

DECLARATION

**An Analytical Accident Investigation Model for the
South African Mining Industry**

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ABSTRACT

DECLARATION

I declare that this thesis is my own work. It is being submitted on the partial fulfilment of the requirements for the Doctoral Degree in Business Administration to the University of Pretoria. It has not been submitted before for any degree or examination to any other university.

21 April 2003

ABSTRACT

This research set out to develop an analytical accident investigation model for the South African mining industry. Industrial accidents and injuries have notably plagued man since the industrial revolution, when a growing number of workers were exposed to new and dangerous machines in an ever more dangerous work environment.

The main thrust of the thesis is in developing a practical analytical accident investigation model that will provide mines with a managerial tool to establish failure modes by analysing the fundamental contributing factors of accidents. Once a practical analytical accident investigation model is in place, it would contribute to the reduction of the number of accidents on mines.

The research included an in depth literature study of accident investigation techniques used by world-class industrial organisations. Some of the models analysed included various cause and effect models, energy threshold models, probability and risk models, as well as some psychological models.

It was necessary to confirm whether the identified contributing factors, contained in the procedures utilised by multi-national companies and government agencies, should be included in an investigation model. In order to achieve this, the researcher undertook study tours to the USA as well as the United Kingdom.

Confirmation of the academically identified fundamental contributing factors was achieved by means of a questionnaire posted to a sample of middle managers and completed by impartial helpers on behalf of mineworkers during structured personal interviews.

Questions were developed to confirm which of the identified factors should be included in accident investigations. In addition to this, the questionnaire was also

used to determine the importance of relevant accident investigation information to production personnel, in the quest towards safety.

The questionnaire-study confirmed that the established fundamental contributing factors indeed needs to be included in analytical accident investigations. It also established the importance of communicating with managers and workers about accidents and failure modes, in order to prevent accidents and to fulfil their routine obligations.

During the study the traditional accident investigation system as utilised by inspectors of the Department of Minerals and Energy was evaluated.

The elements that comprise the new accident investigation model were transformed into a practical methodology to assist investigators in using the model.

It was established that it would generally not be possible to conduct a detailed investigation into every accident. The decision on the level of detail to pursue should be based on the risk profile associated with the accident or group of accidents. A methodology to objectively make such a decision is presented.

The expected benefits identified in the newly developed accident investigation methodology, were evaluated by practical implementation during a pilot study. The pilot study was also utilised to establish the practical limitations of implementing the model on a scale that may include other industries and more diverse types of accidents.

The results obtained during the pilot study confirmed that it is possible to prevent or reduce occupational accidents and the associated suffering, by implementing appropriate recommendations resulting from the use of this model.

OPSOMMING

Hierdie navorsing het begin met die doel om 'n analitiese ongeluksondersoek-model te ontwikkel vir die Suid Afrikaanse mynbou industrie. Bedryfsongelukke en die gepaardgaande beserings het sedert die Nywerheidsrevolusie deel van die werksomgewing geword. 'n Groeiende aantal werkers is blootgestel aan nuwe en gevaarlike masjiene in 'n selfs meer gevaarlike werksomgewing.

Die fokus van die tesis is om 'n praktiese analitiese ongeluksondersoek-model te ontwikkel wat myne sal voorsien van 'n bruikbare instrument waarmee vasgestel kan word watter fundamentele bydraende faktore sal lei tot ongelukke wanneer dit faal. Sodra 'n praktiese analitiese ongeluksondersoek-model in plek gestel word, sal dit grootliks bydra tot die vermindering van die aantal mynongelukke.

Die navorsing het 'n diepgaande literatuurstudie oor die ongeluksondersoek-tegnieke van wêreldklas ondernemings ingesluit. Sommige van die modelle wat ontleed is, sluit verskeie oorsaak-gevolg modelle, energie-drempel modelle, waarskynlikheids- en risiko-modelle, asook psigologiese modelle in.

Dit was nodig om te bevestig dat die fundamentele bydraende faktore, wat deel vorm van die prosedures van multi-nasionale maatskappye en staatsagentskappe, wel deel behoort te vorm van 'n ondersoek-model. Om dit te bereik, was dit nodig om navorsingsbesoeke na die VSA en Brittanje te onderneem.

Die akademies geïdentifiseerde fundamentele bydraende faktore is bevestig deur middel van vraelyste. Die vraelyste is per pos aan 'n steekproef middel bestuurders versend, terwyl dieselfde vraelyste tydens gestruktureerde onderhoude, deur onpartydige helpers namens mynwerkers voltooi is.

Vrae is ontwikkel om te bevestig watter van die geïdentifiseerde faktore behoort ingesluit te word by ongeluksondersoeke. Die vraelyste is ook aangewend om die belangrikheid van inligting uit ongeluksondersoeke vir bedryfspersoneel te bepaal.

Die empiriese studie, bestaande uit vraelyste, het bevestig dat die fundamentele bydraende faktore gewis deel moet vorm van 'n analitiese ongeluksondersoek. Dit het ook die belangrikheid van kommunikasie aan bestuurders en werkers, met betrekking tot ongelukke en die geïdentifiseerde faktore wat faal, bevestig. Hierdie kommunikasie is noodsaaklik ten einde ongelukke te voorkom en roetine-verpligtinge veilig te voltooi.

Die tradisionele ongeluksondersoek-metodologie wat deur die Departement van Mineraal en Energie gebruik word is gedurende die studie ge-evalueer.

Die elemente waaruit die ongeluksondersoek-model bestaan, is in 'n praktiese metodologie omgeskakel om ondersoekers van hulp te wees tydens die implementering van die model.

Dit is vasgestel dat dit nie normaalweg moontlik is om alle ongelukke tot dieselfde mate van volledigheid te ondersoek nie. Die besluit oor die volledigheid hiervan, behoort op die risiko-profiel van die ongeluk, of groep ongelukke, gebaseer te wees. 'n Metode vir die objektiewe neem van so 'n besluit word voorgestel.

Die geïdentifiseerde voordele wat spruit uit die gebruik van die nuut-ontwikkelde ongeluksondersoek-metodologie is gedurende 'n loodsprojek prakties ge-evalueer. Die loodsprojek is ook gebruik om die praktiese beperkings gedurende die implementering van die model in ander nywerheidssektore en 'n verskeidenheid tipes ongelukke te bepaal.

Die loodsprojek se bevindings het die moontlikheid om ongelukke en verwante lyding te voorkom bevestig, mits toepaslike aanbevelings wat gedurende die gebruik van die model bepaal is, geïmplementeer word.

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This research project would not have been possible without the grace of God, who gave me the necessary wisdom and understanding to complete

this work. I therefore would like to quote the following portion from the Scriptures in recognition to Him.

JOB 28:

1 Men know how to mine silver and refined gold,

2 to dig iron from the earth and melt copper from stone.

3, 4 Men know to put light into darkness so that a mine shaft can be sunk into the earth, and the earth searched and its deep secrets explored. Into the black rock, shadowed by death, men descend on ropes, swinging back and forth.

5 Men know how to obtain food from the surface of the earth, while underneath there is fire.

6 They know how to find sapphires and gold dust-

7 treasures that no bird of prey can see, no eagle's eye observe-

8 for they are deep within the mines. No wild animal has ever walked upon those treasures; no lion has set his paw there.

9 Men know how to tear apart flinty rocks and how to overturn the roots of mountains.

10 They drill tunnels in the rocks and lay bare precious stones.

11 They dam up streams of water and pan the gold.

12 But though men can do all these things, they don't know where to find wisdom and understanding.

THE LIVING BIBLE, 1971, COVERDALE HOUSE
PUBLISHERS, ENGLAND

DEDICATION

To Lenél,

Adelein

Ilanie and

Stephan

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