University of Pretoria etd – Marx, C (2003)

CHAPTER 7

SUMMARY, RECOMMENDATIONS AND FINAL CONCLUSIONS

7.1. INTRODUCTION

The primary purpose of this research was to develop an analytical accident investigation model for the South African mining industry. Adapting world best practice accident investigation techniques to a workable new model formed part of the research.

The research combined the most successful techniques from around the world in a way best suited to the South African mining industry. It was combined in a format proven to produce a reduced accident rate.

An in depth literature study of accident investigation techniques used by world-class industrial organizations was conducted with a view to isolating common fundamental contributing factors present in most of these techniques.

Based on the identified factors, a questionnaire was developed that included these factors. The results of the questionnaire was analysed to establish which of the identified contributing factors should be included in the analytical accident investigation model. These results were utilised to develop the accident investigation model. The model was converted into a practical investigation methodology that was tested for effectiveness during a pilot study.

During the pilot study it was proven that line managers and supervisors can use the model developed to prevent similar accidents. The reportable injury frequency rate in the area where the pilot study was undertaken declined from 13,51 persons injured per thousand at the start of the trial to 12,08, twelve months later, at the conclusion of the study. A total of 1 143 accidents were investigated by means of the new procedure during this time.

The use of the analytical accident investigation model as a basis for accident

University of Pretoria etd – Marx, C (2003)

investigation also ensured that a documented, verifiable and repeatable accident prevention programme could be implemented without any unnecessary recording of information.

7.2. THE ANALYTICAL MODEL

The analytical accident investigation model developed as a result of this research comprises of a system that identifies the fundamental contributing factors to an accident, and then associating the relevant failure modes with the occurrence of the accident.

The failure modes were identified by combining the identified failure modes in techniques used by world-class industrial organizations and governmental originations into a single model.

In order to clarify the interaction of the various failure modes, the graphic representation in figure 7.1 is used where the fundamental contributing factors are represented as individual solid plates rotating at individual, varying speeds on a common axis. Each plate in the model represents a fundamental contributing factor associated with a specific potential accident. The solid parts of the plates represent perfect conditions in each of the elements. The randomly positioned holes in the plates represent failure modes of the fundamental contributing factors:

- 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.

University of Pretoria etd – Marx, C (2003)

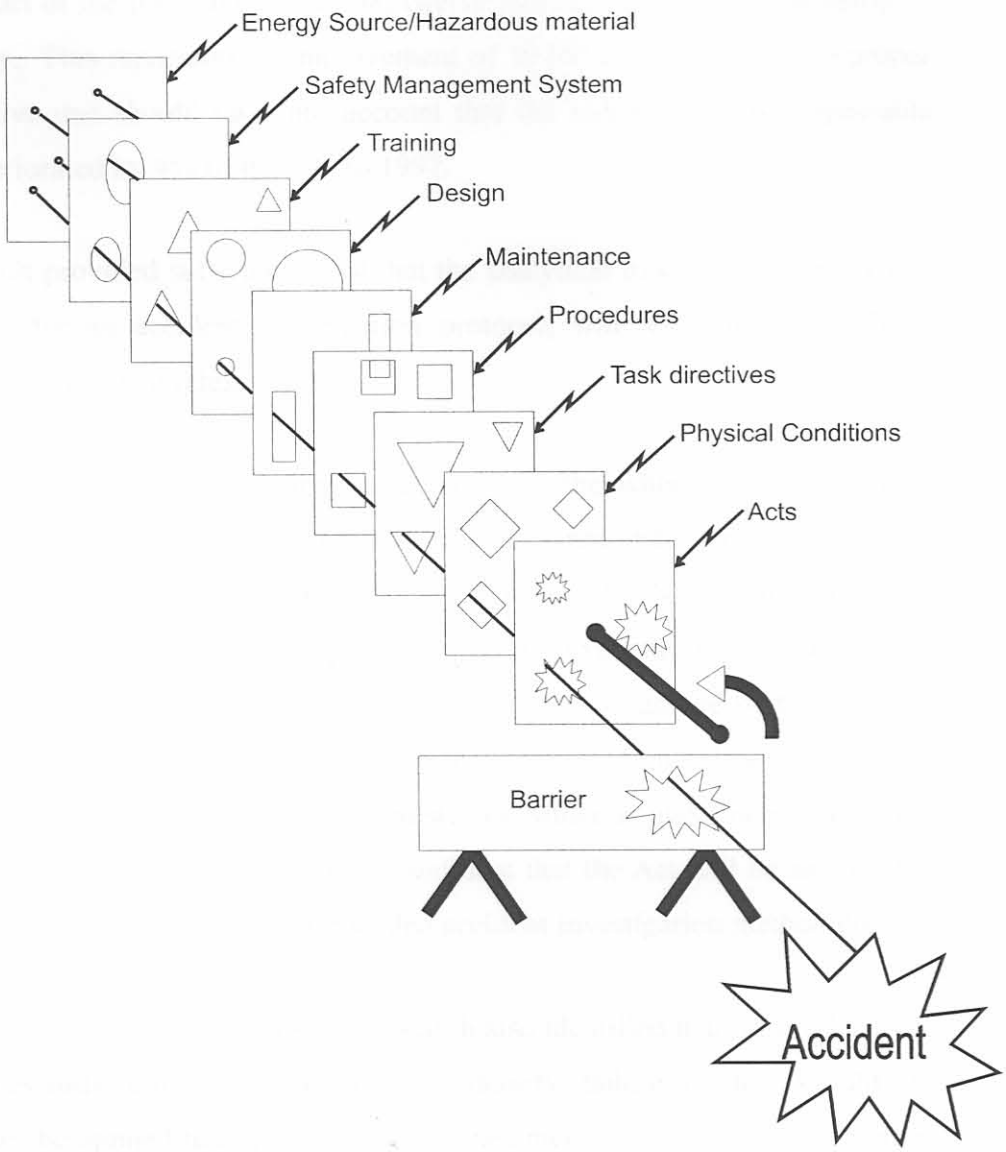

Figure 7.1 – Accident model as developed in Chapter 4

7.3. ACHIEVING THE ORIGINAL GOALS

The researcher set out to develop an analytical accident investigation model to be utilized as a tool to investigate accidents in such a manner that similar accidents could be prevented. The developed model was successfully field tested as reported in Chapter 6 of this thesis. It can safety be said that the pilot study proved the effectiveness of the model since the reportable accident rate in the geographical area where the study was undertaken was reduced from 13,51

University of Pretoria etd – Marx, C (2003)

at the start of the pilot study to 12,08, twelve months later at the conclusion of the study. This represents an improvement of 10,58%. To bring this in proper perspective one should take into account that the industry average reportable rate deteriorated by 4% from 1990 to 1997.

This result provided sufficient proof that the analytical model, when utilized as the basis for an accident investigation protocol, will result in a significant reduction in accident rates.

The developing of the analytical model also set the wheels of legislation in motion to make changes to legislation to accommodate this value adding approach to accident investigation in legislation. At the conclusion of the research a technical task group, appointed to evaluate the possibility of amending the Mine Health and Safety Act to take advantage of the research results, already submitted their report to the statutory Mine Health and Safety Council, responsible to advise the Minister of Minerals and Energy on health and safety matters. The researcher is confident that the Act will be amended in due course to allow for the recommended accident investigation methodology.

In addition to the original goals, the research also identified that the model could be successfully utilized to pro-actively identify failure modes, should the principles be applied to a qualitative risk assessment. This resulted in a totally new approach in the mining industry in respect of its approach to combining accident investigation and risk assessment methodologies.

7.4. RECOMMENDATIONS FOR FURTHER RESEARCH

While this research was only focused on the mining industry, the author suggests further investigations to assess the applicability of the model in industries and even for the investigation road accidents.

University of Pretoria etd – Marx, C (2003)

Needs for further research includes how to incorporate the behaviour based aspects of accidents in the methodology of isolating and identifying appropriate failure modes, without reverting back to a blame fixing culture.

The author is of the opinion that additional research in respect of the ratio relationship of incidents as explained by Heindrich, and the identified hazards, risks and failure modes identified during a qualitative risk assessment will further enhance the potential to manage positive performance indicators for safety in the workplace.

Research in this area should clarify the ratios and relationships between incidents and pro-active positive performance indicators as well. The author believes that the triangle could be expanded as indicated in figure 7.2.

This research identified the failure modes or fundamental contributing factors resulting in accidents. This researcher is confident that the identified factors are comprehensive. It is however clear that the level of control required to bring the risks of the individual fundamental contributing factors down to tolerable levels would vary among the individual factors. The methodology to determine these levels of intervention could possibly be found by utilising existing fuzzy logic methodologies.

University of Pretoria etd – Marx, C (2003)

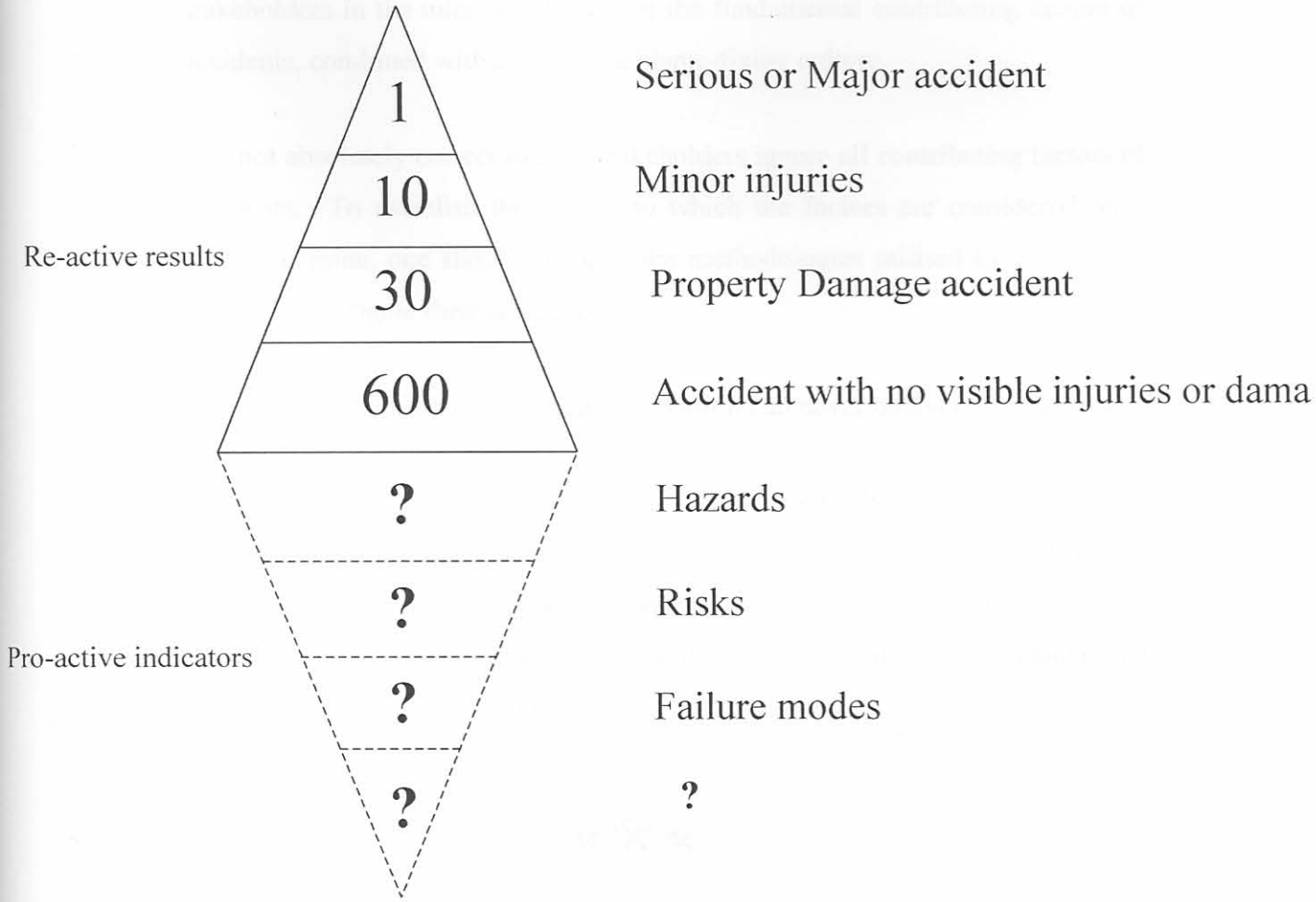

Figure 7.2 Areas identified for further research on Heindrich's triangle

7.5. PUBLICATIONS

During the course of the research a number of articles and technical papers were published in a wide variety of technical publications. The publication of the papers were utilised to ensure that the research outcomes were peer reviewed, by the scrutiny of targeted audiences, at the conclusion of each phase of the research. A list of the publications is contained in annexure "E".

7.6. FINAL CONCLUSIONS

The distinct possibility of a safer mining environment will never be realised as long as the cultural balance is tilted towards compliance rather than prevention.

University of Pretoria etd – Marx, C (2003)

The primary reason for this state of affairs is the lack of awareness among most stakeholders in the mining industry, of the fundamental contributing factors of accidents, combined with a pervasive blame-fixing culture.

It is not absolutely correct that all stakeholders ignore all contributing factors of accidents. To establish the degree to which the factors are considered on a particular mine, one should evaluate the methodologies utilised to assess their risk and investigate their accidents.

The importance of ensuring accident reduction can never be over-emphasized.

The dream of a safer mining environment could be realized if all the stakeholders focus on fundamental contributing factors as identified during this research and apply their findings and results to prevent similar accidents. Preventative accident management should be integrated into the managerial cultures of mining and all industries.