

Chapter 4**THE EMPIRICAL INVESTIGATION - INTERPRETATION****4.1. INTERPRETING THE RESULTS**

In this chapter the results obtained with the aids of the questionnaires developed and distributed as explained in Chapter 3 will be analysed and interpreted.

4.2. THE RESULTS

The research results are based on the responses of 591 usable questionnaires representing the views of a population of 268 751 workers in the South African mining industry, with a confidence level of 95 % and a margin of 5%. This was achieved by sending out 858 questionnaires through the post as well as interviewing 388 mineworkers.

A total of 171 questionnaires were posted to coalmine management of which 67 (39,2%) replied with usable questionnaires, goldmine management received 598 questionnaire and returned 151 (25,3%) usable questionnaires while platinum mine management received 89 questionnaires and the researcher received 24 (27,0%) usable replies from this sector. The replies the coalmine workers (82), goldmine workers (235) and platinum mine workers (32) were obtained after the postal questionnaires were received back and it was decided to keep the sectors replies similar in size. This resulted in coalmine management to represent 11,34% of the total sample while the coalmine workers represented 13,87%. The goldmine management represented 25,55% while the goldmine workers represented 39,76% and Platinum mine management 4,06% Platinum mine workers 5,41%

The 591 useable questionnaires represent 47,4% of the total number of questionnaires issued.

Both phases contained replies from three distinct commodity groupings namely

coal, gold and platinum. An attempt was made to ensure that the responses received from the management component in each commodity, constituted a similar relative size to the responses from the workers in that commodity. As a result of the unpredictability of the number of replies received from a postal questionnaire, replies from the interviews represent approximately similar relative sizes.

4.2.1. SECTION 1

The aim of Section One was to establish whether the fundamental contributing factors isolated from the various accident investigation techniques, do indeed represented the factors that are believed to require confirmation during accident investigations.

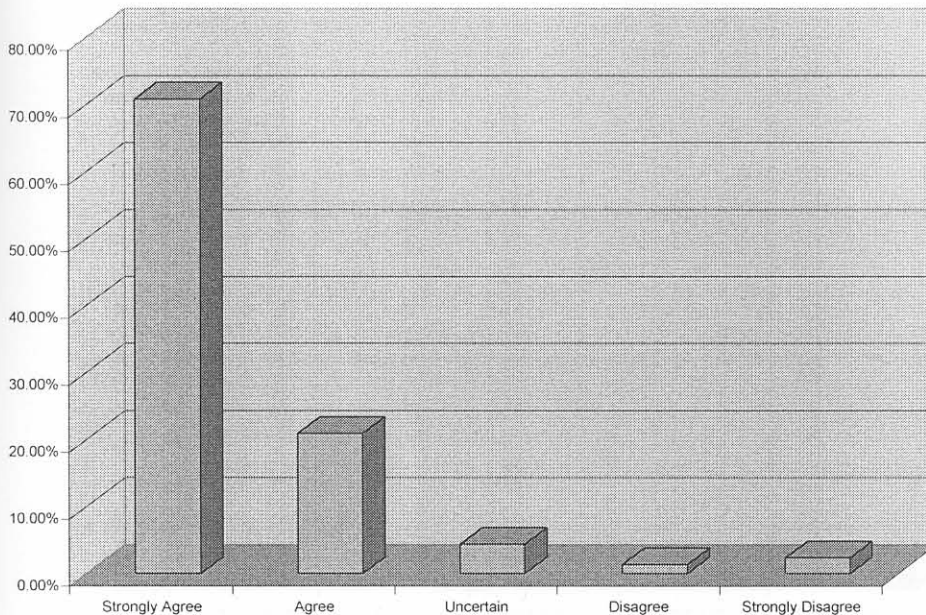
4.2.1.1. QUESTION 1.1

The questionnaire started with a general question on the effect of properly conducted accident investigations in the South African mining industry. Question 1.1 wanted to establish whether the respondents were of the opinion that proper accident investigations could prevent future accidents.

Of the 591 respondents, 419 indicated that they strongly agreed and a further 124 recorded that they agreed with the statement. This means that a total of 91.88% of the respondents support this view. A total of 26 (4.40%) were uncertain while 8 (1.35%) disagreed and 14 (2.37%) strongly disagreed.

The overwhelming response was that they strongly agree that proper accident investigations will prevent future accidents as can clearly be seen from Graph 4.1.

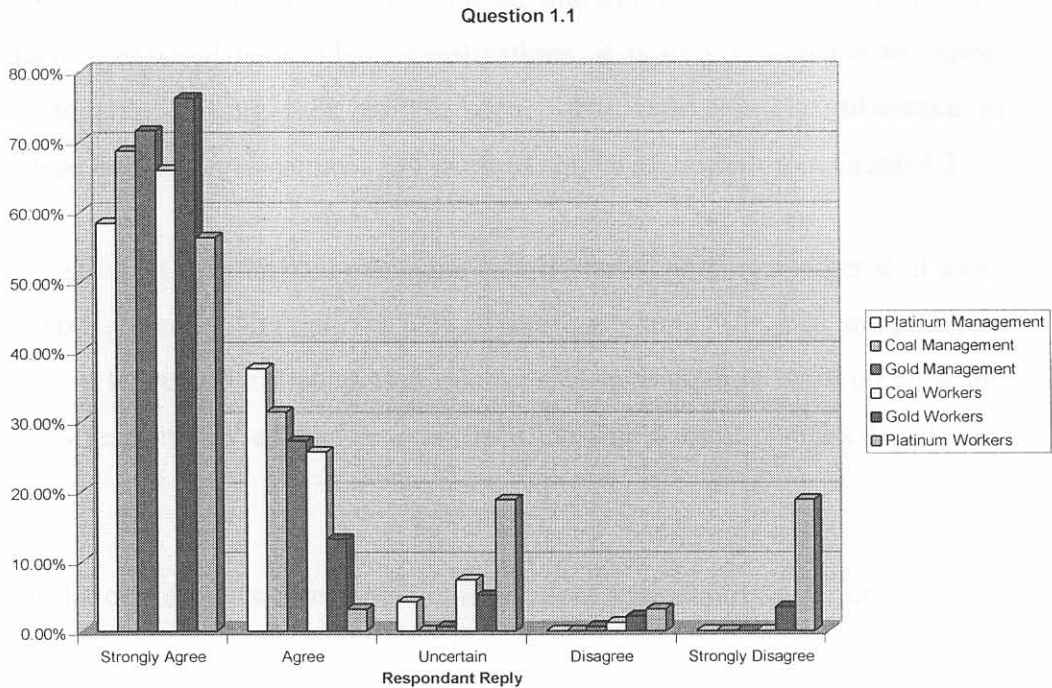
Question 1.1



Graph 4.1 - Replies to Question 1.1

The question was also utilised to establish any disparity between the six identified groups.

From Graph 4.2, constructed using the sub-group responses on question 1.1, it is clear that, with the exception of some of the platinum workers, the overwhelming majority of the sample agreed that, in order to reduce accidents, proper accident investigations was essential.



Graph 4.2 - Sub-group responses to Question 1.1

The difference in response from some platinum workers could possibly be ascribed to the relatively small number of respondents from this group that will cause a large percentage difference for a small numerical difference.

4.2.1.2. QUESTION 1.2

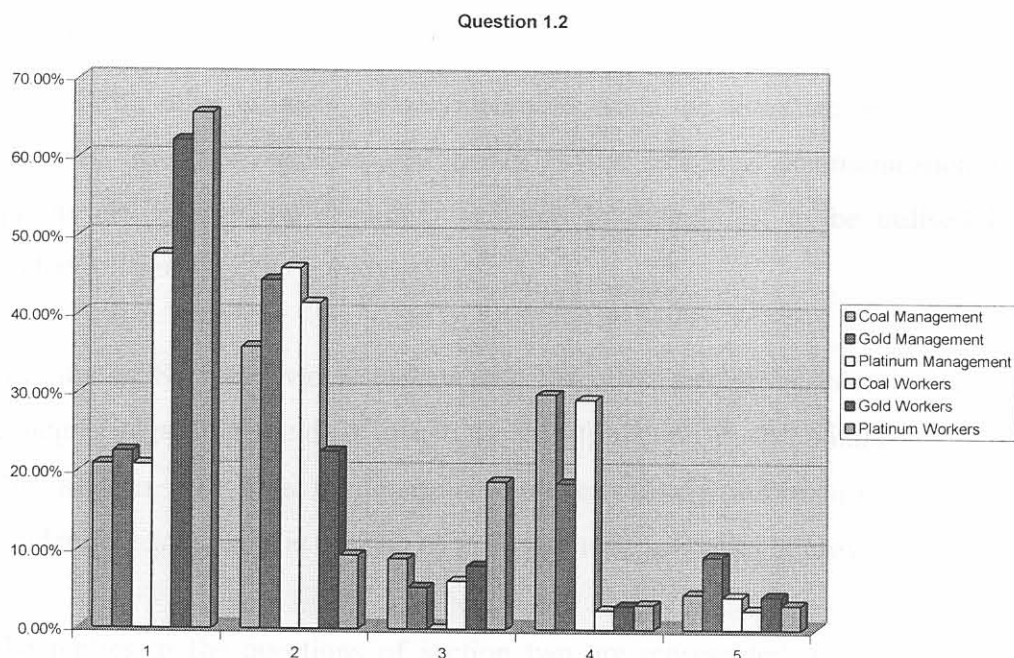
Question 1.2 aimed to establish the respondent's opinion on the importance of establishing the person responsible for the accident. This question stated that it is important to establish who was at fault during accident investigations. The inclusion of this question was to establish the belief of the different groupings and sub-groupings in relation to blame-fixing. The literature is unanimous that blame-fixing will achieve nothing to reduce the occurrence of accidents.

From the replies it is clear that the South African mining industry is still very much focussed on fixing blame. Of the 591 respondents, 259 (43.82%) replied that they strongly agreed that it was important, while 192 (32.49%) agreed that it was important. A total of 44 (7.45%) was uncertain. It was encouraging to note that 96 (16.25%) of the respondents disagreed.

As the focus only recently started changing, and as it is management that is most frequently exposed to accident investigations, it is only reasonable to expect them to start shifting their beliefs sooner than workers. The difference in response between management and workers can be identified from Graph 4.3.

It is significant that the coal managers clearly started making a larger shift away from fixing blame, with only 56.72% supporting blame. The gold and platinum managers however, still supported this type of investigation, with 66.86% and 66.66% respectively as can be seen from the information contained in Graph 4.3.

A similar difference is detectable in the accident statistics of the groupings.



Graph 4.3 - Sub-group responses to Question 1.2

It is meaningful to note that all worker groupings were of the overwhelming opinion of the importance of establishing who the person at fault was. These responses confirm the influence that the current accident investigation system in use in the mining industry, has on workers.

4.2.1.3. QUESTION 1.3 TO 1.13

Question 1.3 to 1.13 aimed to establish whether the respondents agreed that the ten elements isolated from the literature were indeed important to establish during accident investigations, in order to prevent similar accidents.

Only a very small percentage of respondents disagreed (0.51% to 5.25%) with the inclusion of the ten fundamental contributing factors in an accident investigation designed to prevent future accidents.

These graphs can be viewed for detail in annexure "C".

4.2.2. SECTION 2

One of the other primary issues identified from the literature as having a profound effect on occupational safety is the effective communication of appropriate information regarding accident investigations, to be utilised by production personnel to improve safety.

The aim of Section Two is to establish the effect of current communication strategies regarding accident investigation information in the mining industry. This section also tries to determine how effectively information regarding accident investigations is utilised by production personnel to improve safety.

The replies to the questions of section two are represented in a table. The information is grouped as follows:

The first column is utilised to separate the respondents into different categories. The first three groups are the management respondents from respectively coal, gold and platinum mining. The next three groups are worker respondents from these sectors. The main body of the table gives the number of respondents replying to each of the options (Strongly Agree; Agree; Uncertain; Disagree and Strongly Disagree). The percentages reflect the proportion of respondents in

each category that selected a specific response. In the last row the total replies for each response type is added together to give the total picture irrespective of the category of the respondent.

4.2.2.1. QUESTION 2.1 TO 2.3

The questions in this section deal with the frequency of official communication of the occurrence of accidents of various severities to the respondents.

Question 2.1 required the respondent to state, "How often are you officially informed that a fatal accident occurred on the mine that you work on?"

Table 4.1 gives the replies received from the 591 respondents in respect of this question. It is clear that the official communication of information regarding fatal accidents is conducted effectively. A total of 84.94% of respondents either replied that they are always or regularly informed of this type of accident. The difference between the replies from management and workers are negligible. A worrying factor is that 3,38% of the respondents replied that they are never officially informed about the occurrence of a fatal accident while a further 2,2% responded that they are seldom informed. As a result of the severity of this type of accident one would have expected that these replies would not occur.

Table 4.1 - Responses in respect of Question 2.1

Category	Always	Regular	Sometime	Seldom	Never	Total
Coal Management	58	4	3	1	1	67
	86.57%	5.97%	4.48%	1.49%	1.49%	100.00%
Gold Management	130	12	6	2	1	151
	86.09%	7.95%	3.97%	1.32%	0.66%	100.00%
Platinum Management	20	2	1	1	0	24
	83.33%	8.33%	4.17%	4.17%	0.00%	100.00%
Coal Workers	47	14	13	4	4	82
	57.32%	17.07%	15.85%	4.88%	4.88%	100.00%
Gold Workers	176	13	32	5	9	235
	74.89%	5.53%	13.62%	2.13%	3.83%	100.00%
Platinum Workers	26	0	1	0	5	32
	81.25%	0.00%	3.13%	0.00%	15.63%	100.00%
Total	457	45	56	13	20	591
	77.33%	7.61%	9.48%	2.20%	3.38%	100.00%

Question 2.2 was included to determine how often respondents are officially informed that a **Reportable** accident occurred on the mine that they work on. Table 4.2 gives the responses in respect of this question.

Table 4.2 - Responses in respect of Question 2.2

Category	Always	Regular	Sometime	Seldom	Never	Total
Coal Management	43 64.18%	12 17.91%	9 13.43%	3 4.48%	0 0.00%	67 100.00%
Gold Management	79 52.32%	46 30.46%	16 10.60%	10 6.62%	0 0.00%	151 100.00%
Platinum Management	10 41.67%	9 37.50%	4 16.67%	1 4.17%	0 0.00%	24 100.00%
Coal Workers	39 47.56%	20 24.39%	11 13.41%	2 2.44%	10 12.20%	82 100.00%
Gold Workers	141 60.00%	19 8.09%	45 19.15%	11 4.68%	19 8.09%	235 100.00%
Platinum Workers	18 56.25%	5 15.63%	4 12.50%	0 0.00%	5 15.63%	32 100.00%
Total	330 55.84%	111 18.78%	89 15.06%	27 4.57%	34 5.75%	591 100.00%

A total of 74.62% replied that they are either always or regularly informed about a reportable accident on the mine that they work on. There are no, or very little distinction between the responses of the workers and management.

This regression of effectiveness of communication can only be attributed to the perception of the communicators that a reportable accident is less severe than a fatal accident and therefore requires less communication effort.

Question 2.3 required the respondents to indicate how often they are officially informed about a **Lost Time** accident on the mine that they work on. Their responses are reflected in table 4.3.

Table 4.3 - Responses in respect of Question 2.3

Category	Always	Regular	Sometime	Seldom	Never	Total
Coal Management	33 49.25%	14 20.90%	14 20.90%	4 5.96%	2 2.99%	67 100.00%
Gold Management	64 42.38%	37 24.51%	25 16.56%	19 12.58%	6 3.97%	151 100.00%
Platinum Management	5 20.83%	10 41.67%	6 25.00%	3 12.50%	0 0.00%	24 100.00%
Coal Workers	32 39.02%	17 20.74%	12 14.63%	1 1.22%	20 24.39%	82 100.00%
Gold Workers	133 56.60%	27 11.48%	27 11.49%	9 3.83%	39 16.60%	235 100.00%
Platinum Workers	17 53.13%	4 12.50%	5 15.62%	0 0.00%	6 18.75%	32 100.00%
Total	284 48.05%	109 18.45%	89 15.06%	36 6.09%	73 12.35%	591 100.00%

A total of 66.50% of respondents replied that they are either always or regularly informed. The difference between the replies from management and workers are negligible.

From the responses to the three questions it is clear that the less severe the accident the lower frequency of communication. It is also significant that management are not better communicated to than workers.

The information obtained from these questions is very important in that it highlights the focus that mines are placing on the severity of accidents. At first it appears that this approach is correct, however, the severity of an accident is only one indication of the risk. According to Marx (2000) health and safety risk is the combination of the severity of the consequences, the frequency of occurrence and the level of exposure of the workforce to the hazard.

The replies indicate that South African mines do not necessarily follow this approach when deciding on a health and safety communication strategy.

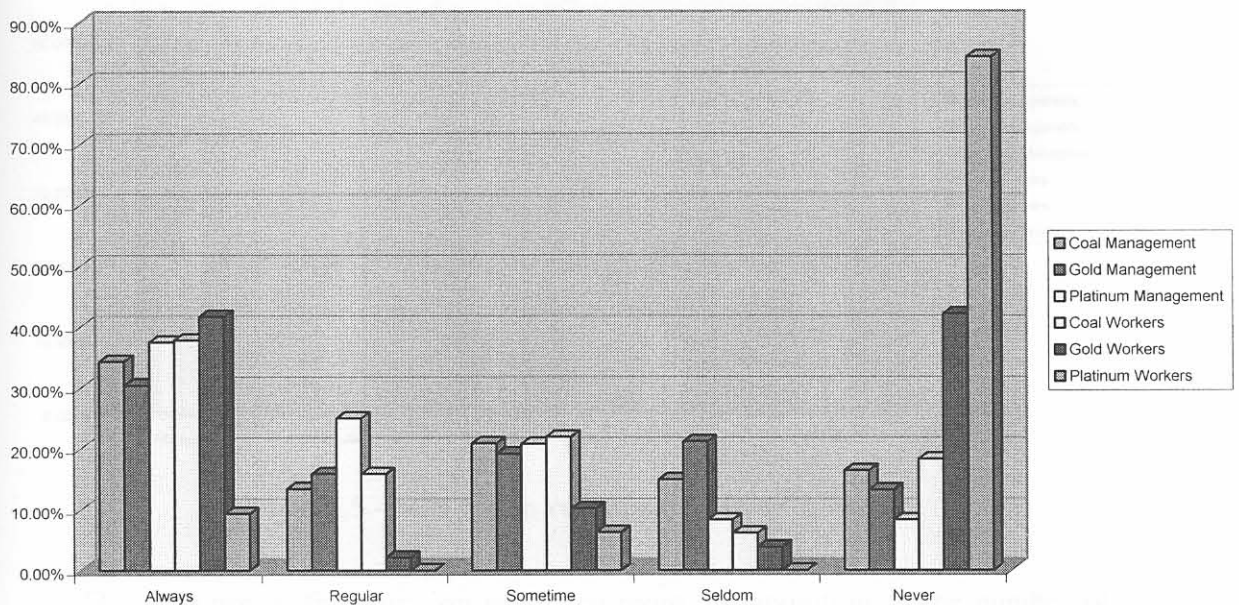
4.2.2.2. QUESTION 2.4 TO 2.6

The next three questions dealt with the frequency of official communication regarding the outcomes of accident investigations on the mine where the respondents are employed.

Question 2.4 required the respondents to reply to the question: "How often are you officially informed about the **outcome of fatal accident investigations** held on the mine that you work on?"

The reply to this question was very disappointing as the replies clearly indicate that, once the investigation is completed, the emphasis is off the accident. Yet the first step to prevention is to ensure that all role-players are informed about the appropriate corrective action.

Question 2.4



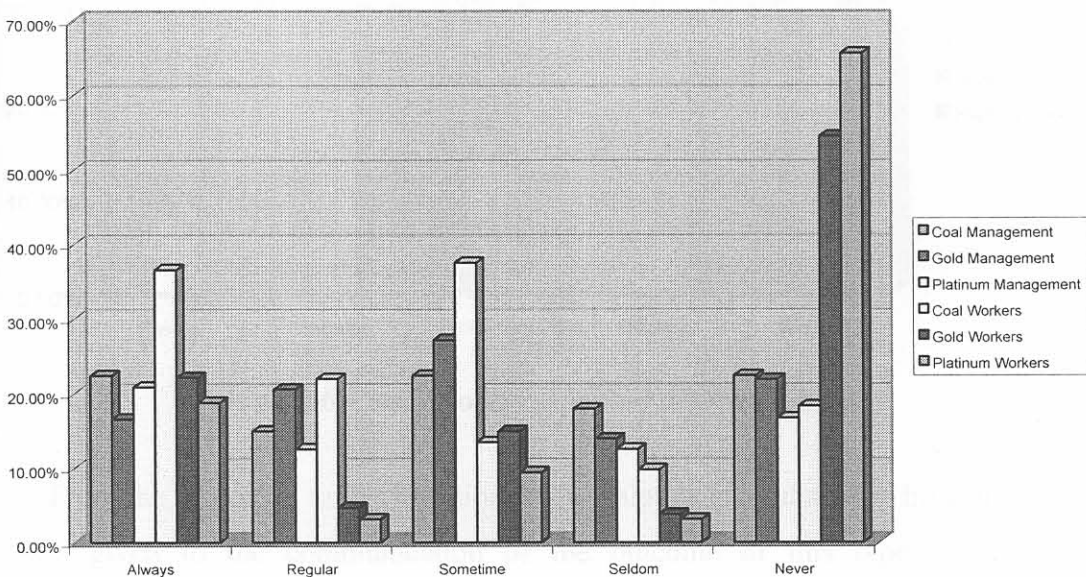
Graph 4.4 - Sub-group responses to Question 2.4

Should the outcome of a fatal accident that happened on the mine where the respondents work not be communicated it can be expected that very little action would follow to rectify any deviations identified.

The data shows that only 45,18% of respondents was always or regularly officially informed about the outcome of fatal accident investigations held on the mine that they work on.

Question 2.5 required the respondents to reply to the question: "How often are you officially informed about the outcome of **reportable accident investigations** held on the mine that you work on?"

Question 2.5



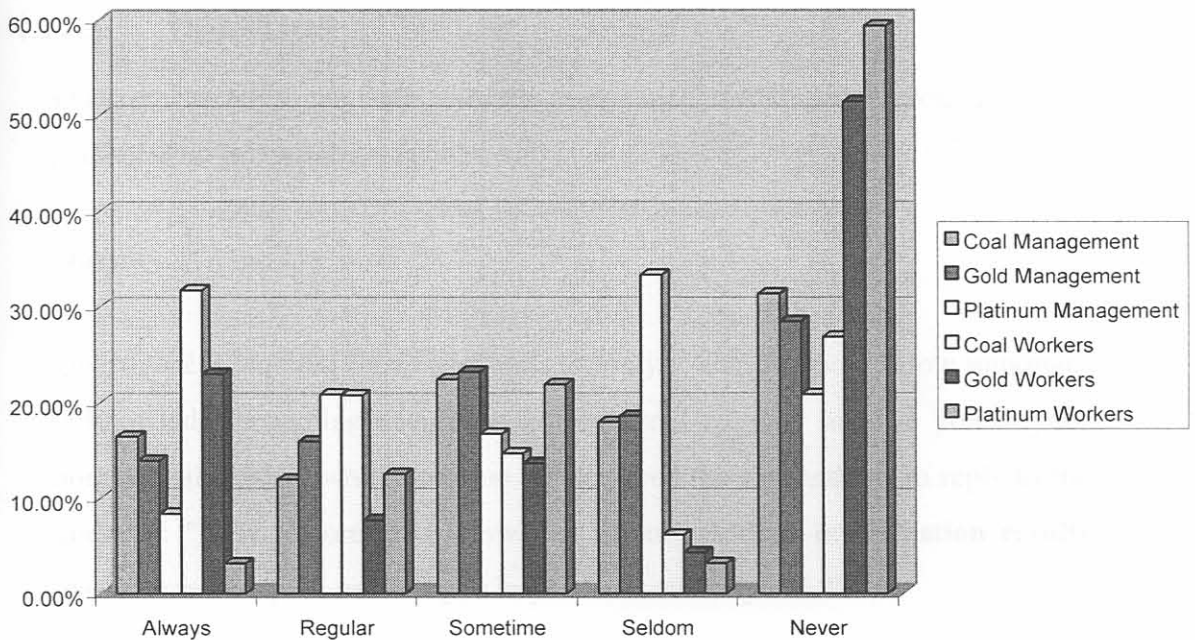
Graph 4.5 - Sub-group responses to Question 2.5

The response to this question was even more disappointing as the number of reportable accidents exceed the number of fatalities by a factor of about 5, as can be seen from table 2.1 in Chapter 2. With the higher incidence of reportable accidents the multiplying effect is clear. The data indicate that 64,97% of the responses was that the respondents were sometimes, seldom or never informed about the outcome of this type of investigation.

Question 2.6

Question 2.6 required the respondents to reply to the question: "How often are you officially informed about the outcome of **lost time accident investigations** held on the mine that you work on?"

Question 2.6



Graph 4.6 - Sub-group responses to Question 2.6

From the responses to this question it is absolutely clear that very little attention is given to the communication of the outcome of this type of accident investigation. The data indicate that 32.32% of the total sample, management as well as workers, are only informed about the outcome "regular" or "always". The equivalent responses from the worker respondents is even lower at only 20,30%.

Conclusion

The poor communication of accident investigations results to persons not directly associated with the investigation, together with the fact that the

importance of communication is associated with the severity of the consequences of the accident prevention information obtained during accident investigations are one of the primary conclusions that can be drawn from this portion of the empirical investigation. One possible reason for this may be that the existing investigation methodologies are not producing practical preventative measures, as they are primarily focussed on finding a party to blame.

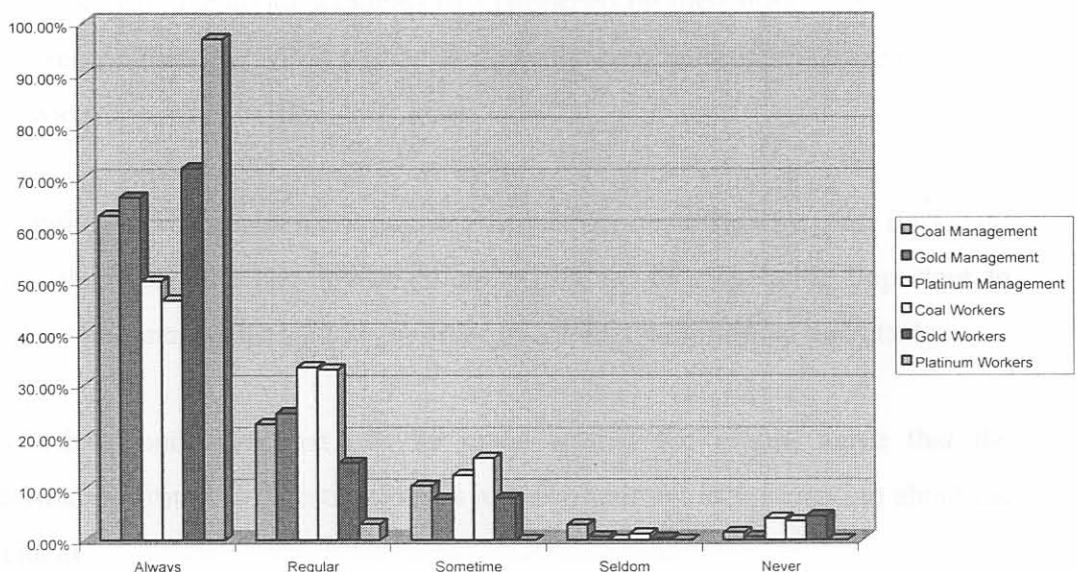
4.2.2.3. QUESTION 2.7 TO 2.10

Questions seven to ten deals with the importance of knowledge about accidents and accident investigation results.

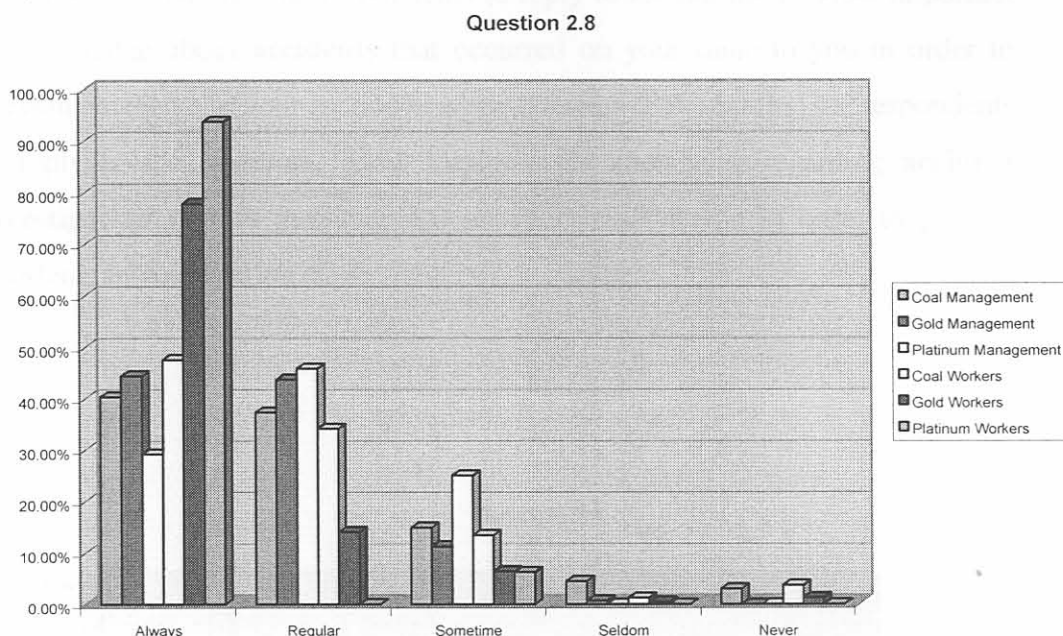
Question 2.7 and Question 2.8

Question 2.7 required the respondents to reply to the question: "How important is knowledge regarding **accidents** that occurred on your mine to you in your normal daily task?" while question 2.8 required the respondents to reply to the question: "How important is knowledge about **accident investigation results** that occurred on your mine to you in your normal daily task?"

Question 2.7



Graph 4.7 - Sub-group responses to Question 2.7



Graph 4.8 - Sub-group responses to Question 2.8

It is significant that a shift is noticeable when the respondents had to evaluate the importance of accident investigation. Responses indicated that 87,14% of the respondents felt that it was always or regularly important to their daily tasks to have knowledge about accidents that happened on their mines. With slightly more respondents (87,31%) replied that results from investigations are regularly or always important to their daily tasks.

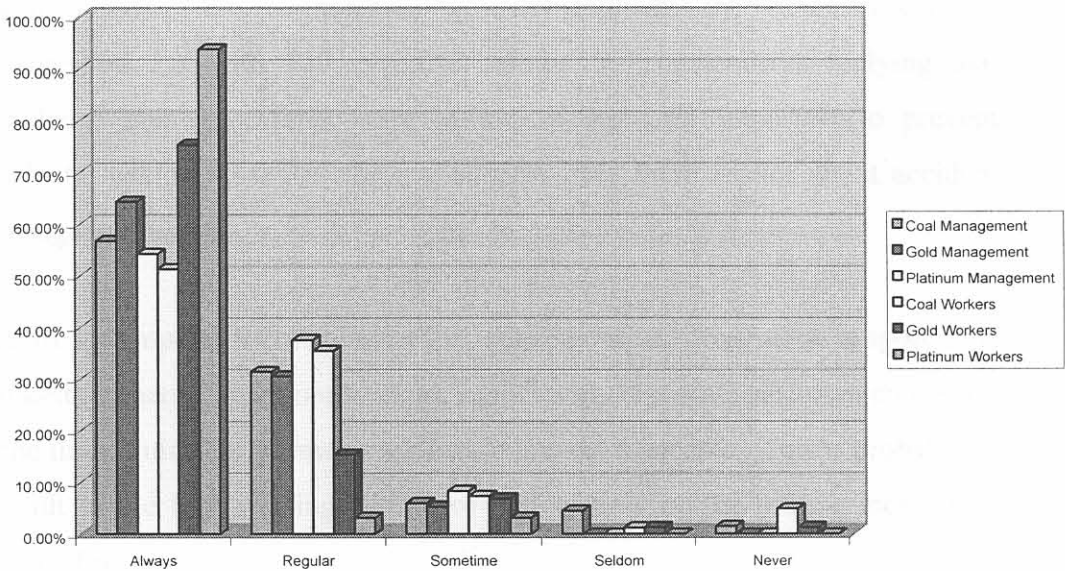
A number of conclusions are possible from these results. The most important being that accidents and investigation results are overwhelming important to workers and management alike, in order to conduct their normal daily tasks.

A further conclusion that can be made is that the groups agree that the information from the investigations is just as important as information about the accident

Question 2.9 and Question 2.10

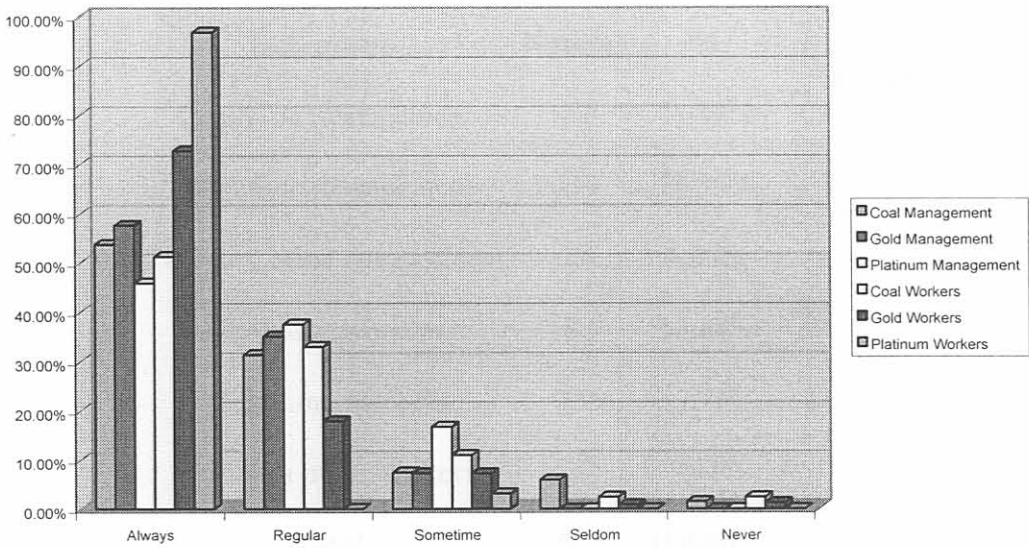
Question 2.9 required the respondents to reply to the question: "How important is knowledge about **accidents** that occurred on your mine to you in order to prevent accidents in your section?" while question 2.10 required the respondents to reply to the question: "How important is knowledge regarding **accident investigation results** that occurred on your mine to you in order to prevent accidents in your section?"

Question 2.9



Graph 4.9 - Sub-group responses to Question 2.9

Question 2.10



Graph 4.10 - Sub-group responses to Question 2.10

The responses of the two questions virtually duplicates the responses received for question 2.7 with 539 (91,20%) of the 591 respondents replying that knowledge about accidents were always or regularly important to prevent accidents, while 89,68% of the respondents gave these replies about accident investigation results.

One of the important conclusions that can be derived from these responses is that neither management nor workers significantly distinguishes between the use of the information for normal work and to prevent accidents. This is probably as a result of the longstanding culture of “safety first” in the mining industry in South Africa.

4.2.3. SECTION 3

In section 3 questions to establish the demographics of the sample were asked. This was necessary in order to establish whether there were any major differences between the responses of the various subgroups.

Table 4.4 – Demographic distribution of respondents:

Sub-group	Number	%
Coalmine management	67	11,34%
Goldmine management	151	25,55%
Platinum mine management	24	4,06%
Coalmine workers	82	13,87%
Goldmine workers	235	39,76%
Platinum mine workers	32	5,41%
Total	591	100,00%

No further discussion about this is necessary.

4.3. CONCLUSION

It is concluded beyond any reasonable doubt that it would be justifiable to include the following fundamental contributing factors in accident investigations designed to prevent future accidents of a similar nature:

- Energy sources out of control,
- Management system failure,
- Training deficiency,
- Latent design defects,
- Inappropriate maintenance,
- Imperfect procedures,
- Unsuitable task directives,
- Substandard physical conditions,
- Unsafe acts,
- Barrier failures.

The conclusion is supported by the outcome of Section 1 that dealt with the specific fundamental contributing factors, as well as all the sections dealing with communication and the usefulness of information.

The identified fundamental contributing factors will, in chapter 5, be utilised to develop the new analytical investigation model.

The research also confirmed that communication to managers and workers about accidents and failure modes is necessary in order to prevent accidents as well as to conduct their daily tasks.

In the next chapter the information confirmed in the empirical investigation above will be utilised as building blocks to develop an analytical model that can be utilised as the basis for accident investigation methodologies.

