



Bureau for
International Risk Assessments (Pty) Ltd
Reg No 992373807

P O Box 7880
Birchleigh
KEMPTON PARK
1621
South Africa
Tel: (011) 976-3623
Fax: (011) 393-5963
Cell: 082 577 7181
E-mail:
minnaarh@mweb.co.za

RISK ASSESSMENT STUDY ON THE ROCKCRETER
FOR
ROCKCRETE EQUIPMENT
&
GUNINTING SERVICES

August 2000

Prepared by: *HFB Minnaar*
Dr H F B Minnaar
Managing Director

Rockcrete Equipment
Risk Assessment Study

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Rev. 0

Report Summary Sheet

Client: Rockcrete Equipment & Guniting Services		Client Order No. 4282
Title of Report: A report on the Risk Assessment Study of the Rockcreter		
Summary: (Brief description of report) This report deals with the risks associated with the operations of the Rockcreter		
Indexing Terms: (keywords) Rockcrete Equipment & Guniting Services Risk Assessment Study Rockcreter		
Work Carried Out By: (Team initials or names) HM		
Job No:	102	

Document Revision Record

Rev No	Issue Date	Reason for Issue	Prepared By	Reviewed By
0	August 2000	Report	HM	<i>ABM</i>

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EXECUTIVE SUMMARY

This risk assessment addresses the risks associated with the Rockcreter. As there are different models of Rockcreters, the basic principle of operation is the same and for that reason this risk assessment can be considered as a generic risk assessment for all the rockcreters manufactured by Rockcrete Equipment and Guniting Services.

For this risk assessment only the Rockcreter was considered. The risk assessment thus excludes any equipment or service that is not supplied as part of the Rockcreter.

For this risk assessment the Failure Mode and Effect Analyses (FMEA) and Fault Tree Analyses (FTA) techniques were used.

From the FMEA (Appendix I) follows that there are three categories of risk associated with the Rockcreter, namely:

- Injuries to personnel
- Ill health to personnel
- Damage to equipment and production loss.

From the analyses it follows that if the **operating and maintenance procedures** are adhered to and if the operating personnel are well **trained** and being **aware of the hazards** associated with the operation of the Rockcreter, the risk should be acceptable.

It is recommended that a pre-use inspection procedure be put in place.

1. INTRODUCTION

This risk assessment addresses the risks associated with the Rockcreter. As there are different models of Rockcreters, the basic principle of operation is the same and for that reason this risk assessment can be considered as a generic risk assessment for all the rockcreters manufactured by Rockcrete Equipment and Guniting Services.

For this risk assessment only the Rockcreter was considered. The risk assessment thus excludes any equipment or service that is not supplied as part of the Rockcreter.

2.0 RISK ASSESSMENT

For this risk assessment the Failure Mode and Effect Analyses (FMEA) and Fault Tree Analyses (FTA) techniques were used.

From the FMEA (Appendix I) follows that there are three categories of risk associated with the Rockcreter, namely:

- Injuries to personnel
- Ill health to personnel
- Damage to equipment and production loss.

For these categories of risk three different Fault Tree Analyses were carried out as given in Appendix II, III and IV, respectively. The different combinations of basic events that could result in one of these three categories of risk are given in tables 1, 2 and 3 respectively.

The minimum combinations of basic events are events that have to happen simultaneously in order for the injury, ill health or damage to equipment/production loss to result.

It is important to note that the contents of tables 1, 2 and 3 must be read together with the Fault Tree Analyses given in appendices II, III and IV.

3.0 CONCLUSION AND RECOMMENDATIONS

From the analyses, as shown in Tables 1, 2 and 3, it follows that if the **operating and maintenance procedures** are adhered to and if the operating personnel are well trained and being aware of the hazards associated with the operation of the Rockcreter, the risk should be acceptable.

It is recommended that a pre-use inspection procedure be put in place.

Table 1: The Minimum combination of basic events that will result in injury to personnel
Basic Events

Minimum combination of events	Basic Events		
B3,C3	Maintenance is being carried out on the Rockcrete	Rockcrete is not disconnected from air or power supply	
F4,C4	Rockcrete is not stopped timeously when blockage occurs (back pressure in Rockcrete)	Foreign object in Rockcrete	
F4,D4	Rockcrete is not stopped timeously when blockage occurs (back pressure in Rockcrete)	Rockcrete Running too fast	
F4,E4	Rockcrete is not stopped timeously when blockage occurs (back pressure in Rockcrete)	Material hose not properly cleaned since previous use	
I4,J4	Dislodging of a blockage in the material hose takes place	The material hose is not secured properly	
H,J	Pre-use inspection fails to detect a potential problem and have it rectified timeously	Mechanical failure of the material hose connection takes place	
H,B5	Pre-use inspection fails to detect a potential problem and have it rectified timeously	Air hose comes loose due to a loose bracket or damaged hose	
H,L	Pre-use inspection fails to detect a potential problem and have it rectified timeously	Mechanical failure of the material hose takes place	
H,B2,C2	Pre-use inspection fails to detect a potential problem and have it rectified timeously	The sieve is removed from the Rockcrete	Rockcrete is loaded
C,D,H,F	Air supply hose is connected to the Rockcrete	Mechanical failure of the connecting coupling on the air supply hose takes place	Pre-use inspection fails to detect a potential problem and have it rectified timeously
			Safety chains/straps on the air supply hose fails

Table 1: (Continue)

Basic Events			
Minimum combination of events	Basic Events		
C,D,H,G	Air supply hose is connected to the Rockcreter	Mechanical failure of the connecting coupling on the air supply hose takes place	Pre-use inspection fails to detect a potential problem and have it rectified timeously
			Safety chains/straps are not connected to the air supply hose (operating procedure not followed)

Table 2: The Minimum combination of basic events that will result in ill health to personnel

Basic Events		
Minimum combination of events	Basic Events	
C6,H	Incorrect clamping procedure is used	Pre-use inspection fails to detect a potential problem and have it rectified timeously
H,E6	Pre-use inspection fails to detect a potential problem and have it rectified timeously	Critical parts are worn
H,G6	Pre-use inspection fails to detect a potential problem and have it rectified timeously	Nozzle is failed

Table 3: The Minimum combination of basic events that will result in damage to equipment and or production loss

Minimum combination of events		Basic Events	
C7,H	Two or more of the lifting hooks on the Rockcreter fail	Pre-use inspection fails to detect a potential problem and have it rectified timeously	
H,H7	Pre-use inspection fails to detect a potential problem and have it rectified timeously	Incorrect electrical connection exists	
H,I7	Pre-use inspection fails to detect a potential problem and have it rectified timeously	Air motor is connected incorrectly	
E7,F7	A foreign object is put into the Rockcreter	The Rockcreter is not stopped timeously	

APPENDIX I

Failure Mode And Effect Analyses

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Appendix I

Rockcrete Equipment
Risk Assessment

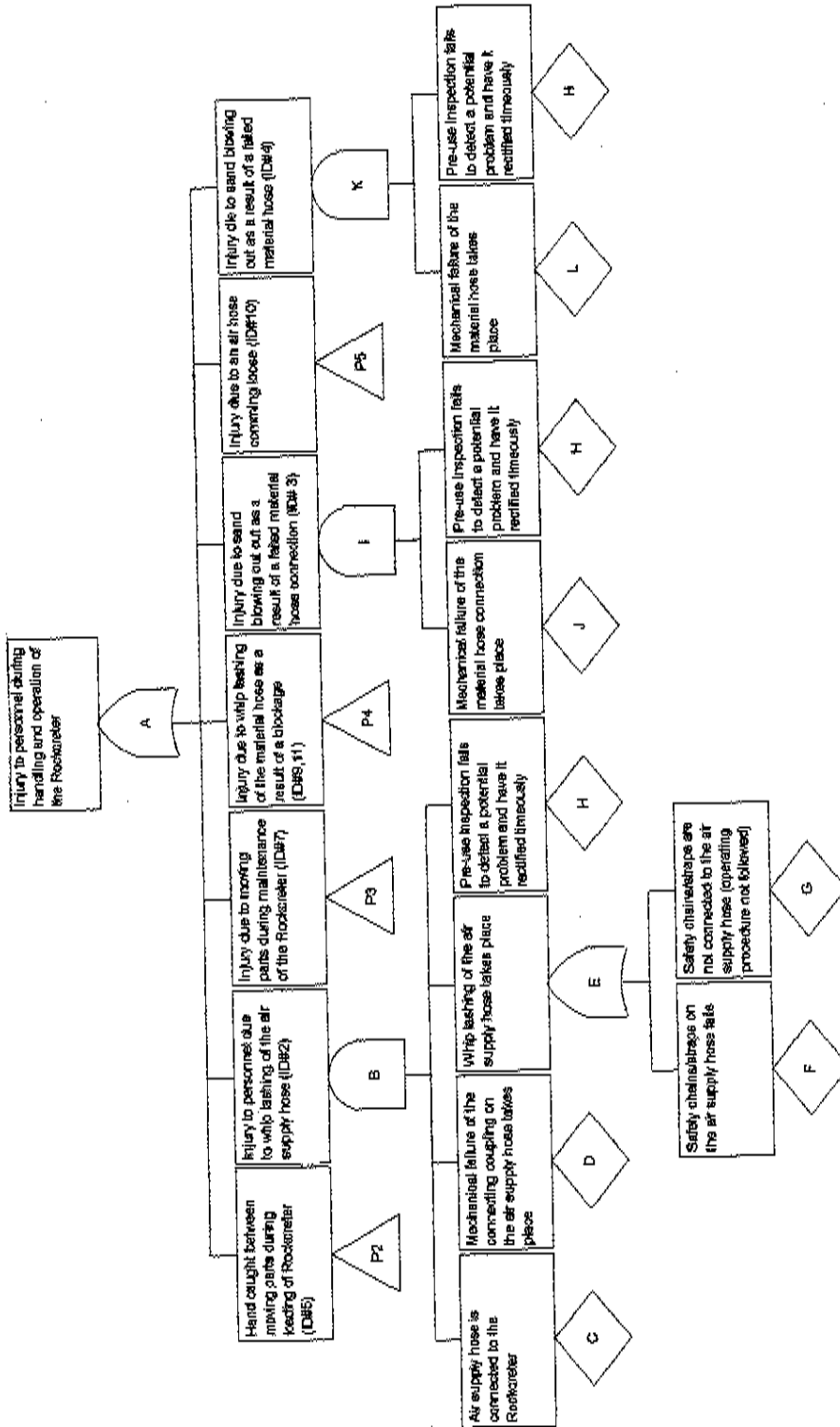
PROJECT: Risk Assessment on Rockcrete ORGANIZATION: Rockcrete Equipment & Guniting Services LOCATION: BIRA Office DATE: 10-Aug-00 PROJECT NO.: P102 TEAM MEMBERS: Mike Treges						LEADER : HM
						RECORDER : HM
						NODE : 001
						TIME:
ID#	Failure Mode	Failure Description/ Mode	Prevention or Mitigation Measure	Effects if prevention works	Effects if prevention fails	
1	Failure of more than one of the lifting/hoisting hooks during slinging of the Rockcrete	Mechanical failure of two or more of the lifting hooks	Visual inspection of lifting hooks prior to slinging	Nothing	Rockcrete going down the shaft and or damage to equipment	
		Incorrect slinging of the Rockcrete	Training and awareness	Nothing	Rockcrete going down the shaft and or damage to equipment	
2	Failure of the air supply connection to the Rockcrete	Mechanical failure of the connecting coupling	Training, awareness and inspection Operating procedure	Nothing	Whip lashing of the hose resulting in injuries/fatality	
			Safety chains/straps	Nothing	Whip lashing of the hose resulting in injuries/fatality	
3	Failure of the material hose connection	Mechanical failure of the connecting coupling	Training, awareness and inspection	Nothing	Injuries/splashes in eyes due to sand blowing out from the failed material hose	
4	Failure of the material hose during operation	Mechanical failure due to wear and tear	Training, awareness and daily inspection of hoses	Nothing	Injuries/splashes in eyes due to sand blowing out at the failed connection	
5	Hand or loose clothing caught in moving parts during loading of Rockcrete	Loading of sand and cement when the sieve is removed	Training and awareness not allowed to operate the Rockcrete without the sieve in place. Safety procedure	Nothing	Severe injuries to hand/arm	
6	Mechanical damage to the Rockcrete	Foreign objects entering through the sieve	Sieve, training and awareness	Nothing	Production loss and repair cost	

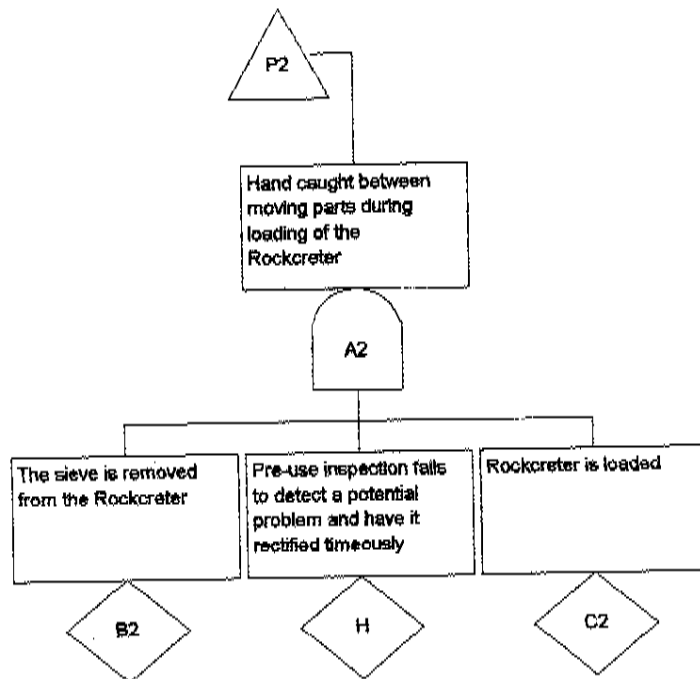
Rockcrete Equipment R102
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Appendix IRockcrete Equipment
Risk Assessment

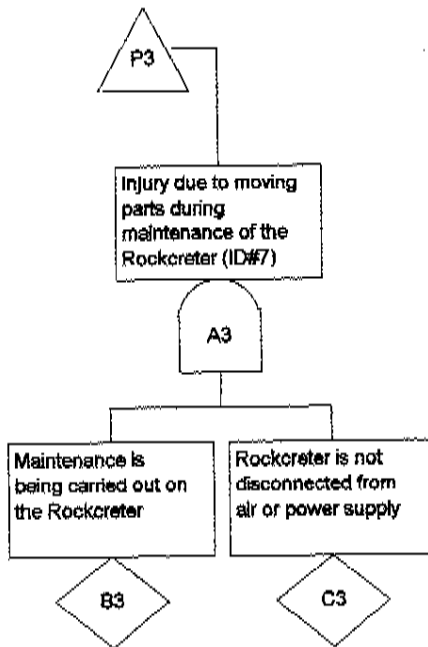
ID #	Failure Mode	Failure Mechanism	Failure Detection Mode	Prevention or Mitigation Strategy	Effects if Protective Meas.	Effects if Protection fails
7	Exposure of personnel to moving parts during maintenance	maintenance being carried out whilst machine is not disconnected	Visual	Training and awareness/ not allowed to carry out any maintenance on the Rockcrete whilst in operation or when power and or air is connected to it	Nothing	Severe injuries to hand
8	Excessive dust during operation of the Rockcrete	Incorrect setting of Rockcrete Worn parts Loss of water pressure at the nozzle Foreign objects	Visual Visual inspection Visual inspection	Training, awareness and correct clamping procedure Training, awareness and scheduled maintenance maintenance of the nozzle and inspection Stop Rockcrete immediately	Nothing Nothing Nothing	Ill health resulting from excessive exposure to dust Ill health resulting from excessive exposure to dust Ill health resulting from excessive exposure to dust Injury to personnel due to whip lashing of the material hose
9	Blockage of the material hose	Rockcrete running too fast Rockcrete/material hose not properly cleaned since previous use	Back pressure will cause exhausting in the hopper Back pressure will cause exhausting in the hopper Visual inspection	Training and awareness Rockcrete immediately	Nothing Nothing	Injury to personnel due to whip lashing of the material hose Injury to personnel due to whip lashing of the material hose
10	Air hoses on the Rockcrete coming loose	Loose clamps or damaged hose	Pre-use inspection	Maintenance	Nothing	Injury to body parts
11	Whip lashing of the material hose during dislodging of a blockage	Blockage of the material hose and over pressurisation	Visual	Training and awareness Operating procedures	Nothing	Injury to personnel due to whip lashing of the material hose
12	Damage to electrical motor	Single phasing of the motor due to cable failure or incorrect connection	Pre-use inspection	Training and awareness	Nothing	Damage to electrical motor and consequential production loss
13	Rockcrete turning in the wrong direction	Incorrect electrical connections Incorrect connection of the air motor	Pre-use inspection Pre-use inspection	Training and awareness Training and awareness	Nothing Nothing	Rockcrete will not operate Rockcrete will not operate

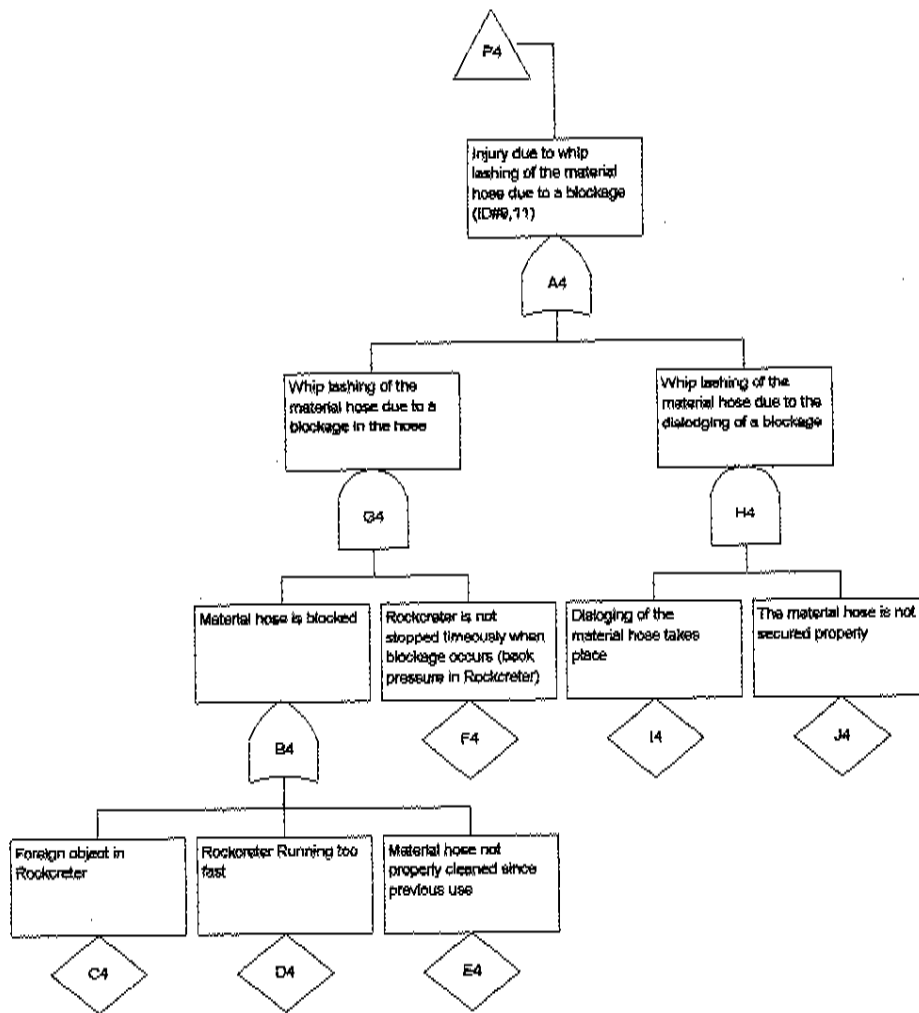
APPENDIX II

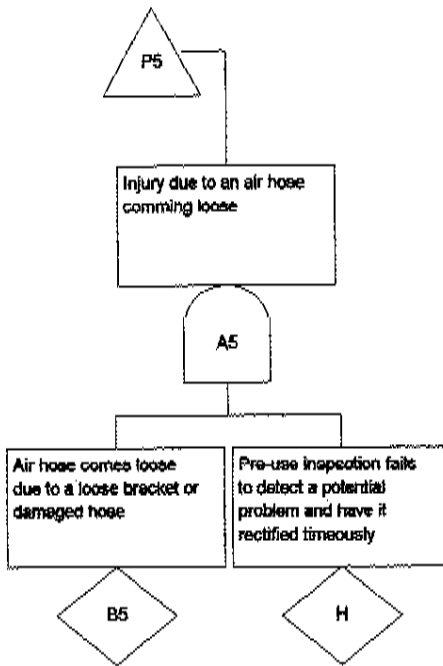
Fault Tree Analyses (Injuries to operators)





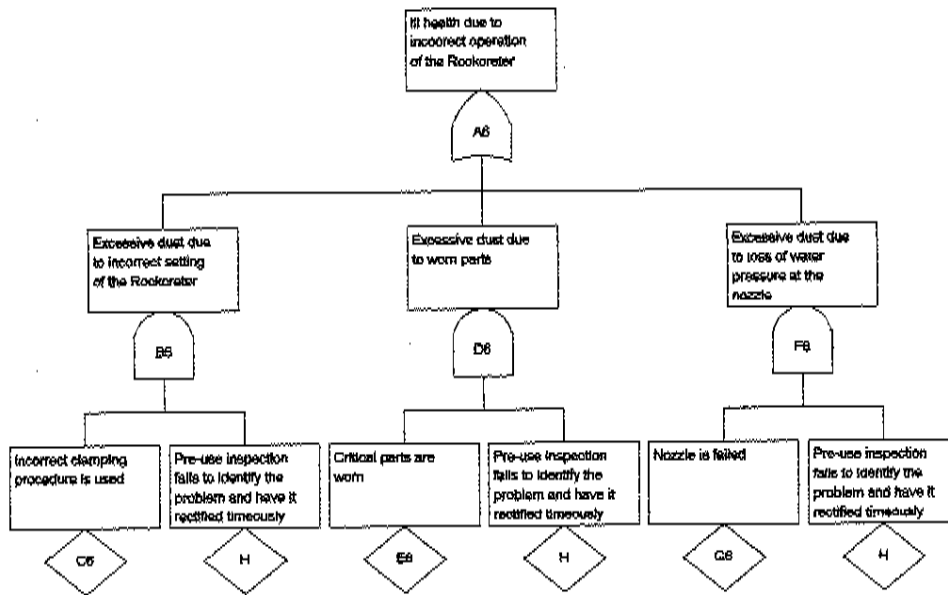






APPENDIX III

Fault Tree Analyses (III Health to operators)



APPENDIX IV

Fault Tree Analyses (Damage to equipment/Production loss)

