0.1%	9.3%	1.9%	17.4%	31.0%
Centre gully/Tip	588	14.1%	2.6%	2.8%	3.7%	7.3%	2.1%	9.1%	5.9%	17.3%	35.1%
Raise/winze	417	18.2%	1.7%	5.2%	9.0%	6.8%	1.5%	8.0%	6.2%	9.6%	33.9%
Stope worked out/reclamation/entrance	401	9.0%	5.3%	12.5%	0.1%	19.9%	0.0%	15.7%	0.1%	9.1%	28.3%
Boxhole/orepass	389	12.0%	6.3%	1.8%	12.8%	4.8%	1.5%	9.1%	3.4%	15.1%	33.1%
Reef drive	376	10.8%	11.4%	2.9%	17.6%	4.8%	3.8%	20.6%	0.1%	8.6%	19.5%
Development end	291	11.7%	14.2%	1.7%	38.3%	4.9%	6.9%	7.5%	0.0%	0.5%	14.3%
Surface sites	196	14.4%	0.4%	0.1%	0.3%	0.7%	13.1%	25.2%	3.1%	9.7%	33.0%
Other locations	188	11.8%	3.5%	3.3%	8.2%	10.0%	11.3%	17.6%	0.3%	12.3%	21.5%
Conveyors/Surface transport	179	4.5%	0.2%	0.1%	3.9%	0.3%	44.2%	11.0%	0.7%	7.1%	28.0%
Engineering locations	169	31.1%	4.2%	0.3%	0.7%	1.1%	0.9%	16.2%	3.6%	27.2%	14.9%
Plant locations	155	24.7%	0.4%	0.0%	0.1%	0.4%	0.2%	20.6%	14.0%	10.4%	29.2%
Overall distribution	12534	10.6%	7.8%	7.2%	12.2%	10.6%	5.3%	12.7%	1.7%	8.8%	23.2%

Table 28a

Analysis of allocated days lost by type of activity and accident classification

Number of days lost divided by 1000

Classification	Total days (divided by 1000)	Activity group									
		Misc	Wrkng place preparation	Supporting	Drill/blast cycle	Cleaning cycle	Riding/ driving	Transport activities	Hoisting	Equip. inst. maintain	Non-prod/ supervsry
Rockburst	2096	139	213	293	518	395	31	120	0	135	252
Strainburst	343	43	17	17	95	74	0	16	0	16	64
Fall of ground	3800	287	564	464	589	551	33	293	27	242	751
Machinery	152	37	8	1	22	8	0	6	6	42	22
Other transport/mining equipment	79	11	0	0	0	0	14	23	0	21	10
Locomotive	405	16	0	0	1	5	208	53	0	13	109
Locomotive drawn vehicle	619	54	6	0	0	8	139	161	8	26	218
Winch (not scraper winch)	26	0	0	0	0	1	6	3	0	9	6
Scraper winch	476	61	7	1	5	45	7	53	9	83	206
Monorope/monorail	281	52	1	4	0	1	0	61	1	70	91
Hand trammed	84	4	0	0	0	0	1	65	0	3	10
Mechanical loader	77	6	0	0	0	2	31	20	1	5	12
Transporter	124	8	0	0	0	0	37	8	0	2	68
Motor vehicles	44	1	6	0	0	0	22	2	0	0	14
Falling rock/material	610	101	19	28	66	48	4	105	21	56	161
Manual handling	371	35	9	7	13	24	2	198	18	32	32
Falling in shafts	140	24	0	0	0	0	18	24	18	0	54
Falling in excavations	345	44	13	13	14	18	0	43	18	31	152
Falling from structures	136	25	7	7	3	0	0	15	0	35	43
Slipping and falling	174	23	4	10	4	7	1	19	3	10	94
Burning and scalding	43	12	1	0	1	0	0	11	4	5	10
Splinters	85	20	3	1	12	11	6	2	4	13	12
Dust, gas or fumes	271	23	16	1	19	32	0	3	18	39	119
Inundation or drowning	300	81	7	31	6	6	6	59	36	36	32
Struck by vent door	31	21	0	0	0	0	1	0	0	0	9
Conveyance malfunction	62	7	6	0	0	12	0	0	6	12	18
Struck by shaft equipment	160	28	1	0	6	13	6	27	0	26	53
Travelling in shaft	195	7	6	0	0	0	54	85	13	6	24
Electrical equipment	80	26	0	0	0	0	1	6	0	33	14
Fires	16	1	1	0	0	0	0	0	0	1	14
Explosives (not nitroglycerine)	153	47	0	0	54	14	0	24	0	3	11
Nitroglycerine	329	44	18	0	73	25	19	8	0	50	92
Occupational diseases	5	0	0	0	1	1	0	0	0	0	1
Heat sickness	97	2	24	8	6	14	0	18	0	8	16
Miscellaneous	326	47	13	11	16	14	14	56	2	39	113
Non-casualty	0	0	0	0	0	0	0	0	0	0	0
Total days (divided by 1000)	12534	1335	973	898	1525	1331	661	1588	214	1103	2908

Table 28b

Analysis of allocated days lost by type of activity and accident classification

Distribution of accident classifications for each activity type compared with overall distribution

Classification	Overall distribution	Activity group									
		Misc	Wrkng place preparation	Supporting	Drill/blast cycle	Cleaning cycle	Riding/ driving	Transport activities	Hoisting	Equip, inst, maintain	Non-prod/ supervsry
Rockburst	16.7%	10.4%	21.9%	32.7%	34.0%	29.7%	4.7%	7.5%	0.2%	12.2%	8.7%
Strainburst	2.7%	3.2%	1.8%	1.9%	6.3%	5.5%	0.0%	1.0%	0.1%	1.5%	2.2%
Fall of ground	30.3%	21.5%	58.0%	51.7%	38.6%	41.4%	4.9%	18.4%	12.4%	22.0%	25.8%
Machinery	1.2%	2.8%	0.8%	0.1%	1.4%	0.6%	0.1%	0.4%	2.9%	3.8%	0.8%
Other transport/mining equipment	0.6%	0.8%	0.0%	0.0%	0.0%	0.0%	2.1%	1.5%	0.0%	1.9%	0.3%
Locomotive	3.2%	1.2%	0.0%	0.0%	0.0%	0.4%	31.5%	3.4%	0.1%	1.1%	3.8%
Locomotive drawn vehicle	4.9%	4.0%	0.6%	0.0%	0.0%	0.6%	21.0%	10.1%	3.7%	2.4%	7.5%
Winch (not scraper winch)	0.2%	0.0%	0.0%	0.0%	0.0%	0.1%	0.9%	0.2%	0.1%	0.8%	0.2%
Scraper winch	3.8%	4.6%	0.7%	0.1%	0.3%	3.4%	1.0%	3.3%	4.3%	7.5%	7.1%
Monorope/monorail	2.2%	3.9%	0.1%	0.5%	0.0%	0.1%	0.0%	3.8%	0.3%	6.3%	3.1%
Hand trammed	0.7%	0.3%	0.0%	0.0%	0.0%	0.0%	0.1%	4.1%	0.1%	0.3%	0.3%
Mechanical loader	0.6%	0.4%	0.1%	0.0%	0.0%	0.2%	4.7%	1.3%	0.3%	0.4%	0.4%
Transporter	1.0%	0.6%	0.0%	0.0%	0.0%	0.0%	5.6%	0.5%	0.0%	0.2%	2.4%
Motor vehicles	0.4%	0.0%	0.6%	0.0%	0.0%	0.0%	3.3%	0.1%	0.0%	0.0%	0.5%
Falling rock/material	4.9%	7.6%	2.0%	3.1%	4.4%	3.6%	0.6%	6.6%	10.0%	5.1%	5.5%
Manual handling	3.0%	2.6%	0.9%	0.8%	0.9%	1.8%	0.4%	12.5%	8.4%	2.9%	1.1%
Falling in shafts	1.1%	1.8%	0.0%	0.1%	0.0%	0.0%	2.7%	1.5%	8.4%	0.0%	1.9%
Falling in excavations	2.8%	3.3%	1.3%	1.4%	0.9%	1.4%	0.0%	2.7%	8.4%	2.8%	5.2%
Falling from structures	1.1%	1.8%	0.7%	0.8%	0.2%	0.0%	0.0%	1.0%	0.0%	3.2%	1.5%
Slipping and falling	1.4%	1.7%	0.4%	1.1%	0.3%	0.5%	0.1%	1.2%	1.2%	0.9%	3.2%
Burning and scalding	0.3%	0.9%	0.1%	0.0%	0.0%	0.0%	0.0%	0.7%	1.9%	0.4%	0.4%
Splinters	0.7%	1.5%	0.3%	0.1%	0.8%	0.9%	1.0%	0.1%	1.7%	1.2%	0.4%
Dust, gas or fumes	2.2%	1.7%	1.7%	0.2%	1.2%	2.4%	0.0%	0.2%	8.5%	3.5%	4.1%
Inundation or drowning	2.4%	6.1%	0.7%	3.4%	0.4%	0.5%	0.9%	3.7%	16.9%	3.3%	1.1%
Struck by vent door	0.2%	1.6%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.3%
Conveyance malfunction	0.5%	0.5%	0.6%	0.0%	0.0%	0.9%	0.1%	0.0%	2.8%	1.1%	0.6%
Struck by shaft equipment	1.3%	2.1%	0.1%	0.0%	0.4%	0.9%	1.0%	1.7%	0.2%	2.3%	1.8%
Travelling in shaft	1.6%	0.6%	0.6%	0.0%	0.0%	0.0%	8.1%	5.4%	5.9%	0.5%	0.8%
Electrical equipment	0.6%	1.9%	0.0%	0.0%	0.0%	0.0%	0.1%	0.4%	0.0%	3.0%	0.5%
Fires	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.5%
Explosives (not nitroglycerine)	1.2%	3.5%	0.0%	0.0%	3.5%	1.1%	0.0%	1.5%	0.0%	0.3%	0.4%
Nitroglycerine	2.6%	3.3%	1.9%	0.0%	4.8%	1.9%	2.9%	0.5%	0.0%	4.5%	3.2%
Occupational diseases	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
Heat sickness	0.8%	0.2%	2.5%	0.9%	0.4%	1.1%	0.0%	1.1%	0.0%	0.8%	0.6%
Miscellaneous	2.6%	3.6%	1.3%	1.2%	1.0%	1.0%	2.2%	3.5%	1.1%	3.5%	3.9%
Non-casualty	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total days (divided by 1000)	12534	1335	973	898	1525	1331	661	1588	214	1103	2908

Table 28c

Analysis of allocated days lost by type of activity and accident classification

Distribution of activity types for each accident classification compared with overall distribution

Classification	Total days (divided by 1000)	Activity group									
		Misc	Wrkng place preparation	Supporting	Drill/blast cycle	Cleaning cycle	Riding/ driving	Transport activities	Hoisting	Equip, inst, maintain	Non-prod/ supervsry
Rockburst	2096	6.6%	10.1%	14.0%	24.7%	18.9%	1.5%	5.7%	0.0%	6.4%	12.0%
Strainburst	343	12.5%	5.1%	5.0%	27.8%	21.5%	0.1%	4.6%	0.1%	4.7%	18.7%
Fall of ground	3800	7.5%	14.8%	12.2%	15.5%	14.5%	0.9%	7.7%	0.7%	6.4%	19.8%
Machinery	152	24.5%	5.1%	0.5%	14.4%	5.3%	0.3%	3.8%	4.1%	27.6%	14.4%
Other transport/mining equipment	79	13.3%	0.5%	0.2%	0.3%	0.1%	17.3%	29.3%	0.1%	27.0%	12.0%
Locomotive	405	4.0%	0.0%	0.0%	0.1%	1.2%	51.3%	13.2%	0.1%	3.1%	27.0%
Locomotive drawn vehicle	619	8.7%	1.0%	0.0%	0.0%	1.2%	22.4%	25.9%	1.3%	4.2%	35.2%
Winch (not scraper winch)	26	0.4%	0.1%	0.2%	0.0%	5.2%	23.0%	11.7%	0.6%	34.3%	24.5%
Scraper winch	476	12.8%	1.4%	0.2%	1.0%	9.5%	1.4%	11.1%	1.9%	17.4%	43.2%
Monorope/monorail	281	18.6%	0.3%	1.5%	0.1%	0.3%	0.0%	21.7%	0.2%	24.9%	32.3%
Hand trammed	84	4.7%	0.0%	0.2%	0.0%	0.3%	0.7%	78.2%	0.4%	4.1%	11.4%
Mechanical loader	77	7.4%	0.6%	0.0%	0.0%	3.0%	40.4%	26.3%	0.8%	6.1%	15.3%
Transporter	124	6.2%	0.0%	0.0%	0.1%	0.1%	29.9%	6.8%	0.0%	1.9%	55.2%
Motor vehicles	44	1.5%	13.6%	0.0%	0.0%	0.0%	48.8%	4.5%	0.0%	0.4%	31.3%
Falling rock/material	610	16.6%	3.2%	4.5%	10.9%	7.9%	0.6%	17.2%	3.5%	9.2%	26.4%
Manual handling	371	9.5%	2.4%	1.8%	3.6%	6.4%	0.7%	53.4%	4.8%	8.6%	8.7%
Falling in shafts	140	17.2%	0.3%	0.3%	0.3%	0.0%	12.9%	17.4%	12.9%	0.0%	38.7%
Falling in excavations	345	12.7%	3.8%	3.7%	3.9%	5.2%	0.0%	12.6%	5.2%	9.0%	43.9%
Falling from structures	136	18.1%	5.2%	5.4%	2.1%	0.2%	0.0%	11.2%	0.0%	26.1%	31.6%
Slipping and falling	174	13.1%	2.5%	5.5%	2.5%	4.1%	0.5%	10.7%	1.5%	5.5%	54.1%
Burning and scalding	43	27.3%	1.5%	0.3%	1.5%	0.1%	0.1%	24.6%	9.3%	11.2%	24.1%
Splinters	85	24.0%	3.7%	0.8%	14.2%	13.3%	7.5%	2.5%	4.3%	15.2%	14.5%
Dust, gas or fumes	271	8.4%	5.9%	0.5%	7.0%	11.9%	0.0%	1.2%	6.7%	14.3%	43.9%
Inundation or drowning	300	27.0%	2.4%	10.2%	2.0%	2.2%	2.0%	19.6%	12.0%	12.0%	10.6%
Struck by vent door	31	66.6%	0.0%	0.2%	0.0%	0.0%	4.0%	0.8%	0.0%	0.2%	28.1%
Conveyance malfunction	62	10.9%	9.7%	0.0%	0.0%	19.5%	0.7%	0.1%	9.7%	19.5%	29.9%
Struck by shaft equipment	160	17.2%	0.8%	0.0%	4.0%	7.9%	4.0%	16.9%	0.3%	16.1%	33.0%
Travelling in shaft	195	3.8%	3.1%	0.0%	0.0%	0.0%	27.5%	43.6%	6.4%	3.1%	12.6%
Electrical equipment	80	32.1%	0.5%	0.0%	0.0%	0.0%	0.8%	7.8%	0.0%	41.2%	17.7%
Fires	16	4.1%	4.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.8%	86.9%
Explosives (not nitroglycerine)	153	30.9%	0.1%	0.0%	35.0%	9.3%	0.0%	15.8%	0.0%	2.1%	7.0%
Nitroglycerine	329	13.4%	5.5%	0.0%	22.3%	7.6%	5.8%	2.3%	0.0%	15.1%	28.0%
Occupational diseases	5	4.4%	7.5%	7.4%	22.8%	16.8%	8.2%	8.1%	1.5%	10.8%	12.5%
Heat sickness	97	2.2%	24.8%	8.3%	6.3%	14.5%	0.0%	18.7%	0.0%	8.5%	16.7%
Miscellaneous	326	14.6%	4.0%	3.4%	4.8%	4.2%	4.4%	17.1%	0.7%	11.9%	34.8%
Overall distribution	12534	10.6%	7.8%	7.2%	12.2%	10.6%	5.3%	12.7%	1.7%	8.8%	23.2%

Table 29a

Analysis of allocated days lost by type of activity and accident cause

Number of allocated days lost

Cause	Total days (divided by 1000)	Activity group										
		Misc	Wrkng place preparation	Supporting	Drill/blast cycle	Cleaning cycle	Riding/ driving	Transport activities	Hoisting	Equip. inst. maintain	Non-prod/ supervsry
Failure to comply with instructions	1275	136	31	26	97	118	129	109	43	134	452
Failure to comply with recognized good practice/standards/procedure	2766	369	158	83	192	129	275	513	54	264	728
Failure to use safety or protective devices/equipment/systems	375	59	38	12	20	25	15	68	6	62	71
Failure to supply safety or protective devices/equipment/systems	185	3	0	14	27	33	0	23	5	12	68
Failure to supply proper tools/equipment	24	1	0	0	1	6	0	8	1	1	7
Lack of (or unsuitable) system(s)/facilities	2580	185	228	370	556	496	40	193	0	181	330
Lack of (or inadequate) standards/procedures	292	57	20	22	15	39	2	47	2	34	54
Lack of caution/alertness	1151	148	90	29	49	53	90	242	37	97	316
Lack of clearance (obstruction)	115	4	1	0	1	8	17	29	1	11	41
Lack of illumination/visibility	1	0	0	0	0	0	0	0	0	0	0
Lack of adequate/suitable training/instruction	54	8	7	6	0	0	1	15	0	8	10
Inadequate supervision/discipline	114	9	7	1	4	13	8	22	0	2	48
Inadequate examination/inspection/test	2836	255	372	317	494	368	34	216	32	176	571
Inadequate (lack of) fencing/guarding	269	36	3	4	27	10	6	35	9	42	98
Inadequate preventive maintenance	84	16	9	5	2	9	7	6	1	4	25
Use of unsuitable/defective equipment/materials/facilities	346	47	2	7	38	8	30	61	19	62	73
Rendering safety device ineffective	68	1	6	2	2	15	6	2	4	14	16
Total days (divided by 1000)	12534	1335	973	898	1525	1331	661	1588	214	1103	2908

Table 29b

Analysis of allocated days lost by type of activity and accident cause

Distribution of accident causes for each activity type compared with overall distribution

Cause	Overall distribution	Activity group									
		Misc	Wrkng place preparation	Supporting	Drill/blast cycle	Cleaning cycle	Riding/ driving	Transport activities	Hoisting	Equip, inst, maintain	Non - prod/ supervsry
Failure to comply with instructions	10.2%	10.2%	3.1%	2.9%	6.4%	8.9%	19.5%	6.9%	20.2%	12.1%	15.5%
Failure to comply with recognized good practice/standards/procedure	22.1%	27.6%	16.2%	9.3%	12.6%	9.7%	41.5%	32.3%	25.3%	24.0%	25.0%
Failure to use safety or protective devices/equipment/systems	3.0%	4.4%	3.9%	1.3%	1.3%	1.9%	2.3%	4.3%	2.7%	5.6%	2.4%
Failure to supply safety or protective devices/equipment/systems	1.5%	0.2%	0.0%	1.5%	1.8%	2.5%	0.0%	1.4%	2.2%	1.1%	2.3%
Failure to supply proper tools/equipment	0.2%	0.1%	0.0%	0.0%	0.0%	0.5%	0.0%	0.5%	0.3%	0.1%	0.2%
Lack of (or unsuitable) system(s)/facilities	20.6%	13.9%	23.4%	41.2%	36.5%	37.3%	6.1%	12.1%	0.1%	16.4%	11.4%
Lack of (or inadequate) standards/procedures	2.3%	4.3%	2.1%	2.4%	1.0%	2.9%	0.4%	2.9%	0.9%	3.0%	1.9%
Lack of caution/alertness	9.2%	11.1%	9.3%	3.2%	3.2%	4.0%	13.6%	15.3%	17.2%	8.8%	10.9%
Lack of clearance (obstruction)	0.9%	0.3%	0.1%	0.0%	0.1%	0.6%	2.5%	1.9%	0.6%	1.0%	1.4%
Lack of illumination/visibility	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Lack of adequate/suitable training/instruction	0.4%	0.6%	0.7%	0.7%	0.0%	0.0%	0.1%	0.9%	0.0%	0.7%	0.3%
Inadequate supervision/discipline	0.9%	0.7%	0.7%	0.1%	0.2%	1.0%	1.2%	1.4%	0.2%	0.2%	1.6%
Inadequate examination/inspection/test	22.6%	19.1%	38.2%	35.3%	32.4%	27.7%	5.2%	13.6%	15.1%	16.0%	19.6%
Inadequate (lack of) fencing/guarding	2.1%	2.7%	0.3%	0.4%	1.8%	0.7%	0.9%	2.2%	4.2%	3.8%	3.4%
Inadequate preventive maintenance	0.7%	1.2%	0.9%	0.5%	0.2%	0.6%	1.1%	0.4%	0.5%	0.3%	0.9%
Use of unsuitable/defective equipment/materials/facilities	2.8%	3.5%	0.2%	0.8%	2.5%	0.6%	4.6%	3.8%	8.8%	5.6%	2.5%
Rendering safety device ineffective	0.5%	0.1%	0.6%	0.2%	0.1%	1.1%	1.0%	0.1%	1.8%	1.2%	0.5%
Total days (divided by 1000)	12534	1335	973	898	1525	1331	661	1588	214	1103	2908

Table 29c

Analysis of allocated days lost by type of activity and accident cause

Distribution of activity types for each accident cause compared with overall distribution

Cause	Total days (divided by 1000)	Activity group									
		Misc	Wrkng place preparation	Supporting	Drill/blast cycle	Cleaning cycle	Riding/ driving	Transport activities	Hoisting	Equip, inst, maintain	Non-prod/ supervsry
Failure to comply with instructions	1275	10.7%	2.4%	2.1%	7.6%	9.3%	10.1%	8.6%	3.4%	10.5%	35.5%
Failure to comply with recognized good practice/standards/procedure	2766	13.3%	5.7%	3.0%	6.9%	4.7%	9.9%	18.6%	2.0%	9.6%	26.3%
Failure to use safety or protective devices/equipment/systems	375	15.8%	10.1%	3.1%	5.3%	6.8%	4.0%	18.0%	1.5%	16.4%	19.0%
Failure to supply safety or protective devices/equipment/systems	185	1.7%	0.0%	7.4%	14.6%	17.8%	0.1%	12.4%	2.5%	6.5%	36.8%
Failure to supply proper tools/equipment	24	3.0%	1.2%	0.7%	3.0%	25.9%	0.0%	31.3%	2.5%	4.5%	28.0%
Lack of (or unsuitable) system(s)/facilities	2580	7.2%	8.8%	14.3%	21.6%	19.2%	1.6%	7.5%	0.0%	7.0%	12.8%
Lack of (or inadequate) standards/procedures	292	19.6%	6.9%	7.5%	5.3%	13.2%	0.9%	16.0%	0.6%	11.5%	18.5%
Lack of caution/alertness	1151	12.9%	7.9%	2.5%	4.2%	4.6%	7.8%	21.1%	3.2%	8.4%	27.5%
Lack of clearance (obstruction)	115	3.8%	1.3%	0.3%	0.9%	7.2%	14.6%	25.6%	1.2%	9.8%	35.5%
Lack of illumination/visibility	1	0.0%	0.0%	0.0%	0.0%	0.0%	8.8%	42.1%	0.0%	4.2%	44.9%
Lack of adequate/suitable training/instruction	54	14.3%	13.3%	11.4%	0.1%	0.1%	1.7%	27.1%	0.0%	14.3%	17.7%
Inadequate supervision/discipline	114	7.8%	6.3%	1.1%	3.1%	11.3%	6.9%	19.0%	0.4%	2.0%	42.1%
Inadequate examination/inspection/test	2836	9.0%	13.1%	11.2%	17.4%	13.0%	1.2%	7.6%	1.1%	6.2%	20.1%
Inadequate (lack of) fencing/guarding	269	13.2%	1.2%	1.3%	10.0%	3.6%	2.3%	13.2%	3.3%	15.5%	36.4%
Inadequate preventive maintenance	84	18.7%	10.7%	5.6%	2.8%	10.1%	8.6%	7.5%	1.3%	4.5%	30.1%
Use of unsuitable/defective equipment/materials/facilities	346	13.6%	0.5%	2.1%	10.8%	2.4%	8.7%	17.5%	5.4%	17.9%	21.1%
Rendering safety device ineffective	68	2.2%	9.2%	2.8%	2.5%	22.4%	9.4%	2.3%	5.7%	20.2%	23.3%
Overall distribution	12534	10.6%	7.8%	7.2%	12.2%	10.6%	5.3%	12.7%	1.7%	8.8%	23.2%

Table 30a

Relationship between activity types and contraventions

Number of days divided by 1000

Activity type	Total days (divided by 1000)	Type of contravention		
		Definitely no contravention	Contravention in opinion of RME, though evidence inconclusive	Probable prosecution
Non-productive or supervisory activities	2908	2284	226	398
Activities associated with ore or material transportation	1588	1360	100	127
Drilling and blasting cycle	1525	1343	74	108
Miscellaneous activities	1335	1116	69	150
Cleaning cycle activities	1331	1156	46	129
Equipping, installing, maintaining or operating machinery	1103	867	101	134
Working place preparation	973	883	46	43
Activities concerned with supporting	898	837	31	30
Riding or driving vehicles	661	405	78	179
Activities concerned with hoisting	214	167	16	30
Total days (divided by 1000)	12534	10418	787	1329

Table 30b

Relationship between activity types and contraventions

Distribution of contraventions for each activity type compared with overall distribution

Activity type	Number of days divided by 1000	Type of contravention		
		Definitely no contravention	Contravention in opinion of RME, though evidence inconclusive	Probable prosecution
Non-productive or supervisory activities	2908	78.6%	7.8%	13.7%
Activities associated with ore or material transportation	1588	85.7%	6.3%	8.0%
Drilling and blasting cycle	1525	88.1%	4.8%	7.1%
Miscellaneous activities	1335	83.6%	5.2%	11.2%
Cleaning cycle activities	1331	86.9%	3.5%	9.7%
Equipping, installing, maintaining or operating machinery	1103	78.7%	9.2%	12.2%
Working place preparation	973	90.8%	4.8%	4.4%
Activities concerned with supporting	898	93.2%	3.4%	3.4%
Riding or driving vehicles	661	61.2%	11.7%	27.0%
Activities concerned with hoisting	214	78.3%	7.5%	14.3%
Overall distribution	12534	83.1%	6.3%	10.6%

Table 31

Distribution of accidents by occupation

Occupation	Total number				Percentage			
	Incidents	Fatalities	Reportable injuries	Allocated days	Incidents	Fatalities	Reportable injuries	Allocated days
Rock drill machine crew	6846	368	6478	3124947	14.9%	13.8%	15.0%	13.5%
Team leader	4209	307	3902	2549012	9.2%	11.5%	9.0%	11.0%
Winch driver	3356	204	3152	1795146	7.3%	7.7%	7.3%	7.7%
Mine labourer	4792	173	4619	1772087	10.4%	6.5%	10.7%	7.6%
General labourer	2685	184	2501	1528736	5.8%	6.9%	5.8%	6.6%
Lasher	2481	165	2316	1388490	5.4%	6.2%	5.3%	6.0%
Locomotive driver	3380	132	3248	1334106	7.4%	5.0%	7.5%	5.8%
Pneumatic driller	2442	159	2283	1268350	5.3%	6.0%	5.3%	5.5%
Scraper winch driver	1562	119	1443	964078	3.4%	4.5%	3.3%	4.2%
Miner's assistant	949	88	861	708327	2.1%	3.3%	2.0%	3.1%
Stope timber	1189	55	1134	514909	2.6%	2.1%	2.6%	2.2%
Driller	792	50	742	422020	1.7%	1.9%	1.7%	1.8%
Locomotive guard/tumbler pointer	543	41	502	347214	1.2%	1.5%	1.2%	1.5%
Labourer	738	34	704	335524	1.6%	1.3%	1.6%	1.4%
Machine operator	422	39	383	300811	0.9%	1.5%	0.9%	1.3%
Boesman/rocker arm shovel driver	747	32	715	300292	1.6%	1.2%	1.7%	1.3%
Pinch bar user	490	33	457	287200	1.1%	1.2%	1.1%	1.2%
Other occupations (< 1% of allocated days each)	8346	477	7869	4244272	18.2%	17.9%	18.2%	18.3%
TOTAL	45969	2660	43309	23185521	100.0%	100.0%	100.0%	100.0%

Table 32

Distribution of accidents by occupation grouping

Occupation	Total number				Percentage			
	Incidents	Fatalities	Reportable injuries	Allocated days	Incidents	Fatalities	Reportable injuries	Allocated days
Driller or drilling crew	5402	344	5058	2775999	23.4%	23.1%	23.4%	22.1%
Labourer	4044	226	3818	1983282	17.5%	15.2%	17.7%	15.8%
Winch driver	2683	199	2484	1618645	11.6%	13.3%	11.5%	12.9%
Team leader	2151	179	1972	1448871	9.3%	12.0%	9.1%	11.6%
Locomotive driver or guard	2009	92	1917	879827	8.7%	6.2%	8.9%	7.0%
Lasher	1226	84	1142	698446	5.3%	5.6%	5.3%	5.6%
Engineering staff	1307	74	1233	685443	5.7%	5.0%	5.7%	5.5%
Transport staff	1038	65	973	552475	4.5%	4.4%	4.5%	4.4%
Supervisory or managerial posts	734	60	674	474725	3.2%	4.0%	3.1%	3.8%
Service depts/surface and misc	650	48	602	395113	2.8%	3.2%	2.8%	3.2%
Miner's assistant	442	50	392	383898	1.9%	3.4%	1.8%	3.1%
Stope timber	731	36	695	332329	3.2%	2.4%	3.2%	2.7%
Boesman operator	392	18	374	162022	1.7%	1.2%	1.7%	1.3%
Pinch bar user	254	16	238	143066	1.1%	1.1%	1.1%	1.1%
TOTAL	23063	1491	21572	12534141	100.0%	100.0%	100.0%	100.0%

Table 33a

Analysis of allocated days lost by occupation grouping and activity type

Number of days divided by 1000

Occupation group	Total days (divided by 1000)	Activity group									
		Misc	Wrkng place preparation	Supporting	Drill/blast cycle	Cleaning cycle	Riding/ driving	Transport activities	Hoisting	Equip, inst, maintain	Non-prod/ supervsry
Driller or drilling crew	2776	191	276	119	1290	206	20	207	8	109	349
Labourer	1983	235	45	259	33	311	31	352	35	146	538
Winch driver	1619	138	78	82	9	308	29	187	30	355	401
Team leader	1449	162	197	98	35	101	66	142	23	83	541
Locomotive driver or guard	880	103	24	2	6	16	276	251	12	41	149
Lasher	698	70	34	148	16	171	2	82	6	30	139
Engineering staff	685	78	21	2	44	29	65	79	19	194	155
Transport staff	552	119	3	11	6	43	23	76	33	68	170
Supervisory or managerial posts	475	79	90	25	2	20	17	34	20	28	161
Service depts/surface and misc	395	63	33	6	7	16	86	51	18	14	101
Miner's assistant	384	41	67	19	68	48	0	29	7	8	96
Stope timber	332	41	18	110	2	34	9	44	3	6	66
Boesman operator	162	6	26	0	1	17	37	48	0	5	21
Pinch bar user	143	8	60	16	7	10	0	6	0	15	21
Total days (divided by 1000)	12534	1335	973	898	1525	1331	661	1588	214	1103	2908

Table 33b

Analysis of allocated days lost by occupation grouping and activity type

Distribution of activity types for each occupation grouping compared with overall distribution

Occupation group	Total days (divided by 1000)	Activity group									
		Misc	Wrkng place preparation	Supporting	Drill/blast cycle	Cleaning cycle	Riding/ driving	Transport activities	Hoisting	Equip, inst, maintain	Non-prod/ supervsry
Driller or drilling crew	2776	6.9%	10.0%	4.3%	46.5%	7.4%	0.7%	7.4%	0.3%	3.9%	12.6%
Labourer	1983	11.8%	2.3%	13.1%	1.7%	15.7%	1.6%	17.7%	1.7%	7.3%	27.1%
Winch driver	1619	8.5%	4.8%	5.1%	0.6%	19.0%	1.8%	11.6%	1.9%	21.9%	24.8%
Team leader	1449	11.2%	13.6%	6.8%	2.4%	7.0%	4.6%	9.8%	1.6%	5.7%	37.3%
Locomotive driver or guard	880	11.8%	2.7%	0.2%	0.7%	1.8%	31.3%	28.6%	1.3%	4.6%	17.0%
Lasher	698	10.0%	4.9%	21.2%	2.2%	24.5%	0.3%	11.7%	0.9%	4.3%	19.9%
Engineering staff	685	11.4%	3.0%	0.3%	6.4%	4.2%	9.4%	11.5%	2.8%	28.3%	22.7%
Transport staff	552	21.6%	0.6%	1.9%	1.0%	7.8%	4.2%	13.7%	6.0%	12.3%	30.8%
Supervisory or managerial posts	475	16.6%	18.9%	5.3%	0.3%	4.3%	3.6%	7.1%	4.1%	6.0%	33.8%
Service depts/surface and misc	395	16.0%	8.5%	1.5%	1.8%	4.0%	21.8%	12.9%	4.5%	3.6%	25.6%
Miner's assistant	384	10.8%	17.3%	5.0%	17.8%	12.5%	0.0%	7.7%	1.8%	2.2%	24.9%
Stope timber	332	12.4%	5.5%	33.2%	0.5%	10.2%	2.7%	13.2%	0.9%	1.7%	19.8%
Boesman operator	162	3.9%	16.3%	0.2%	0.4%	10.7%	23.0%	29.5%	0.0%	2.9%	13.2%
Pinch bar user	143	5.4%	42.1%	11.0%	4.6%	6.8%	0.1%	4.4%	0.3%	10.4%	14.8%
Overall distribution	12534	10.6%	7.8%	7.2%	12.2%	10.6%	5.3%	12.7%	1.7%	8.8%	23.2%

Table 33c

Analysis of allocated days lost by occupation grouping and activity type

Distribution of occupation groupings for each activity type compared with overall distribution

Occupation group	Overall distribution	Activity group									
		Misc	Wrkng place preparation	Supporting	Drill/blast cycle	Cleaning cycle	Riding/ driving	Transport activities	Hoisting	Equip, inst, maintain	Non-prod/ supervsry
Driller or drilling crew	22.1%	14.3%	28.4%	13.2%	84.6%	15.5%	3.0%	13.0%	3.8%	9.9%	12.0%
Labourer	15.8%	17.6%	4.6%	28.8%	2.2%	23.4%	4.7%	22.1%	16.2%	13.2%	18.5%
Winch driver	12.9%	10.3%	8.1%	9.2%	0.6%	23.2%	4.4%	11.8%	14.2%	32.2%	13.8%
Team leader	11.6%	12.1%	20.2%	10.9%	2.3%	7.6%	10.0%	9.0%	10.8%	7.5%	18.6%
Locomotive driver or guard	7.0%	7.7%	2.5%	0.2%	0.4%	1.2%	41.7%	15.8%	5.5%	3.7%	5.1%
Lasher	5.6%	5.2%	3.5%	16.5%	1.0%	12.8%	0.3%	5.2%	2.9%	2.7%	4.8%
Engineering staff	5.5%	5.8%	2.1%	0.2%	2.9%	2.2%	9.8%	5.0%	8.9%	17.6%	5.3%
Transport staff	4.4%	8.9%	0.3%	1.2%	0.4%	3.3%	3.5%	4.8%	15.5%	6.2%	5.9%
Supervisory or managerial posts	3.8%	5.9%	9.2%	2.8%	0.1%	1.5%	2.6%	2.1%	9.1%	2.6%	5.5%
Service depts/surface and misc	3.2%	4.7%	3.4%	0.7%	0.5%	1.2%	13.0%	3.2%	8.3%	1.3%	3.5%
Miner's assistant	3.1%	3.1%	6.8%	2.2%	4.5%	3.6%	0.0%	1.9%	3.2%	0.8%	3.3%
Stope timber	2.7%	3.1%	1.9%	12.3%	0.1%	2.5%	1.3%	2.8%	1.4%	0.5%	2.3%
Boesman operator	1.3%	0.5%	2.7%	0.0%	0.0%	1.3%	5.6%	3.0%	0.0%	0.4%	0.7%
Pinch bar user	1.1%	0.6%	6.2%	1.8%	0.4%	0.7%	0.0%	0.4%	0.2%	1.3%	0.7%
Total days (divided by 1000)	12534	1335	973	898	1525	1331	661	1588	214	1103	2908

Table 34

Distribution of accidents by body part injured

Body part injured	Total number				Percentage			
	Incidents	Fatalities	Reportable injuries	Allocated days	Incidents	Fatalities	Reportable injuries	Allocated days
Multiple (Most of body)	3422	901	2521	6236804	7.4%	33.9%	5.8%	26.9%
Unspecified	1403	688	715	4455468	3.1%	25.9%	1.7%	19.2%
Head, face & neck	1687	465	1222	2894447	3.7%	17.5%	2.8%	12.5%
Chest	1244	199	1045	1239710	2.7%	7.5%	2.4%	5.3%
Multiple (Head, face & neck)	434	177	257	1094436	0.9%	6.7%	0.6%	4.7%
Finger	8229	2	8227	1034291	17.9%	0.1%	19.0%	4.5%
Multiple fingers	2166	0	2166	1030621	4.7%	0.0%	5.0%	4.4%
Multiple (Trunk)	431	125	306	788840	0.9%	4.7%	0.7%	3.4%
Lower leg	3695	6	3689	605328	8.0%	0.2%	8.5%	2.6%
Pelvis	1051	34	1017	480078	2.3%	1.3%	2.3%	2.1%
Abdomen	1352	33	1319	438209	2.9%	1.2%	3.0%	1.9%
Thigh	1034	11	1023	410061	2.2%	0.4%	2.4%	1.8%
Foot	3845	1	3844	286579	8.4%	0.0%	8.9%	1.2%
Eye	1112	1	1111	264092	2.4%	0.0%	2.6%	1.1%
Ankle	2395	0	2395	259377	5.2%	0.0%	5.5%	1.1%
Thumb	1624	0	1624	253597	3.5%	0.0%	3.7%	1.1%
Forearm	1945	0	1945	187212	4.2%	0.0%	4.5%	0.8%
Knee	1994	0	1994	175066	4.3%	0.0%	4.6%	0.8%
Shoulder	909	1	908	141937	2.0%	0.0%	2.1%	0.6%
Toes	1736	0	1736	141810	3.8%	0.0%	4.0%	0.6%
Whole leg	283	1	282	134733	0.6%	0.0%	0.7%	0.6%
Upper arm	513	1	512	127501	1.1%	0.0%	1.2%	0.5%
Both legs	153	2	151	105536	0.3%	0.1%	0.3%	0.5%
Multiple (One hand)	684	1	683	99418	1.5%	0.0%	1.6%	0.4%
Wrist	722	0	722	66505	1.6%	0.0%	1.7%	0.3%
Hand	1119	2	1117	59290	2.4%	0.1%	2.6%	0.3%
Both hands	56	2	54	44773	0.1%	0.1%	0.1%	0.2%
Elbow	310	1	309	37298	0.7%	0.0%	0.7%	0.2%
Multiple (One arm)	135	2	133	35381	0.3%	0.1%	0.3%	0.2%
Ear	129	3	126	26159	0.3%	0.1%	0.3%	0.1%
Both feet	71	0	71	14715	0.2%	0 0%	0.2%	0.1%
Both arms	44	0	44	8478	0.1%	0.0%	0.1%	0.0%
Trunk miscellaneous	42	1	41	7771	0.1%	0.0%	0.1%	0.0%
TOTAL	45969	2660	43309	23185521	100.0%	100.0%	100.0%	100.0%

Table 35a

Analysis of allocated days lost by body part injured and accident classification

Number of days divided by 1000

Body part injured	Total days	Accident classification										
		Fall of ground	Rockburst/ strainburst	Track bound vehicle	Falling	Falling materials	Winches	Explosives	Manual handling	Inundation/ drowning	Monorope/ monorail	Other classifctns
Multiple (Most of body)	6237	2178	1700	444	480	164	85	320	40	149	4	672
Unspecified	4455	946	1232	144	299	88	46	153	20	428	1	1098
Head, face & neck	2894	1034	399	241	227	194	176	50	52	49	26	446
Chest	1240	540	167	149	32	53	50	12	20	12	0	202
Multiple (Head, face & neck)	1094	436	159	85	102	38	68	74	12	18	0	101
Finger	1034	96	11	103	2	124	47	1	241	0	108	301
Multiple fingers	1031	57	7	109	0	49	142	37	104	0	324	202
Multiple (Trunk)	789	293	121	124	109	7	26	13	13	0	6	76
Lower leg	605	178	31	141	4	58	69	1	32	1	1	89
Pelvis	480	185	47	128	7	18	12	0	5	0	0	77
Abdomen	438	187	54	33	13	27	20	12	16	1	1	74
Thigh	410	151	40	57	7	48	18	7	14	0	7	60
Foot	287	98	10	43	1	44	15	0	27	0	5	45
Eye	264	13	3	1	0	17	16	6	14	0	3	191
Ankle	259	78	9	26	5	37	19	0	22	0	3	58
Thumb	254	20	3	44	1	27	19	0	44	1	23	72
Forearm	187	56	13	17	4	20	7	4	9	0	4	53
Knee	175	44	12	14	5	21	15	0	10	0	1	53
Shoulder	142	29	6	16	7	15	9	0	6	0	1	54
Toes	142	34	2	15	0	32	4	0	20	0	2	33
Whole leg	135	33	14	28	1	8	14	0	4	1	1	31
Upper arm	128	26	6	10	4	6	9	6	5	0	6	49
Both legs	106	14	3	35	1	3	9	0	1	0	0	38
Multiple (One hand)	99	23	1	3	3	3	11	1	3	0	14	38
Wrist	67	10	5	3	4	5	3	3	2	0	3	27
Hand	59	20	1	3	0	7	1	0	6	0	1	19
Both hands	45	0	0	0	0	6	0	6	0	0	12	20
Elbow	37	4	1	1	3	2	1	1	7	0	4	14
Multiple (One arm)	35	16	3	1	1	1	7	0	1	0	0	5
Ear	26	13	0	1	0	0	7	0	0	0	0	5
Both feet	15	0	0	6	0	0	6	0	0	0	0	2
Both arms	8	0	1	1	1	0	0	0	0	0	0	5
Trunk miscellaneous	8	1	6	0	0	0	0	0	0	0	0	0
Total days	23186	6813	4068	2030	1323	1121	931	706	755	663	563	4212

Table 35b

Analysis of allocated days lost by body part injured and accident classification

Distribution of body parts injured for each accident classification compared with overall distribution

Body part injured	Overall distribution	Accident classification										
		Fall of ground	Rockburst/ strainburst	Track bound vehicle	Falling	Falling materials	Winches	Explosives	Manual handling	Inundation/ drowning	Monorope/ monorail	Other classifctns
Multiple (Most of body)	26.9%	32.0%	41.8%	21.9%	36.3%	14.7%	9.1%	45.3%	5.3%	22.5%	0.7%	16.0%
Unspecified	19.2%	13.9%	30.3%	7.1%	22.6%	7.9%	5.0%	21.7%	2.7%	64.5%	0.2%	26.1%
Head, face & neck	12.5%	15.2%	9.8%	11.9%	17.1%	17.3%	18.9%	7.1%	6.9%	7.3%	4.6%	10.6%
Chest	5.3%	7.9%	4.1%	7.4%	2.5%	4.8%	5.4%	1.7%	2.6%	1.9%	0.0%	4.8%
Multiple (Head, face & neck)	4.7%	6.4%	3.9%	4.2%	7.7%	3.4%	7.4%	10.5%	1.6%	2.7%	0.0%	2.4%
Finger	4.5%	1.4%	0.3%	5.1%	0.2%	11.0%	5.0%	0.1%	32.0%	0.0%	19.2%	7.1%
Multiple fingers	4.4%	0.8%	0.2%	5.4%	0.0%	4.4%	15.2%	5.2%	13.7%	0.0%	7.6%	4.8%
Multiple (Trunk)	3.4%	4.3%	3.0%	6.1%	8.3%	0.7%	2.8%	1.8%	1.8%	0.1%	1.1%	1.8%
Lower leg	2.6%	2.6%	0.8%	6.9%	0.3%	5.1%	7.4%	0.1%	4.3%	0.2%	0.2%	2.1%
Pelvis	2.1%	2.7%	1.2%	6.3%	0.5%	1.6%	1.3%	0.0%	0.6%	0.0%	0.0%	1.8%
Abdomen	1.9%	2.7%	1.3%	1.6%	1.0%	2.4%	2.2%	1.7%	2.2%	0.1%	0.1%	1.8%
Thigh	1.8%	2.2%	1.0%	2.8%	0.5%	4.3%	1.9%	1.0%	1.9%	0.1%	1.3%	1.4%
Foot	1.2%	1.4%	0.3%	2.1%	0.1%	3.9%	1.6%	0.0%	3.5%	0.0%	0.9%	1.1%
Eye	1.1%	0.2%	0.1%	0.0%	0.0%	1.5%	1.8%	0.9%	1.8%	0.0%	0.5%	4.5%
Ankle	1.1%	1.2%	0.2%	1.3%	0.4%	3.3%	2.0%	0.1%	3.0%	0.1%	0.6%	1.4%
Thumb	1.1%	0.3%	0.1%	2.2%	0.1%	2.4%	2.0%	0.0%	5.9%	0.1%	4.1%	1.7%
Forearm	0.8%	0.8%	0.3%	0.8%	0.3%	1.8%	0.7%	0.5%	1.2%	0.0%	0.7%	1.3%
Knee	0.8%	0.6%	0.3%	0.7%	0.4%	1.8%	1.6%	0.0%	1.4%	0.0%	0.2%	1.3%
Shoulder	0.6%	0.4%	0.1%	0.8%	0.5%	1.3%	1.0%	0.0%	0.8%	0.1%	0.1%	1.3%
Toes	0.6%	0.5%	0.1%	0.7%	0.0%	2.8%	0.4%	0.0%	2.7%	0.0%	0.3%	0.8%
Whole leg	0.6%	0.5%	0.3%	1.4%	0.1%	0.7%	1.5%	0.0%	0.5%	0.1%	0.2%	0.7%
Upper arm	0.5%	0.4%	0.2%	0.5%	0.3%	0.5%	1.0%	0.8%	0.6%	0.0%	1.0%	1.2%
Both legs	0.5%	0.2%	0.1%	1.7%	0.1%	0.3%	1.0%	0.0%	0.2%	0.1%	0.0%	0.9%
Multiple (One hand)	0.4%	0.3%	0.0%	0.2%	0.2%	0.2%	1.1%	0.1%	0.4%	0.0%	2.4%	0.9%
Wrist	0.3%	0.2%	0.1%	0.1%	0.3%	0.4%	0.3%	0.4%	0.3%	0.0%	0.6%	0.7%
Hand	0.3%	0.3%	0.0%	0.2%	0.0%	0.7%	0.1%	0.0%	0.8%	0.0%	0.2%	0.5%
Both hands	0.2%	0.0%	0.0%	0.0%	0.0%	0.5%	0.0%	0.8%	0.0%	0.0%	2.2%	0.5%
Elbow	0.2%	0.1%	0.0%	0.1%	0.2%	0.1%	0.1%	0.1%	1.0%	0.0%	0.7%	0.3%
Multiple (One arm)	0.2%	0.2%	0.1%	0.1%	0.0%	0.0%	0.8%	0.0%	0.2%	0.0%	0.0%	0.1%
Ear	0.1%	0.2%	0.0%	0.1%	0.0%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.1%
Both feet	0.1%	0.0%	0.0%	0.3%	0.0%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%
Both arms	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Trunk miscellaneous	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total days divided by 1000	23186	6813	4068	2030	1323	1121	931	706	755	663	563	4212

Table 35c

Analysis of allocated days lost by body part injured and accident classification

Distribution of accident classifications for each body part injured compared with overall distribution

Body part injured	Total days (divided by 1000)	Accident classification										
		Fall of ground	Rockburst/ strainburst	Track bound vehicle	Falling	Falling materials	Winches	Explosives	Manual handling	Inundation/ drowning	Monorope/ monorail	Other classifctns
Multiple (Most of body)	6237	34.9%	27.3%	7.1%	7.7%	2.6%	1.4%	5.1%	0.6%	2.4%	0.1%	10.8%
Unspecified	4455	21.2%	27.7%	3.2%	6.7%	2.0%	1.0%	3.4%	0.5%	9.6%	0.0%	24.6%
Head, face & neck	2894	35.7%	13.8%	8.3%	7.8%	6.7%	6.1%	1.7%	1.8%	1.7%	0.9%	15.4%
Chest	1240	43.6%	13.5%	12.1%	2.6%	4.3%	4.1%	1.0%	1.6%	1.0%	0.0%	16.3%
Multiple (Head, face & neck)	1094	39.8%	14.5%	7.8%	9.4%	3.5%	6.3%	6.7%	1.1%	1.6%	0.0%	9.2%
Finger	1034	9.3%	1.0%	10.0%	0.2%	12.0%	4.5%	0.1%	23.3%	0.0%	10.5%	29.1%
Multiple fingers	1031	5.6%	0.6%	10.5%	0.0%	4.8%	13.7%	3.6%	10.1%	0.0%	31.5%	19.6%
Multiple (Trunk)	789	37.1%	15.3%	15.8%	13.9%	0.9%	3.3%	1.6%	1.7%	0.0%	0.8%	9.7%
Lower leg	605	29.4%	5.2%	23.3%	0.7%	9.5%	11.4%	0.1%	5.4%	0.2%	0.2%	14.6%
Pelvis	480	38.6%	9.8%	26.7%	1.4%	3.8%	2.5%	0.0%	1.0%	0.0%	0.0%	16.1%
Abdomen	438	42.8%	12.3%	7.5%	2.9%	6.2%	4.6%	2.7%	3.7%	0.2%	0.2%	16.8%
Thigh	410	36.8%	9.9%	14.0%	1.6%	11.7%	4.3%	1.7%	3.5%	0.1%	1.8%	14.6%
Foot	287	34.2%	3.6%	15.0%	0.2%	15.2%	5.1%	0.0%	9.3%	0.0%	1.8%	15.6%
Eye	264	4.9%	1.0%	0.2%	0.1%	6.5%	6.2%	2.3%	5.2%	0.1%	1.1%	72.4%
Ankle	259	30.3%	3.6%	10.1%	2.0%	14.4%	7.2%	0.1%	8.7%	0.2%	1.2%	22.3%
Thumb	254	8.0%	1.0%	17.5%	0.3%	10.5%	7.5%	0.0%	17.5%	0.3%	9.0%	28.4%
Forearm	187	29.8%	7.0%	9.2%	2.3%	10.5%	3.6%	2.0%	4.7%	0.1%	2.2%	28.5%
Knee	175	25.0%	6.8%	8.3%	2.8%	11.8%	8.3%	0.0%	5.9%	0.1%	0.6%	30.4%
Shoulder	142	20.1%	3.9%	11.2%	4.7%	10.4%	6.4%	0.1%	4.4%	0.3%	0.4%	38.1%
Toes	142	23.7%	1.6%	10.7%	0.1%	22.2%	2.8%	0.0%	14.1%	0.0%	1.3%	23.5%
Whole leg	135	24.6%	10.2%	21.1%	1.0%	5.7%	10.5%	0.0%	2.9%	0.4%	0.7%	22.9%
Upper arm	128	20.6%	5.0%	8.2%	2.9%	4.7%	7.1%	4.6%	3.6%	0.2%	4.5%	38.5%
Both legs	106	12.9%	2.8%	33.4%	1.3%	3.0%	9.0%	0.0%	1.4%	0.4%	0.0%	35.7%
Multiple (One hand)	99	22.8%	1.4%	3.4%	3.2%	2.8%	10.8%	0.5%	3.2%	0.1%	13.6%	38.2%
Wrist	67	15.7%	8.1%	4.5%	5.7%	6.9%	4.3%	4.5%	3.7%	0.4%	5.1%	41.3%
Hand	59	32.9%	2.4%	5.3%	0.3%	12.4%	2.0%	0.1%	10.3%	0.0%	1.7%	32.5%
Both hands	45	0.9%	0.2%	0.0%	0.0%	13.6%	0.2%	13.4%	0.2%	0.0%	27.3%	44.2%
Elbow	37	9.9%	3.2%	3.5%	7.0%	4.3%	3.6%	2.0%	19.8%	0.0%	10.4%	36.2%
Multiple (One arm)	35	46.0%	7.9%	3.1%	1.5%	1.6%	20.8%	0.1%	3.9%	0.0%	0.8%	14.5%
Ear	26	49.1%	0.7%	4.9%	0.1%	0.2%	26.1%	0.5%	1.0%	0.1%	0.0%	17.3%
Both feet	15	2.1%	0.0%	42.5%	0.3%	1.1%	41.3%	0.0%	0.7%	0.0%	0.0%	11.9%
Both arms	8	5.3%	7.8%	9.5%	9.5%	3.4%	0.2%	0.0%	0.0%	0.0%	0.2%	64.1%
Trunk miscellaneous	8	7.7%	79.8%	0.4%	0.8%	0.0%	3.0%	0.0%	2.3%	0.0%	0.0%	6.1%
Overall distribution	23186	29.4%	17.5%	8.8%	5.7%	4.8%	4.0%	3.0%	3.3%	2.9%	2.4%	18.2%

Table 36

Distribution of types of injury

Type of injury	Total number				Percentage			
	Incidents	Fatalities	Reportable injuries	Allocated days	Incidents	Fatalities	Reportable injuries	Allocated days
Multiple injury	4926	1547	3379	10335276	10.7%	58.2%	7.8%	44.6%
Fracture	16125	481	15644	5288029	35.1%	18.1%	36.1%	22.8%
Amputation	4124	9	4115	2796400	9.0%	0.3%	9.5%	12.1%
Crushing	906	239	667	1493228	2.0%	9.0%	1.5%	6.4%
Suffocation	96	94	2	576000	0.2%	3.5%	0.0%	2.5%
Laceration	9913	27	9886	493751	21.6%	1.0%	22.8%	2.1%
Gassing	242	58	184	440000	0.5%	2.2%	0.4%	1.9%
Other injury	815	56	759	364424	1.8%	2.1%	1.8%	1.6%
Contusion bruise	5124	17	5107	213430	11.1%	0.6%	11.8%	0.9%
Burn (flame)	213	18	195	166827	0.5%	0.7%	0.5%	0.7%
Heat stroke	39	19	20	154000	0.1%	0.7%	0.0%	0.7%
Drowning	22	18	4	132000	0.0%	0.7%	0.0%	0.6%
Dislocation	629	5	624	106390	1.4%	0.2%	1.4%	0.5%
Burn (electric)	41	17	24	105951	0.1%	0.6%	0.1%	0.5%
Concussion	51	16	35	97785	0.1%	0.6%	0.1%	0.4%
Foreign body or splinter	469	1	468	83954	1.0%	0.0%	1.1%	0.4%
Puncture	618	7	611	67663	1.3%	0.3%	1.4%	0.3%
Heat exhaustion	104	10	94	62820	0.2%	0.4%	0.2%	0.3%
Burn (steam or hot substance)	179	4	175	51509	0.4%	0.2%	0.4%	0.2%
Sprain or strain	627	4	623	48133	1.4%	0.2%	1.4%	0.2%
Abrasion	437	6	431	45666	1.0%	0.2%	1.0%	0.2%
Poisoning	23	7	16	42800	0.1%	0.3%	0.0%	0.2%
Burn (chemical)	126	0	126	13595	0.3%	0.0%	0.3%	0.1%
Dermatitis	110	0	110	5500	0.2%	0.0%	0.3%	0.0%
Hernia (rupture)	10	0	10	390	0.0%	0.0%	0.0%	0.0%
TOTAL	45969	2660	43309	23185521	100.0%	100.0%	100.0%	100.0%

Table 37a

Analysis of allocated days lost by type of injury and accident classification

Number of days divided by 1000

Type of injury	Total days	Accident classification										
		Fall of ground	Rockburst/ strainburst	Track bound vehicle	Falling	Falling materials	Winches	Explosives	Manual handling	Inundation/ drowning	Monorope/ monorail	Other classifctns
Multiple injury	10335	3415	2975	708	879	280	268	391	89	247	21	1062
Fracture	5288	1980	607	476	259	476	260	102	239	66	40	783
Amputation	2796	310	43	463	5	191	278	55	315	7	490	640
Crushing	1493	586	103	293	54	54	69	12	21	12	2	287
Suffocation	576	90	192	0	30	6	0	6	0	216	0	36
Laceration	494	168	38	29	2	50	31	13	43	0	6	113
Gassing	440	0	0	1	0	0	0	6	0	0	0	434
Other injury	364	57	18	25	31	27	1	91	8	12	0	94
Contusion bruise	213	89	26	15	3	16	7	0	17	0	1	40
Burn (flame)	167	0	0	0	0	0	0	20	0	0	0	146
Heat stroke	154	0	0	0	0	0	0	0	0	0	0	154
Drowning	132	12	0	0	0	0	0	0	0	102	0	18
Dislocation	106	8	20	6	5	5	2	0	5	0	0	55
Burn (elctric)	106	0	0	0	0	0	6	0	0	0	0	100
Concussion	98	42	0	0	24	12	6	0	0	0	0	12
Foreign body or splinter	84	1	6	0	0	1	1	3	2	0	0	68
Puncture	68	15	1	0	6	2	2	6	2	0	0	33
Heat exhaustion	63	6	30	0	18	0	0	0	6	0	0	2
Burn (steam or hot substance)	52	0	0	6	1	0	0	1	0	0	0	44
Sprain or strain	48	19	6	0	1	1	0	0	7	0	0	13
Abrasion	46	15	1	7	6	1	1	0	0	0	0	15
Poisoning	43	0	0	0	0	0	0	0	0	0	0	43
Burn (chemical)	14	0	0	0	0	0	0	0	0	0	0	13
Dermatitis	6	0	0	0	0	0	0	0	0	0	0	6
Hernia (rupture)	0	0	0	0	0	0	0	0	0	0	0	0
Total days	23186	6813	4068	2030	1323	1121	931	706	755	663	563	4212

Table 37b

Analysis of allocated days lost by type of injury and accident classification

Distribution of types of injury for each accident classification compared with overall distribution

Type of injury	Overall distribution	Accident classification										
		Fall of ground	Rockburst/ strainburst	Track bound vehicle	Falling	Falling materials	Winches	Explosives	Manual handling	Inundation/ drowning	Monorope/ monorail	Other classifctns
Multiple injury	44.6%	50.1%	73.1%	34.9%	66.4%	25.0%	28.7%	55.3%	11.8%	37.3%	3.8%	25.2%
Fracture	22.8%	29.1%	14.9%	23.4%	19.6%	42.5%	27.9%	14.5%	31.6%	9.9%	7.2%	18.6%
Amputation	12.1%	4.6%	1.1%	22.8%	0.4%	17.0%	29.8%	7.7%	41.7%	1.0%	87.1%	15.2%
Crushing	6.4%	8.6%	2.5%	14.5%	4.1%	4.8%	7.4%	1.7%	2.7%	1.8%	0.4%	6.8%
Suffocation	2.5%	1.3%	4.7%	0.0%	2.3%	0.5%	0.0%	0.8%	0.0%	32.6%	0.0%	0.9%
Laceration	2.1%	2.5%	0.9%	1.4%	0.2%	4.5%	3.3%	1.9%	5.7%	0.1%	1.1%	2.7%
Gassing	1.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.8%	0.0%	0.0%	0.0%	10.3%
Other injury	1.6%	0.8%	0.5%	1.2%	2.3%	2.4%	0.1%	12.8%	1.1%	1.8%	0.0%	2.2%
Contusion bruise	0.9%	1.3%	0.6%	0.7%	0.2%	1.4%	0.7%	0.0%	2.2%	0.0%	0.1%	0.9%
Burn (flame)	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.9%	0.0%	0.0%	0.0%	3.5%
Heat stroke	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.7%
Drowning	0.6%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	15.4%	0.0%	0.4%
Dislocation	0.5%	0.1%	0.5%	0.3%	0.4%	0.4%	0.2%	0.0%	0.7%	0.0%	0.1%	1.3%
Burn (elctric)	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	2.4%
Concussion	0.4%	0.6%	0.0%	0.0%	1.8%	1.1%	0.7%	0.0%	0.0%	0.0%	0.0%	0.3%
Foreign body or splinter	0.4%	0.0%	0.2%	0.0%	0.0%	0.1%	0.1%	0.5%	0.3%	0.0%	0.1%	1.6%
Puncture	0.3%	0.2%	0.0%	0.0%	0.5%	0.2%	0.3%	0.9%	0.3%	0.0%	0.0%	0.8%
Heat exhaustion	0.3%	0.1%	0.7%	0.0%	1.4%	0.0%	0.0%	0.0%	0.8%	0.0%	0.0%	0.1%
Burn (steam or hot substance)	0.2%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%	1.0%
Sprain or strain	0.2%	0.3%	0.1%	0.0%	0.1%	0.1%	0.0%	0.0%	1.0%	0.0%	0.0%	0.3%
Abrasion	0.2%	0.2%	0.0%	0.3%	0.5%	0.1%	0.1%	0.0%	0.1%	0.0%	0.1%	0.3%
Poisoning	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%
Burn (chemical)	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%
Dermatitis	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Hernia (rupture)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total days divided by 1000	23186	6813	4068	2030	1323	1121	931	706	755	663	563	4212

Table 37c

Analysis of allocated days lost by type of injury and accident classification

Distribution of accident classifications for each type of injury compared with overall distribution

Type of injury	Total days (divided by 1000)	Accident classification										
		Fall of ground	Rockburst/ strainburst	Track bound vehicle	Falling	Falling materials	Winches	Explosives	Manual handling	Inundation/ drowning	Monorope/ monorail	Other classifctns
Multiple injury	10335	33.0%	28.8%	6.8%	8.5%	2.7%	2.6%	3.8%	0.9%	2.4%	0.2%	10.3%
Fracture	5288	37.4%	11.5%	9.0%	4.9%	9.0%	4.9%	1.9%	4.5%	1.2%	0.8%	14.8%
Amputation	2796	11.1%	1.5%	16.6%	0.2%	6.8%	9.9%	2.0%	11.3%	0.2%	17.5%	22.9%
Crushing	1493	39.2%	6.9%	19.6%	3.6%	3.6%	4.6%	0.8%	1.4%	0.8%	0.1%	19.2%
Suffocation	576	15.6%	33.3%	0.0%	5.2%	1.0%	0.0%	1.0%	0.0%	37.5%	0.0%	6.3%
Laceration	494	33.9%	7.6%	5.9%	0.4%	10.1%	6.2%	2.7%	8.8%	0.1%	1.2%	23.0%
Gassing	440	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	1.3%	0.0%	0.0%	0.0%	98.6%
Other injury	364	15.6%	5.1%	7.0%	8.4%	7.5%	0.2%	24.9%	2.2%	3.3%	0.1%	25.9%
Contusion bruise	213	41.8%	12.3%	7.1%	1.4%	7.3%	3.1%	0.1%	7.8%	0.1%	0.4%	18.7%
Burn (flame)	167	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	12.1%	0.0%	0.0%	0.0%	87.7%
Heat stroke	154	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Drowning	132	9.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	77.3%	0.0%	13.6%
Dislocation	106	7.2%	19.0%	5.6%	4.7%	4.3%	1.8%	0.0%	4.7%	0.3%	0.3%	52.1%
Burn (elctric)	106	0.0%	0.0%	0.0%	0.0%	0.0%	5.7%	0.0%	0.0%	0.0%	0.0%	94.3%
Concussion	98	43.2%	0.0%	0.3%	24.6%	12.6%	6.2%	0.1%	0.2%	0.0%	0.1%	12.6%
Foreign body or splinter	84	1.6%	7.6%	0.1%	0.0%	0.8%	1.6%	4.0%	2.6%	0.2%	0.5%	80.9%
Puncture	68	21.5%	0.8%	0.5%	9.4%	2.8%	3.5%	9.4%	3.3%	0.0%	0.2%	48.5%
Heat exhaustion	63	10.0%	47.9%	0.1%	28.8%	0.0%	0.0%	0.0%	9.6%	0.0%	0.0%	3.5%
Burn (steam or hot substance)	52	0.0%	0.0%	11.9%	1.3%	0.1%	0.1%	1.3%	0.0%	0.0%	0.7%	84.7%
Sprain or strain	48	39.9%	12.6%	0.7%	1.6%	1.4%	0.4%	0.0%	15.4%	0.2%	0.0%	27.8%
Abrasion	46	32.1%	1.7%	14.4%	13.9%	1.4%	1.9%	0.2%	1.1%	0.4%	0.9%	32.0%
Poisoning	43	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Burn (chemical)	14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.6%	0.0%	0.0%	98.8%
Dermatitis	6	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Hernia (rupture)	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%	50.0%
Overall distribution	23186	29.4%	17.5%	8.8%	5.7%	4.8%	4.0%	3.0%	3.3%	2.9%	2.4%	18.2%

APPENDIX II

NEEDS ANALYSIS OF THE GOLD AND PLATINUM MINING INDUSTRIES

EVALUATION OF ACCIDENTS REPORTED TO THE DEPARTMENT OF MINERAL AND ENERGY AFFAIRS

Introduction

As part of the research needs analysis approximately 1800 accident reports were reviewed from among those submitted to the Department of Mineral and Energy Affairs (DMEA) by gold and platinum mines between 1988 and 1992.

Each accident report was studied for information surrounding events and decisions (ie. contributory factors) prior to an incident, firstly for the purpose of establishing whether such factors are recorded and secondly, to determine if they have any influence on the occurrence or outcome of an accident. Examples of influences or factors sought include production pressures, working conditions, availability and suitability of equipment, or the layout of the working place.

However, although a large number of accidents were reviewed many reports contained little, if any, information of the type being sought. The observations and comments made in this report therefore refer to relative few accidents.

Although in numerical terms the sample was small and therefore not statistically representative it is believed that a number of observations highlight particular hazards inherent in the mining operation and where, perhaps, efforts can be directed to effect a reduction in the number of accidents.

Accident Selection

A number of accident categories were chosen on the basis of the associated risk as expressed by the number of allocated days lost. Examples of such categories include locomotives, locomotive drawn vehicles, slipping and falling, materials handling and falls of ground.

The seven accident categories considered were:-

1. Falls of ground
2. Locomotive drawn vehicles
3. Scraper winches
4. Manual handling of material or mineral
5. Falling in excavations or shafts
6. Slipping and falling
7. Falling material or rolling rocks

The selection of accidents for inclusion in the following tables was purely arbitary with the objective of obtaining as much information as possible on the circumstances surrounding an accident.
The following tables are therefore examples of the types of accidents in certain categories that recorded the greatest hazard based upon the number of allocated days lost.
Under the heading "Allotted cause" the comment in inverted commas is the cause of the accident as given by the mine where this is appropriate. The unpunctuated statement refers to the cause as given by the Regional Mining Engineer as a result of his investigation.

Table 1 lists the categories and the numbers of accident reports recorded.

Table 1

Accident Category	Number Recorded	Fatal	Injured
1. Falls of ground	21	5	16
2. Manual handling material/mineral	25	Nil	25
3. Scrapers	10	Nil	10
4. Slipping falling	9	Nil	9
5. Falling in excavations/shafts	9	6	3
6. Falling material/mineral, rolling material/mineral	18	3	15
7. Locomotives/hoppers and drawn vehicles	20	6	14
TOTAL	112	20	92

FALLS OF GROUND

Observations

The following observations are made from the information included in fall of ground accident reports:-

Many comment that the area had been examined and barred prior to the event.

Comment by mine at the bottom of form MD16 B is frequently "...poor barring.. ".

A number of those injured believed that they were in a safe position. Reports contain statements such as "...it appeared to be safe....".

Approximately sixty-two per cent of fall of ground accidents studied occurred while the injured person was performing one of three activities, namely drilling, barring or installing support. These activities are performed, in the main, at the working face where the area has been disturbed by blasting and when there is no, or only partial, support.

It is perhaps of some significance, that many of the accidents happen to people engaged in activities performed for the purpose of making the working place safe. Comments, therefore, to the effect that the barring was not done properly or that the person was standing in the wrong position seem somewhat inappropriate if not altogether misleading when compiling an accident report.

Comment

Examination of the workings requires the miner to employ both his sense of touch and sight in order to make a judgement. Some conclusions to be drawn from the reports are that:-

1. Existing methods of examination are not adequate nor are they infallible ie. sounding and visual examination.

2. The tools provided for the purpose, pinch bars and hammers, are suitable for bringing down loose ground but are not totally effective as a means of its identification.

3. Examination of the workings is an area prone to poor decision making. Current methods of training even when coupled with many years of experience cannot guarantee a person's safety.

4. A percentage of the accidents arise because of the actions of someone other than the injured person

Production Demands

Although none of the accident reports commented on production demands, they are an ever present factor in all mining operations. However, it is not believed that these demands necessarily precipitate sloppy attitudes or workmanship and while accepting their constant presence, no indication was found to support the postulation that production demands increase the chance of an accident.

Layout of the Workings

Reference to the layout of the workings is made in fatal or serious fall of ground accidents but not in less serious incidents. Comment is limited to the quality and spacing of support, the position and possible influence of geological features, face positions and pillars in situ. Constraints placed on physical activity by the dimensions of the workings and environmental conditions in a task such as examination of the workings, was not noted.

Concurrent Activities

Many mining activities take place concurrently at the working face requiring people to work in relatively confined groups. Within such a confined space there is always the danger that the decisions and actions of one person may create a hazard for another. However, reference to the possible role of such factors was only noted in accident reports where there was a direct link between an injury and the immediate actions of another person. No comments were recorded about hazardous situations that may have been created inadvertently at some time prior to the accident.

The face of any underground workings has been shown to be the most hazardous working area. At present, it would appear that experience, training methods and equipment are not capable of successfully reducing the number of accidents that occur.

LOCOMOTIVE DRAWN VEHICLES

Observations

Accidents involving locomotive drawn vehicles record the second largest number of allocated days lost after falls of ground.

In evaluating the information contained in the accident reports consideration was given to whether the locomotive was leading the train, the type of material conveyed, the driver's field of vision, track conditions, clearance, other activities being performed and the presence of a guard. It was found however, that many of the reports contained only minimal information of this nature.

The following observations are based on the accident reports studied:-

There was no marked difference in the number of accidents involving locomotives leading vehicles and those that were not.

Some 37% of accidents involved a derailment of either the locomotive or the vehicle.

Lack of, or limited clearance between the locomotive, conveyances and the sidewall, stacked equipment or materials particularly timber and supports such as pipe and arch sets was mentioned in almost 70% of the reports.

There appears to be no significant difference between accidents involving only the train crew and those involving other persons either walking, working or standing in the haulage, drive or crosscut.

The track conditions are generally not noted, nor is the condition or position of any rail switching device.

The absence of safety devices such as "aeroplane" sprags was also only noted occasionally.

The re-railing of hoppers, locomotives and other vehicles and particularly the coupling or uncoupling of such vehicles during re-railing operations is responsible for a significant number of injuries. Jacks slipping from beneath the vehicle or locomotive because of poor placement or ground conditions during re-railing were also responsible for many injuries.

Comments

The following comments concern the role of the guard, the driver's field of vision and communication between driver, guard and other persons:-

Guards are appointed to control the operation of a train through a series of signals to the driver from positions around the train and especially at the opposite end *where the driver cannot see.* In a number of incidents it was noted that although a guard was present he was also unsighted and therefore unable to exert proper control over the movement of the loco.

The role of communication between driver, guard and other employees is also critical to the avoidance of hazardous situations. Yet a study of a number of locomotive accidents would indicate that clear communication between guard and driver is not always possible and that signals are readily misunderstood, especially when given in the vicinity of machinery or where concurrent activities may distract or drown out any signal. The noise created by ventilation fans, tip filters, compressed air leaks and rock drills, for example.

The loco guard system relies heavily upon other people in the vicinity heeding the warnings given by the guard especially when the loco is pushing hoppers or other vehicles. At such a time the driver's vision is severely restricted and he depends almost entirely on the warnings given by the guard to move or halt the train. The guard meanwhile may himself be unsighted of persons on the opposite side of the train or unaware that persons have not heard or have not heeded his warnings and who have not acted appropriately to remove themselves from possible danger.

SCRAPER WINCHES

Observations

On gold and platinum mines scrapers are primarily used in stope gullies and raise connections. The following observations refer to accident reports submitted under this category:-

Many accidents happen when the ropes of one winch foul the ropes of another dragging them against a person working in the vicinity.

The majority of accidents occurred to someone other than the driver and who was working in the vicinity of the scraper path. A number of accidents were the result of the scraper scoop fouling timber buried in the broken rock which then trapped someone against a pack or the sidewall.

In approximately 30% of the incidents studied the winch was started without clear warning (Reg. 19.3.3).

Comments

These observations prompt the following comments:-

Layout of the stope or workings or the relative positions of the winches influenced the occurrence of the accident.

The installation of snatch blocks will not necessarily prevent ropes fouling one another.

The level of hazard awareness of both winch drivers and those working in or adjacent to scraper paths appears to be moderate at best.

Signalling procedures or warning systems are not rigorously adhered to nor, it is believed, well maintained.

MANUAL HANDLING OF MATERIAL/MINERAL

Observations

As might be expected, a study of materials handling accidents shows that many of the accidents were the result of handling bulky, irregular shaped and heavy items of equipment, frequently in a confined space. The loading, off loading, installation and removal of ventilation pipes is a common activity resulting in an above average number of hand injuries. Stripping or removing ventilation pipes in haulages was noted as a particular hazard.

Comment

From the accident reports it is evident that the type of hand injuries normally sustained with the handling of pipes and heavy materials are unlikely to be prevented by the wearing of gloves, and that chain blocks are probably unsuitable for this task because of height restrictions. The common procedure when lifting such items appears to be to use a number of workmen, and many injuries result from either too few persons assisting with the task or, letting go before the pipe is safely secured in position.

The agency involved in this type of accident appears to be random although in a number of accidents studied, ventilation pipes appeared fairly frequently. Other agencies included rails, switches, rolls of

chain, drill steel, gas bottles and timber.

FALLING IN EXCAVATIONS OR SHAFTS

Comment

Accidents in this category are very often stated to be the fault of the person who fell. While this may have been the case and the correct wearing of a safety belt or harness prevented the injury, a number of the case studies indicate that the primary cause may have been that someone, other than the injured, did not foresee the possible consequences of his actions or decisions.

SLIPPING AND FALLING

Comment

Slipping and falling accidents tend to result in relatively minor injuries and be blamed on the carelessness of the individual who was injured. Only one of the reports studied contained a comment on the condition of the footwear, which was "good", and as might be expected, many of the incidents occurred on wet, smooth or inclined surfaces.

FALLING MATERIAL/ROLLING ROCK

Comment

From the reports studied, the majority of falling material and rolling rock accidents happen in steep, or steep areas of stopes, and some 44% occur on or near orepasses. Clearing and breaking rocks on stope grizzleys frequently causes hand injuries and the steel hooks which are generally used to perform this task provide only limited control over the rock once it is set in motion. Many hand injuries result when the process of positioning one rock on the breaking platform causes another to roll down the pile.

Timber mats are another fairly common agency and a number of incidents were noted of them falling onto persons during construction of a pack.

SUMMARY

Many accident reports, especially those involving relatively minor injury contain little, if any information in addition to the required facts. In general, only extraordinary events prompt the inclusion of more information and thus in many cases, the reports on accidents in a particular category tend to be repetitious.

The paucity of information contained in many accident reports is attributable to the fact that an investigations has a twofold purpose, namely to establish whether anyone was to blame and secondly, identify what steps can be taken to prevent a recurrence. Therefore, however well intentioned the questioning to establish the circumstances of an accident, the perception that an individual may be blamed in some way for the accident causes him to distance himself from the event by providing only the information required.

However, the information obtained from the case studies does indicate a number of areas where technology can play a role in reducing the number of accidents such as examination of the working place, re-railing of tracked vehicles and handling of bulky or awkwardly shaped equipment, especially in confined surroundings which together represent a substantial hazard in terms of allocated days lost.

This would appear to confirm the belief that additional, circumstantial information on accidents would be of benefit in determining industry needs.

ACCIDENT CATEGORY : FALLS OF GROUND

The following 21 accident studies recorded here have been selected from approximately 200 accident reports.

Acc. No.	Allotted Cause	Circumstances of Accident
018	Contravention of Regulation 8.8.1. Inadequate supervision discipline	A member of the development team was hit by a fall of ground in an orepass causing him to fall 20 m.
020	Inadequate examination	A machine operator was struck by a rock from the hanging in a development end as he barred the sidewall.
026	Inadequate examination/ inspection/test	A machine operator was killed by a fall of ground as he barred the sidewall in a raise.
028	"Section which fell bounded by two fracture planes and a bedding plane fault". Inadequate examination	Following the installation of permanent support in a wide drift, the mechanical props were removed and a section of the hangingwall fell, killing a machine operator.
030	Inadequate examination	A miner's assistant was killed when he was struck by an f.o.g. as he travelled in a strike gully.
031	"Inadequate working space". Inadequate examination	Whilst barring a rock was dislodged from the hangingwall and struck him on the finger. Occupation: stope team leader.
034	"Bad hangingwall conditions". Inadequate examination	A loco guard was struck on the hand by a rock from the hanging as he removed a loader from a footwall drive.
036	"Poor barring". Inadequate examination	As he was charging up the face a miner's assistant was struck on the leg by a rock which dislodged from the face.
038	"Restricted area". Inadequate examination	A scraper winch driver was installing a straining wire when an eyebolt pulled out, loosening a piece of hanging which struck him.
044	"Failed to sound hanging. Area not barred down correctly". Inadequate examination	A team leader was struck by a piece of rock from the hanging as he lashed the "south siding".
045	Lack of caution alertness	A team leader was struck by rock from hanging while barring.
046	Inadequate examination	A barrer was truck by an f.o.g. while barring.
047	"Inadequate barring". Inadequate examination	A machine assistant was blocking a matpack when he was struck by an f.o.g.
049	"High rock stress". Inadequate examination	A machine operator was struck by an f.o.g. while drilling (rock burst).
050	"Inadequate barring". Inadequate examination	A machine operator was struck by rock from hanging while barring face.
073	Inadequate examination	Stope face collapsed, injuring a miner's assistant as he was lashing. Area of high stress, close to holing. Spalling of the face had been noted and additional face sprags marked off.
083	"Failure to recognise hazard". Inadequate examination	A team leader was injured when he was struck by a fall of ground as he began barring. He had recognised the poor ground conditions and taken up position between two packs. A large section of hanging was dislodged. Packs ± 3 m from face.

Acc. No.	Allotted Cause	Circumstances of Accident
085	Failure to comply with recognised standards	During opening up of an old area a member of the stope team was struck by a rock when a brow in the strike gully collapsed. Miner inexperienced. No temporary support installed under brow.
091	Failure to use safety/protective devices	A team leader was struck on the leg by a rock dislodged from the hanging by the action of a rockdrill working above him.
110	"Standard of work unacceptable". Inadequate/ inspection/test	A machine operator was struck by a fall of ground while drilling in a raise. Areas was supported by roof bolts but holes had been drilled flat and bolts used to support snatch block rig.
118	Inadequate examination/ inspection/test	As temporary support was being installed after barring had failed to bring down bad ground, the hanging fell, injuring a workman.

ACCIDENT CATEGORY : LOCOMOTIVES/LOCOMOTIVE DRAWN VEHICLES

The following twenty accident reports were selected from approximately one hundred reports.

Acc. No.	Allotted Cause	Circumstances of Accident
081	"Taking improper position". Lack of (or unsuitable) facilities	Foot was caught between matpack and sidewall when the matpack was struck by a hopper. He was sitting on the matpack at the time.
096	Lack of (inadequate) standards/procedures	While opening the top of the grizzley his hand was caught between the loco and the tipping device. Occupation: Machine Operator.
097	Lack of (inadequate) standards/ procedures "Improper position"	Stood too close to hopper after coupling to loco. When loco moved he was hit by the loco. Occupation: Construction worker.
001	Contravention of Regulation 18.1.1. Lack of caution/ alertness	Having completed a series of shunting manoeuvres at the station orepass, during which the bottom discharge door of a hopper fouled the brow of the orepass, he uncoupled the hoppers and drove the loco onto the tip. The loco fell into the orepass. Occupation: Construction T/L. Comment: No mention of why loco fell into orepass e.g. track gauge.
002	Failure to comply with recognised good practice/ standards procedures	A machine operator was killed when he was struck by an explosives car which derailed as a result of a collision between a full ore train and a transport train at the haulage/cross-cut intersection.
014	Contravention of Regulation 3.14 by deceased. Rendering safety device ineffective	A boilermaker's assistant was crushed when he was struck by a train as he was working on a hopper parked at the entrance to a pump chamber leading off the haulage. Switch not closed.
027	Locomotive driver "to be charged". Failure to comply with recognised good practice standards/procedures	A team leader was crushed by a loco which the driver inadvertently set in motion in the wrong direction, the loco struck a ventilation door, knocking the team leader onto the tracks.
054	Batteries fitted incorrectly. Lack of (or inadequate) standards/ procedures	As a loco driver coupled a material car to the loco, his finger was trapped between the batteries and the loco chassis.
068	Not using "shackle pin" to connect up. Lack of caution alertness	A loco driver's fingers were trapped between the buffers as he was coupling them.
098	Lack of caution/alertness. "Failed to stop loco"	As he was coupling a hopper to the loco, the guard's leg was trapped between hopper and loco.
094	Lack of (inadequate) standards/ procedures	As he was waiting for the loco to push hoppers into a cross-cut a hopper derailed and struck him on the leg. Occupation: track maintenance.
095	Lack of caution/alertness	A loader driver was struck by a hopper as he tried to move a hose, as a loco was pushing a span into a development end.
100	Lack of caution/alertness. "Failure to recognise a hazard"	A trammer, who had been sitting in the reef drive slipped as he endeavoured to avoid an incoming span and was struck by a hopper. Warned by guard.
101	Failure to comply with recognised good practice/ procedures	During re-railing operations a loco driver tried to raise the coupling shackle using a coupling pin. His finger was trapped between the pin and the moving hopper.
102	"Failure to recognise a hazard". No loco guard. Inadequate (lack of) fencing/guarding	While repairing a loader in a development end a workman was caught between the loader and a span being pushed into the end. Occupation: pumps

Acc. No.	Allotted Cause	Circumstances of Accident
003	Deceased was drunk. Driver's vision from cab limited. Failure to comply with recognised good practice/standards/procedures	A man was run over by a loco as he lay on the tracks. Driver saw him but was unable to stop. Occupation: scraper winch driver.
013	Contravened Regulation 3.14. Failure to comply with instructions	A loco driver was killed when he drove a full ore train into a repair bay and struck a stationary hopper. Switch in incorrect position.
099	Lack of caution/alertness	A man was struck from behind by a loco as he walked towards the station. Occupation: barrer.
104	Failure to comply with recognised good practice. Charged under Regulation 18.4.4	A man attempted to climb into a moving carriage and was trapped between the carriage and an upright girder. Occupation: lasher.
103	Failure to comply with recognised good practice	The rear end of a train struck a lagging stacked adjacent to the track. As the lagging fell it struck the workman's finger against a disused tipping rail. Occupation: stope team.

ACCIDENT CATEGORY : SCRAPER WINCHES

The following ten accident reports were selected from approximately seventy-five reports.

Acc. No.	Allotted Cause	Circumstances of Accident
035	"Incorrect rigging. Not to standard". Inadequate supervision/discipline	A winch driver was caught between the scoop and a matpack when the scoop overran the tip. The sling suspending the snatch block was too long and did not halt the scoop before it had struck the driver.
037	Lack of caution alertness	A stope timber man was pulled against a pack by a stationary scraper rope which had been fouled by the centre gully winch ropes.
051	Lack of clearance (obstruction)	A winch driver's hand was pressed against a pack by a timber chock that had been fouled by a scraper moving down the face.
067	Failure to comply with instructions	As he climbed over stationary scraper ropes in a strike gully, his foot was trapped against the sidewall as the ropes tightened.
142	"Failure to warn". Failure to comply with instructions	A winch driver was lashing in the centre gully when his leg was caught by the scraper rope as it tensioned. Winch driver set winch in motion without signalling his intention to do so.
143	"Bell wire was not extended". Failure to comply with instructions	A team leader, sitting between the face scraper and the face was caught by the scraper ropes when they were fouled by the gully scraper. No elevating snatch blocks in gully.
144	"Taking up improper position". Lack of caution	A winch driver, pulling a hose in the face, was struck by the face scoop when it deflected after hitting a large rock.
145	Failure to comply with instructions	A workman was hit by the strike gully scraper ropes as he was working, when the ropes were fouled by the scraper ropes in the raise. Elevating snatch blocks had been loosened to facilitate the passage of the mono-rope.
146	Use of unsuitable/defective equipment	The welding holding a winch onto the rails forming the winch bed, failed, tipping the winch over onto his foot.
147	Winch driver charged under Regulation 19.3.3. Lack of caution	The winch driver set the gully winch in motion. A workman in the gully grabbed the rope as it tensioned and his hand was caught in the snatch block.

ACCIDENT CATEGORY : MANUAL HANDLING OF MATERIAL/MINERAL

The following twenty-five accident reports were selected from approximately two hundred reports.

Acc. No.	Allotted Cause	Circumstances of Accident
042	"Instructed to wear P.V.C. gloves". Lack of caution/ alertness	A stope team member was handling mats in the stope when one slipped from his grasp and fell on his finger.
084	"Failure to recognise hazard". Inadequate fencing/guarding	As he was collaring a drill hole the machine operator's glove became wrapped around the jumper.
086	"Taking up improper position". Lack of (or unsuitable systems/ facilities)	An onsetter was struck on the leg by a material car as he pulled it from the cage.
088	"Taking up improper position. Sub standard housekeeping"	The scraper winch was being used to carry timber into the stope. When he signalled to the winch driver to start the winch, his leg was caught by a piece of bellwire entangled in the timber, dragging him down the gully. Occupation: machine operator.
092	Lack of clearance	As he was withdrawing a scotch car from a cage a loader driver caught his finger between the car and the cage. First shift in this occupation.
119	"Inattentive or careless behaviour". Lack of caution/ alertness	A haulage operator flung a chain onto a truck. As he did so his finger was caught between the hook on the chain and the truck.
120	"Failure to give proper instructions"	As he was transporting timber slabs in the stope a scraper winch driver was struck on the hand.
121	"Failure to get assistance, defective tools, congested". Failure to comply with recognised good practice	A diamond driller was moving his machine with a pinch bar which slipped and struck him on the shoulder.
122	"Failure to get assistance, inattentive or careless behaviour". Failure to comply with recognised good practice	As he was moving ventilation pipes a lasher caught his finger between two pipes.
123	"Improper loading". Failure to comply with recognised good practice	As a lasher was off-loading material his hand was caught against the side of the car.
124	"Failure to warn. Taking up improper position". Failure to comply with recognised good practice	While transporting timber in a travelling way a lasher was struck on the foot by a chock thrown by a fellow worker.
125	Lack of (or inadequate) standards/procedures	As he was trying to remove a chock tied to the mono-rail the chock swung back and struck him on the back. Occupation: general labourer.
126	Lack of (or inadequate) standards/procedures	While moving a step ladder which he was using to remove vent. pipes, a shaft worker was struck on the foot when three vent. pipes fell and struck the ladder.
127	Lack of caution/alertness	As he was assisting with the transport of a scraper scoop into the face a lasher was injured when his foot was trapped between the scoop and the broken rock.

Acc. No.	Allotted Cause	Circumstances of Accident
128	"Failure to get assistance. Unsafe design". Lack of caution/alertness	As he was installing the bolt in the suspension chain his assistant let go of the pipe which fell onto his foot. Occupation: pipes and tracks.
129	"Improper lifting". Failure to use safety equipment	As he was turning over a rail his finger was caught between the rail and the footwall. Occupation: pipes and tracks. Correct tools were available.
130	Lack of caution	A loco driver was hit on the foot when the rail switch he was assisting to remove from a flat car bumped the sidewall and the others let go.
131	Lack of caution	Two men were moving a chain block from one anchor point to another when one slipped and let go, causing the chain block to strike the other man on the hand. Occupation: winch transport.
132	"Careless". Lack of caution	As a loco driver was jacking up a derailed hopper, the jack slipped and struck him on the ankle.
133	"Improper lifting". Lack of caution	A machine operator assisting with loading of vent pipes onto a flat car trapped his finger between the flange and the car when his assistant let go prematurely.
134	Lack of standards/procedures	As he was assisting with the removal of a vent. pipe a winch driver caught his finger against the hanging when the last bolt was cut.
135	Lack of caution	A team leader strained his back as he was helping to lift a rail switch from a car. A chain block was used but did not give them sufficient height.
136	Lack of standards/procedures	As timber was being hand transported by a number of stope workers, one workman's hand was trapped between the end of the chock he was holding and another passed to him.
137	"Non-adherence to standards". Lack of standard procedures	A stope timber man caught his finger on a rail when handling timber.
138	"Failure to get assistance". Lack of caution	As two members of a stope team were loading gas cylinders, the bottle slipped out of one's hand, trapping the hand of the other against the car.

ACCIDENT CATEGORY : FALLING IN EXCAVATIONS/SHAFTS

The following nine accident reports were selected from approximately seventy reports.

Acc. No.	Allotted Cause	Circumstances of Accident
007	Failure to use safety devices	A section of sidewall collapsed onto a platform installed in the shaft, breaking the platform and causing two men to fall 22 m to shaft bottom.
008	Not recorded. Regulation 7.3.2	A loco driver hand tramming a car across a redundant, planked off orepass, fell down the orepass when one of the planks tilted.
009	For reasons unknown the safety belt unbuckled	As the slack was being taken out of a slack hoist rope a kink developed. A plank was inserted in the eye of the kink. The plank slipped against the corkscrew of the rope and spun around knocking a workman into the shaft.
011	Failure to use safety devices	A machine operator was lashing ore in a loading box when he slipped and fell into the shaft. Was not wearing a safety belt.
012	Failure to use safety devices	A stope team member fell down a steeply inclined stope as the footwall gave way and collapsed the platform on which he was standing.
023	Mine overseer charged under Regulation 7.11.4	A shift boss fell down an orepass which he was trying to unblock.
024	Onsetter charged under Regulation 16.91.1	A stope timber man fell down a shaft when the onsetter rang the cage away before the doors were closed.
082	"Failure to recognise a hazard". Inadequate examination	A timber man fell through a hole in an inclined ladderway, where a grid had been removed for repairs.
090	"Failure to recognise a hazard". Inadequate discipline	A machine operator fell into a gully as he tried to move a machine out of the path of the face scraper and the machine hit him on the hand.

ACCIDENT CATEGORY : SLIPPING AND FALLING

The following nine accident studies were selected from approximately one hundred reports.

Acc. No.	Allotted Cause	Circumstances of Accident
106	Lack of caution/alertness	A workman slipped and fell when he stepped on a wet rail as he was walking in the haulage.
107	Lack of caution/alertness	A workman slipped on the wet footwall as he was walking down an incline haulage.
052	Lack of caution/alertness	As he was using a length of gum plank to re-rail a material car he slipped and his foot was caught between the rail and car. Occupation: development crew.
033	"Failure to recognise hazard"	As he was crossing a gully he slipped and grabbed the mono winch rope and his finger was caught between rope and pulley. Occupation: stope team.
058	Lack of caution/alertness	Slipped and fell as he ran down the steps from the upper deck loading platform.
114	Lack of caution/alertness	As he was travelling to the station he slipped on mud covering the concrete footwall.
115	Lack of caution/alertness	Walking in the haulage when he stepped onto a wet rail and slipped. "Boots were in order".
116	Lack of caution/alertness	As he stepped from the hopper buffer his foot slipped as he stepped onto a timber chock on the footwall.
117	Lack of caution/alertness	Slipped on a smooth timber plank as he walked in the travelling way.