BIRA

Bureau for
International Risk Assessments (Pty) Ltd
Reg No 9923/738/97

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

RISK ASSESSMENT STUDY ON THE ROCRETER

FOR

ROCKCRETE EQUIPMENT (PTY) LTD

Prepared by: .....

Dr H F B MINAAR
Managing Director

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 risk 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

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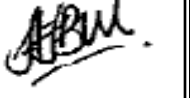
0	August 2000	Report	HM	

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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 risk 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. 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 give 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. 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 be put in place.

Table 1: The Minimum combinat1on of basic events that will result in injury to personnel

Minimum combination of events	Basic Events			
B3,C3	Maintenance is being carried out on the Rockcreter	Rockcreter is not disconnected from air or power supply		
F4, C4	Rockcreter is not stopped timeously when blockage occurs (back pressure in Rockcreter)	Foreign object in Rockcreter		
F4,D4	Rockcreter is not stopped timeously when blockage occurs (back pressure in Rockcreter)	Rockcreter running too fast		
F4, E4	Rockcreter is not stopped timeously when blockage occurs (back pressure in Rockcreter)	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 take 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 Rockcreter	Rockcreter is loaded	

Table 1: (Continue)

Minimum combination of events	Basic Events			
C,D,H,F	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 on the air supply hose fails
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 to followed)

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

Minimum combination of events	Basic Events	
C6,H	Incorrect clamping 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

PROJECT:	**Risk Assessment on Rockcreter**
ORGANIZATION:	**Rockcrete Equipment & Guniting Services**
LOCATION:	**BIRA Office**
DATE:	**10-Aug-00**
PROJECT NO.:	**P102**
TEAM MEMBERS:	**Mike Treges**

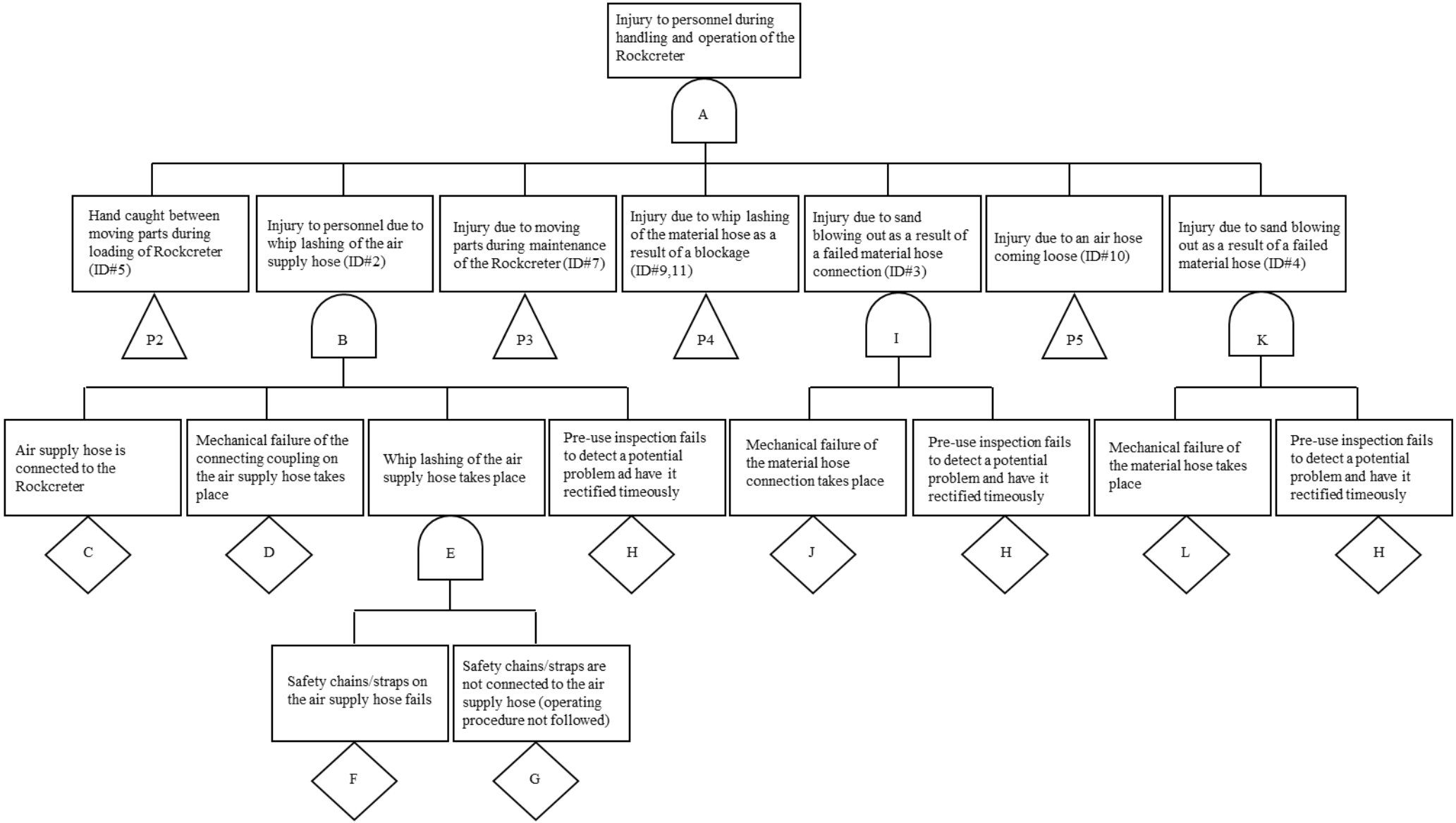
LEADER: HM
RECORDER: HM
NODE: 001
TIME:

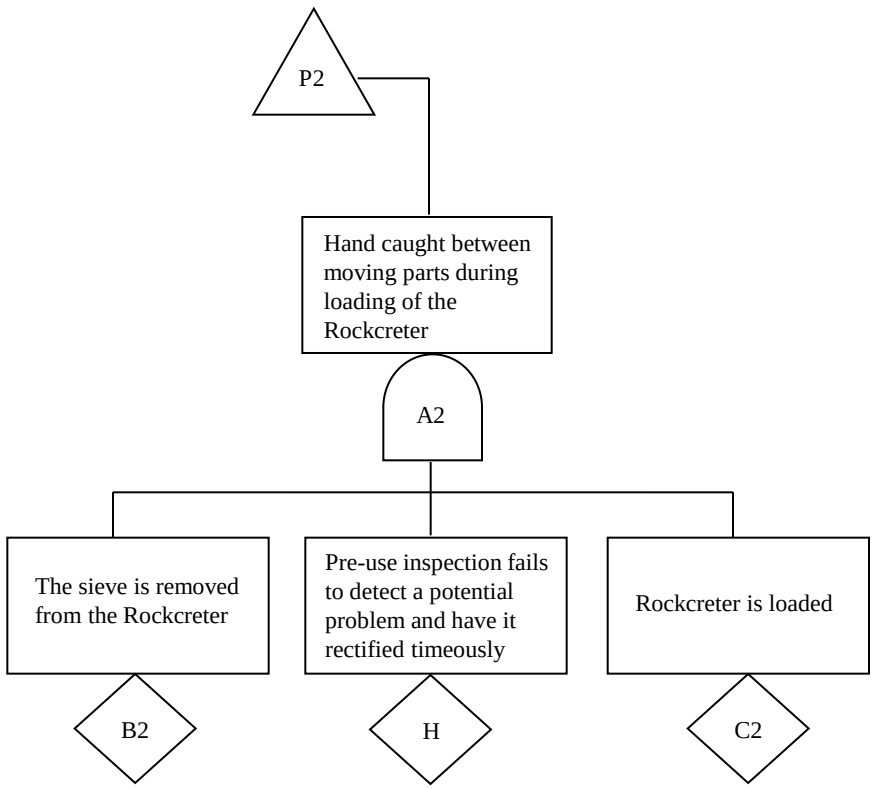
ID #	Failure Mode	Failure Mechanism	Failure Detection Mode	Protection or mitigating measures	Effects if protection works	Effects if protection fails
1	Failure of more than one of the lifting/hoisting hooks during slinging of the Rockcreter	Mechanical failure of two or more of the lifting hooks	Visual inspection of lifting hooks	Visual inspection of lifting hooks prior to slinging	Nothing	Rockcreter going down the shaft and or damage to equipment
		Incorrect failure of the connecting coupling	Visual inspection	Training and awareness	Nothing	Rockcreter going down the shaft and or damage to equipment
2	Failure of the air supply connection to the Rockcreter	Mechanical failure of the connecting coupling	Visual inspection	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	Visual inspection	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	Visual inspection	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 Rockcreter	Loading of sand and cement when the sieve is removed	Visual inspection	Training and awareness/not allowed to operate the Rockcreter without the sieve in place. Safety procedure	Nothing	Severe injuries to hand/arm
6	Mechanical damage to the Rockcreter	Foreign objects entering through the sieve	Stalling of Rockcreter	Sieve, training and awareness	Nothing	Production loss and repair cost
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 Rockcreter whilst in operation or when power and or air is connected to it	Nothing	Severe injuries to hand and other body parts

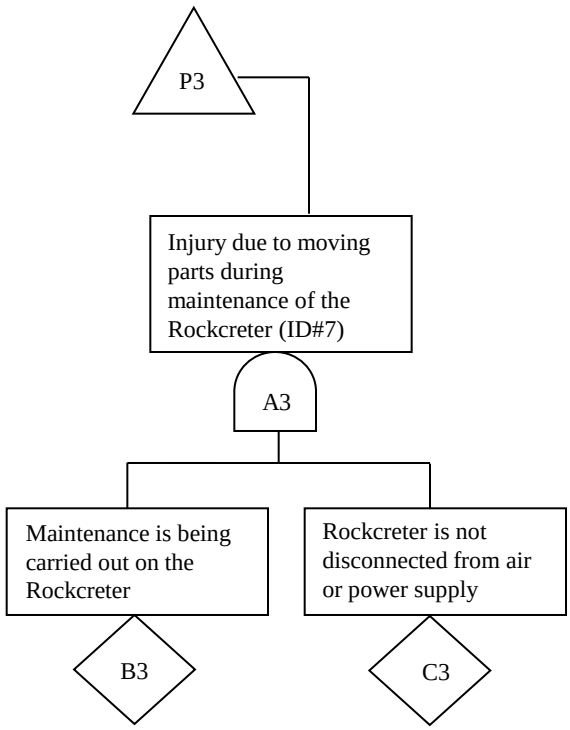
ID #	Failure Mode	Failure Mechanism	Failure Detection Mode	Protection or mitigating measures	Effects if protection works	Effects if protection fails
7.1	Screen on hopper to be pad locked	Maintenance being carried out whilst machine is not disconnected	Visual	Training and awareness/not allowed to carry out any maintenance on the Rockcreter whilst in operation or when power and or air is connected to it	Nothing	Severe injuries to hand and other body parts
7.2	Main air in to have lock out on valve	Maintenance being carried out whilst machine is not disconnected	Visual	Training and awareness/not allowed to carry out any maintenance on the Rockcreter whilst in operation or when power and or air is connected to it	Nothing	Severe injuries to hand and other body parts
8	Excessive dust during operation of the Rockcreter	Incorrect setting of Rockcreter	Visual	Training, awareness and correct clamping procedure	Nothing	Ill health resulting from excessive exposure to dust
		Worn parts	Visual inspection	Training, awareness and scheduled maintenance	Nothing	Ill health resulting from excessive exposure to dust
		Loss of water pressure at the nozzle	Visual inspection	Maintenance of the nozzle and inspection	Nothing	Ill health resulting from excessive exposure to dust
9	Blockage of the material hose	Foreign objects	Back pressure will cause exhausting in the hopper	Stop Rockcreter immediately	Nothing	Injury to personnel due to ship lashing of the material hose
		Rockcreter running too fast	Back pressure will cause exhausting in the hopper	Training and awareness. Stop Rockcreter immediately	Nothing	Injury to personnel due to whip lashing of the material hose
		Rockcreter/material hose not properly cleaned since previous use	Visual inspection	Training and awareness	Nothing	Injury to personnel due to whip lashing of the material hose
10	Air hoses on the Rockcreter 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	Rockcreter turning in the wrong direction	Incorrect electrical connection	Pre-use inspection	Training and awareness	Nothing	Rockcreter will not operate
		Incorrect connection of the air motor	Pre-use inspection	Training and awareness	Nothing	Rockcreter will not operate

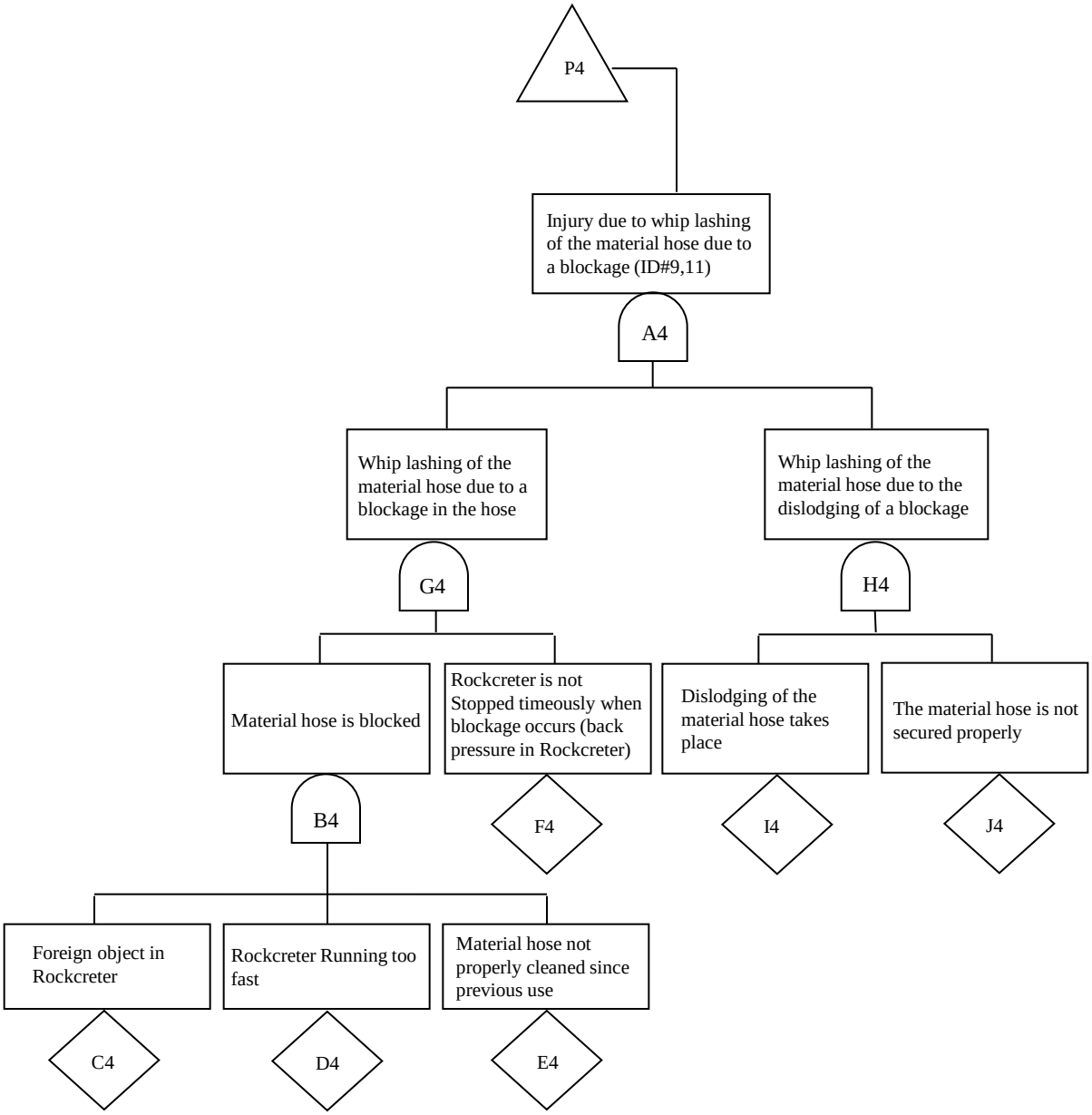
APPENDIX II

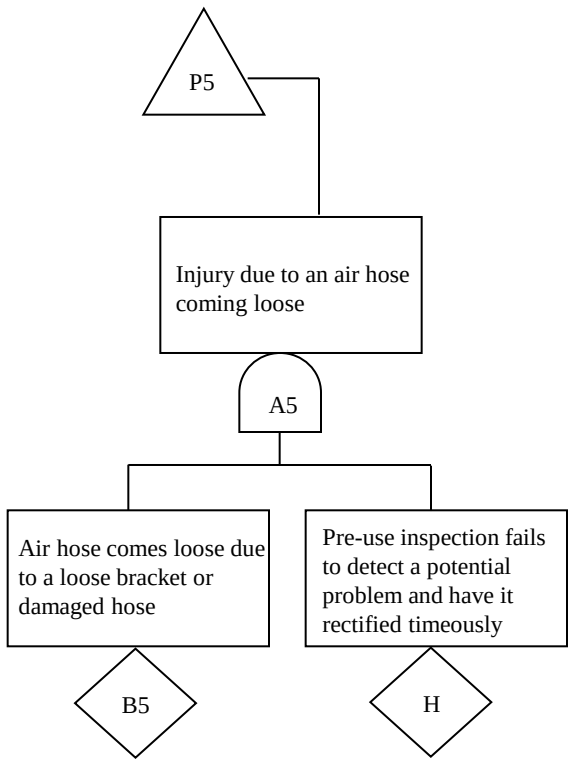
Fault Tree Analyses
(Injuries to operators)


Injury to personnel during handling and operation of the Rockcreter
A
Hand caught between moving parts during loading of Rockcreter (ID#5)
Injury to personnel due to whip lashing of the air supply hose (ID#2)
Injury due to moving parts during maintenance of the Rockcreter (ID#7)
Injury due to whip lashing of the material hose as a result of a blockage (ID#9,11)
Injury due to sand blowing out as a result of a failed material hose connection (ID#3)
Injury due to an air hose coming loose (ID#10)
Injury due to sand blowing out as a result of a failed material hose (ID#4)
P2
B
P3
P4
I
P5
K
Air supply hose is connected to the Rockcreter
Mechanical failure of the connecting coupling on the air supply hose takes place
Whip lashing of the air supply hose takes place
Pre-use inspection fails to detect a potential problem ad have it rectified timeously
Mechanical failure of the material hose connection takes place
Pre-use inspection fails to detect a potential problem and have it rectified timeously
Mechanical failure of the material hose takes place
Pre-use inspection fails to detect a potential problem and have it rectified timeously
C
D
E
H
J
H
L
H
Safety chains/straps on the air supply hose fails
Safety chains/straps are not connected to the air supply hose (operating procedure not followed)
F
G


P2
Hand caught between moving parts during loading of the Rockcreter
A2
The sieve is removed from the Rockcreter
Pre-use inspection fails to detect a potential problem and have it rectified timeously
Rockcreter is loaded
B2
H
C2

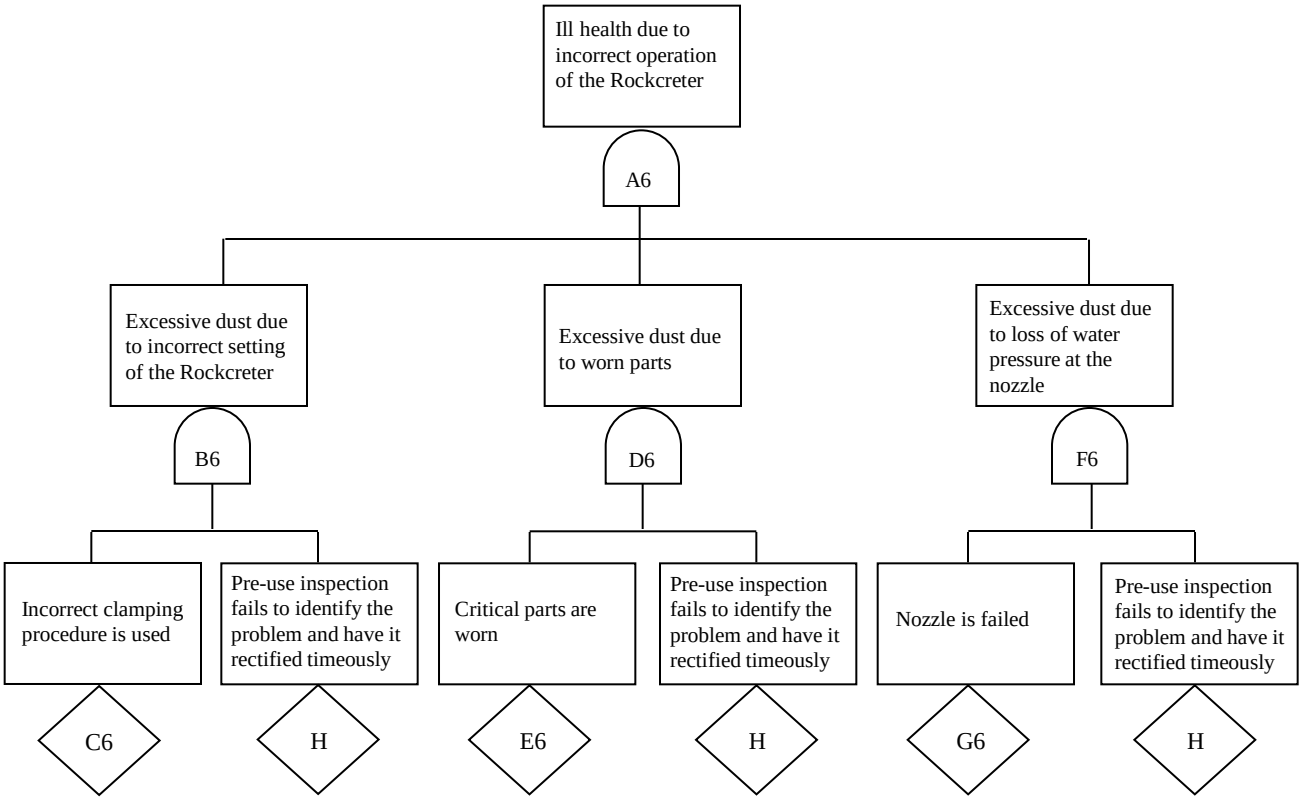

P3
Injury due to moving parts during maintenance of the Rockcreter (ID#7)
A3
Maintenance is being carried out on the Rockcreter
Rockcreter is not disconnected from air or power supply
B3
C3


P4
Injury due to whip lashing of the material hose due to a blockage (ID#9,11)
A4
Whip lashing of the material hose due to a blockage in the hose
Whip lashing of the material hose due to the dislodging of a blockage
G4
H4
Material hose is blocked
Rockcreter is not Stopped timeously when blockage occurs (back pressure in Rockcreter)
Dislodging of the material hose takes place
The material hose is not secured properly
B4
F4
I4
J4
Foreign object in Rockcreter
Rockcreter Running too fast
Material hose not properly cleaned since previous use
C4
D4
E4


P5
Injury due to an air hose coming loose
A5
Air hose comes loose due to a loose bracket or damaged hose
Pre-use inspection fails to detect a potential problem and have it rectified timeously
B5
H

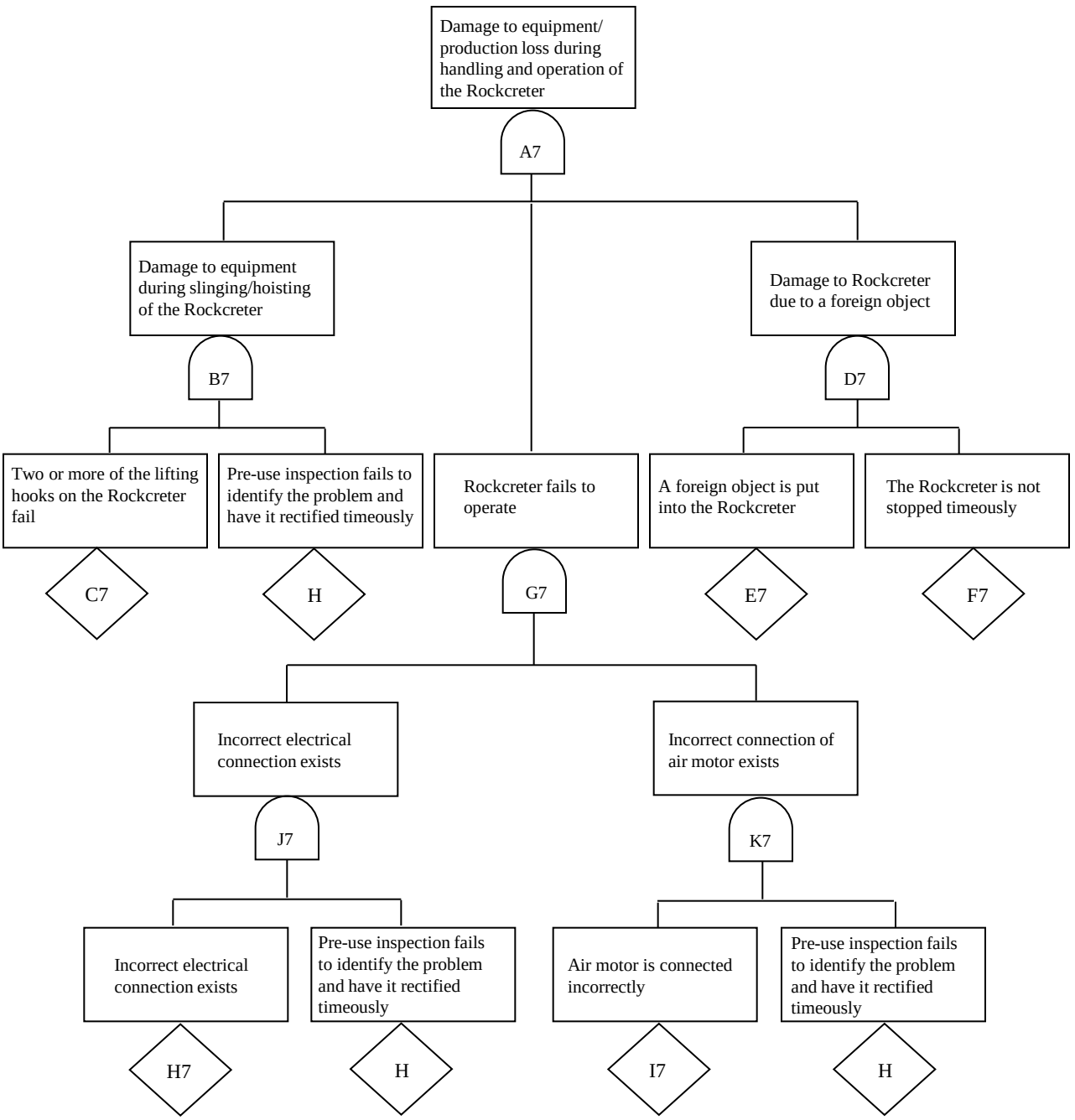
APPENDIX III

Fault Tree Analyses
(Ill Health to operators)


Ill health due to incorrect operation of the Rockcreter
A6
Excessive dust due to incorrect setting of the Rockcreter
Excessive dust due to worn parts
Excessive dust due to loss of water pressure at the nozzle
B6
D6
F6
Incorrect clamping procedure is used
Pre-use inspection fails to identify the problem and have it rectified timeously
Critical parts are worn
Pre-use inspection fails to identify the problem and have it rectified timeously
Nozzle is failed
Pre-use inspection fails to identify the problem and have it rectified timeously
C6
H
E6
H
G6
H

APPENDIX IV

Fault Tree Analyses
(Damage to equipment/Production loss)


Damage to equipment/ production loss during handling and operation of the Rockcreter
A7
Damage to equipment during slinging/hoisting of the Rockcreter
B7
Damage to Rockcreter due to a foreign object
D7
Two or more of the lifting hooks on the Rockcreter fail
Pre-use inspection fails to identify the problem and have it rectified timeously
Rockcreter fails to operate
A foreign object is put into the Rockcreter
The Rockcreter is not stopped timeously
C7
H
G7
E7
F7
Incorrect electrical connection exists
Incorrect connection of air motor exists
J7
K7
Incorrect electrical connection exists
Pre-use inspection fails to identify the problem and have it rectified timeously
Air motor is connected incorrectly
Pre-use inspection fails to identify the problem and have it rectified timeously
H7
H
I7
H