

Appendix 9.13

Human Error Probabilities for Failure Scenarios in CKR

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Type of Human Error	CKR (10 sectors)						WIL	
	400 holes	350 holes	300 holes	250 holes	200 holes	120 holes	6 sectors	4 sectors
Human Error Probabilities for Cut Hole Error								
<i>Wrong design of hole diameter / location for cut</i>								
Design error by BE and failure of design check	1.92E-02						1.92E-02	
Failure to detect and correct error by RE, MD and SF	2.76E-05						2.76E-05	
<i>Wrong location of drilling or incorrect drill size used</i>								
Operator fails to drill correctly	2.26E-02						2.26E-02	
Failure to detect and correct error by BE and SF	1.72E-03						1.72E-03	
<i>Detonator is installed incorrectly</i>								
Wrong installation of one detonator by the SF	3.01E-06						3.01E-06	
SF fails to detect and correct that there are holes without detonators left in the face	2.79E-02						2.79E-02	
Probability of (design or drilling) error significant enough to cause higher vibration	0.5						0.5	
Human Error Probabilities for Wrong Design of Time Delay for a face								
Design error by Blasting Engineer and failure of design check	1.92E-02						1.92E-02	
Failure to detect and correct error by Resident Engineer, Mines Division and Shotfirers	2.76E-05						2.76E-05	
Human Error Probabilities for Detonator put into the wrong hole								
Delivery of incorrect detonators from the magazine to the blast site	2.10E-06						2.10E-06	
Installation of one detonator by Shotfirer into a sector already containing a detonator of that delay period	2.18E-04	1.91E-04	1.64E-04	1.36E-04	1.09E-04	6.54E-05	4.91E-05	3.27E-05
Shotfirer fails to check and correct installation error	2.79E-02						2.79E-02	
Probability of sector contains of same time delay detonator	0.3						0.5	0.75
Probability of Manufacturer Defect of One Detonator for a Blast Face								
	4.00E-05	3.50E-05	3.00E-05	2.50E-05	2.00E-05	1.20E-05	9.00E-06	6.00E-06
Probability of Manufacturer Defect of One Surface Connector for a Blast Face								
	7.00E-07						5.00E-07	3.00E-07
<i>No. of surface connector time delay (excluding 0 ms) used per face</i>								
	7						5	3
Human Error Probabilities for Connection of a Detonator to a Wrong Surface Connector								
Shotfirer misconnects one detonator to the wrong surface connector	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	9.66E-01	7.25E-01	4.85E-01
Failure to detect and correct connection error	1.44E-04						1.44E-04	
Probability of unsafe sector	0.33						0.6	1
Human Error Probabilities for Use of a Wrong Surface Connector								
<i>Number of Different Types of Surface Connector per Face</i>								

Type of Human Error	CKR (10 sectors)						WIL	
	400 holes	350 holes	300 holes	250 holes	200 holes	120 holes	6 sectors	4 sectors
0 ms	10						6	4
others	7						5	3
<i>Shot Firer uses a wrong surface connector</i>								
Wrong Installation of surface connector	2.51E-02						1.62E-02	1.03E-02
Shot firer fails to detect and respond	4.24E-02						4.24E-02	
Failure to detect and respond during final hook-up check	1.10E-04						1.19E-04	
Human Error Probabilities for Excess Emulsion Loaded in a Hole								
<i>Excess emulsion is loaded into a hole</i>								
Excess emulsion is loaded due to wrong density	7.95E-11						7.95E-11	
Shotfirer does not realise hole is overloaded	1.09E-06						1.09E-06	
<i>Wrong design of MIC</i>								
Design error by Blasting Engineer	8.52E-05						8.52E-05	
Failure to detect and correct design error	1.06E-03						1.06E-03	
Human Error Probabilities for Excess Cartridges loaded into a Hole								
<i>Probability of blocked holes</i>	1.67E-01 (Assume once every week (6 days blasting), one blast every day.)						7.14E-02 (Assume once every week with 2 blasts per day, 7 days per week)	
<i>Too many cartridges are inserted in hole</i>								
SF does not count correctly and load excess cartridges into holes	2.95E-01	2.58E-01	2.21E-01	1.85E-01	1.48E-01	8.86E-02	6.64E-02	4.43E-02
Cartridges from blocked holes are not disposed of correctly	8.13E-03						8.13E-03	
SF/BE do not realise holes are overloaded	1.69E-05						1.69E-05	
SF/BE do realise blocked holes are not disposed of	1.21E-03						1.21E-03	
<i>Wrong design of MIC</i>								
Design error by BE	8.52E-05						8.52E-05	
Failure to detect and correct design error	1.06E-03						1.06E-03	