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PRODUCTION DRILLING OPERATIONS PROPOSAL **Long Hole Plug**

Removing the hazard of lost drill rods in 'up holes'



SAFETY PRODUCTS TO ENHANCE OPERATIONAL EFFICIENCY

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PROJECT SCOPE

Assess the value of the Long Hole Plug to remove the hazard of lost drill rods in 'up holes' at your Production Drilling Operation.

CONTEXT

Lost drill rods in 'up holes' are a common problem in the underground mining industry and have the potential to fall out of the hole without warning, posing a serious hazard to personnel and equipment below.

Until recently current industry practice to address this hazard has been to grout the hole in order to lock the drill rods in place, or to 'plate over' the hole with a rock bolt. Each of these operations seriously delays production as both require demobilisation of the production drill and mobilisation of alternative personnel and equipment to address the hazard. Both methods have been assessed for safety and efficiency by several Australian mining companies and contractors and were found to be expensive, high risk, time consuming and in the case of 'plating over', ineffective.

The Long Hole Plug quickly and effectively removes the hazard of lost drill rods in 'up holes' without demobilisation of the production drill. This allows production to continue unaffected and provides increased safety, time and cost savings to the operation.



Figure 1

A Long Hole Plug being installed using a Sandvik drill rig in a West Australian underground nickel mine.

HOW IT WORKS

The Long Hole Plug consists of two components, a slotted tube and a tapered cone. The slotted tube component acts like a friction anchor holding the Long Hole Plug in place up the hole. In the event that the drill rods fall the slotted tube and the tapered cone engage to decelerate the forces generated from the falling drill rods as shown in figure 2.

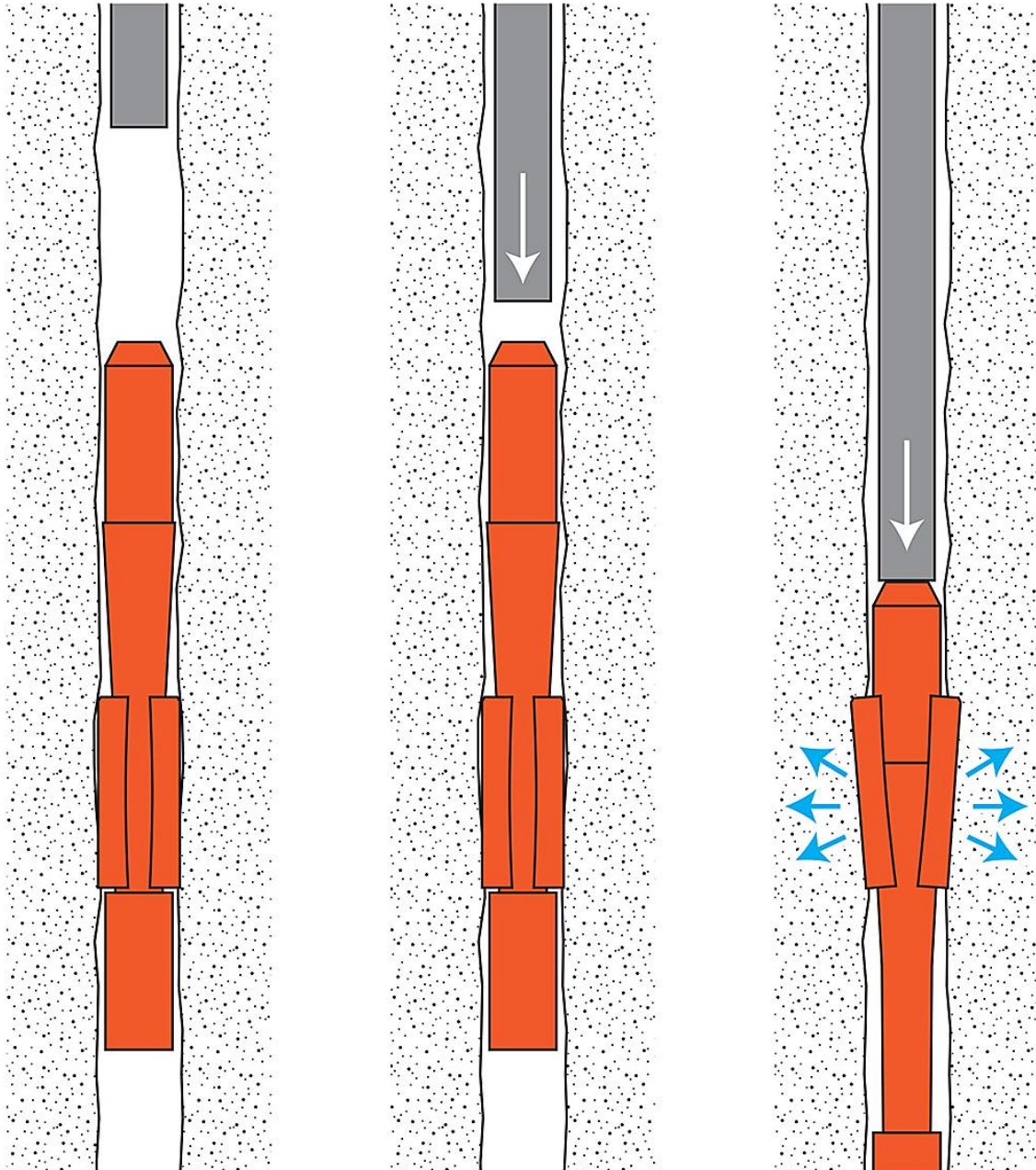


Figure 2

The long hole plug shown in orange is held in place up the hole by the slotted tube component similar to a friction anchor, *left*. The drill rods falling down the hole towards the Long Hole Plug, *centre*, and the drill rods striking the Long Hole Plug and the two components engaging to decelerate the forces generated from the falling drill rods, *right*.

ANALYSIS

The Long Hole Plug has been able to demonstrate superior safety and cost benefits at over 50 underground mines in Australia, Canada, USA and Indonesia and ME SAFE has been involved in the analysis of the products suitability with several mining companies and contractors.

Safety

There are several safety short falls with the current industry practices used for addressing the hazard of lost drill rods in 'up holes'.

Plating over the hole with a rock bolt does not provide adequate protection against a falling drill rod and grouting the hole at a later date puts personnel and equipment in the line of fire of the hazard. A further detailed safety analysis can be found in the following published academic paper, *Long Hole Plug – addressing the hazard of bogged drill rods in 'up holes', 13th AusIMM Underground Operators' Conference 2017.*



Figure 3

Test results from a small scale 'plate over' test where 5 drill rods were allowed to free fall 7m. The test demonstrated that plating over with a rock bolt is an ineffective method of controlling the hazard of lost drill rods in 'up holes'. For more information on this test refer to *Long Hole Plug – addressing the hazard of bogged drill rods in 'up holes', 13th AusIMM Underground Operators' Conference 2017.*

The Long Hole Plug provides an engineered solution to remove the hazard of lost drill rods in 'up holes' immediately. This eliminates the chance of the hazard being forgotten between shifts or the wrong hole being 'plated over' or grouted at a later date.

Cost

Below is an extract of a cost analysis from a prominent Australian mining contractor who currently has 9 production drill rigs operating on several mine sites across Australia.

The Long Hole Plug is the most cost effective solution to removing the hazard of lost drill rods in 'up holes'. A significant proportion of the cost saving is associated with the reduced down time and equipment required to rectify the hazard. A breakdown of this analysis is shown in figure 5.

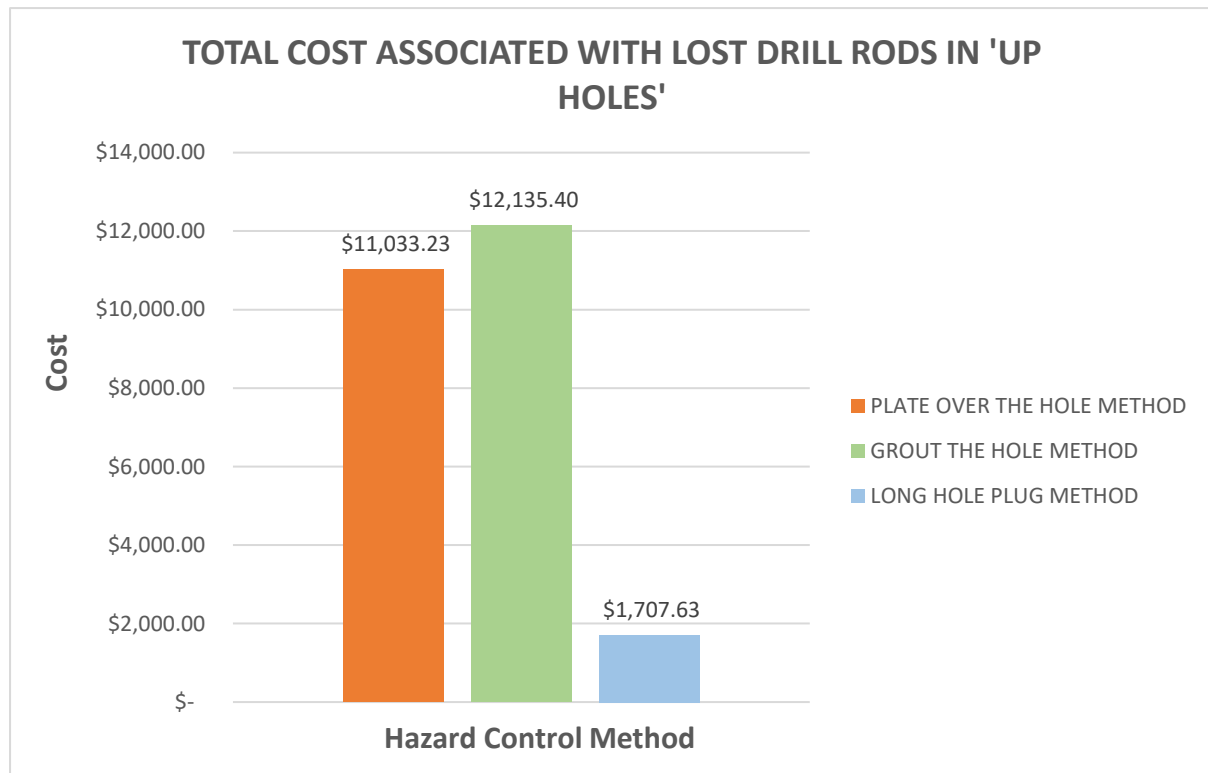


Figure 4

Cost analysis summary from data obtained from a prominent Australian mining contractor. As can be seen the Long Hole Plug is able to remove the hazard of lost drill rods in 'up holes' at a significantly reduced cost when compared to the two other methods employed in the industry. **Note: The Long Hole Plug is made in all hole sizes, the average unit price was used in this analysis.**

PLATE OVER THE HOLE METHOD			
Assumptions			
3 hours to demobilise and re-mobilise production and Jumbo drill rig			
Description	Quantity	Rate	Value
Equipment			
Jumbo Drill	3	\$ 41.67	125.01
Production Drill	3	\$ 43.75	131.25
Light Vehicle	1	\$ 3.47	3.47
Maintenance			
Jumbo Drill	0.5	\$ 168.00	84.00
Production Drill	0.5	\$ 183.00	91.50
Light Vehicle	1	\$ 15.00	15.00
Operator			
Jumbo Operator	3	\$ 109.00	327.00
Production Drill Operator	3	\$ 79.00	237.00
Nipper	1	\$ 48.00	48.00
Fuel			
Jumbo Drill	1	\$ 12.00	12.00
Production Drill	0.5	\$ 12.00	6.00
Light Vehicle	1	\$ 8.00	8.00
Materials			
Rock Bolt	1	\$ 25.00	25.00
Opportunity Cost			
Production Drilling (m)	120	\$ 40.00	4,800.00
Development (m)	1.6	\$ 3,200.00	5,120.00
Services	0		-
TOTAL COST			\$ 11,083.23
Strengths			
None Identified			
Opportunities			
None Identified			
Weaknesses			
Does not remove the hazard			
Requires demobilisation of the production drill			
Loss of production			
Places Jumbo in hazard zone			
Risk			
Deemed ineffective by clients			
Loss of reputation as a quality contractor			

GROUT THE HOLE METHOD			
Assumptions			
Pull out the production drill until the hole is grouted. IT and two operators required to get gear and grout the hole, production driller on other duties until 12 hour grout cure time complete.			
Description	Quantity	Rate	Value
Equipment			
IT	2	\$ 6.25	12.50
Production Drill	8	\$ 43.75	350.00
Light Vehicle	4	\$ 3.47	13.88
Maintenance			
IT	2	\$ 45.00	90.00
Production Drill	0.5	\$ 183.00	91.50
Light Vehicle	2	\$ 15.00	30.00
Operator			
IT operator	2	\$ 54.00	108.00
Production Drill Operator	14	\$ 79.00	1,106.00
Service man	2	\$ 48.40	96.80
Fuel			
IT	2	\$ 12.00	24.00
Production Drill	0.5	\$ 12.00	6.00
Light Vehicle	2	\$ 8.00	16.00
Materials			
Grout	10	\$ 7.50	75.00
Opportunity Cost			
Production Drilling (m)	240	\$ 40.00	9,600.00
Development (m)			-
Services	2	\$ 257.86	515.72
TOTAL COST			\$ 12,135.40
Strengths			
Effective method of hazard control			
Opportunities			
Potential to use resin as opposed to grout			
Weaknesses			
Requires demobilisation of the production drill			
Significant loss of production drill metres			
Exposes personnel & equipment to the hazard when grouting			
Risk			
Incident as a result of personnel being in the line of fire while grouting the hole - Loss of safety reputation			

LONG HOLE PLUG METHOD			
Assumptions			
Long Hole Plug stored on drill rig			
Description	Quantity	Rate	Value
Equipment			
Production Drill	0.2	\$ 43.75	7.29
Maintenance			
Production Drill	0.2	\$ 183.00	30.50
Operator			
Production Drill Operator	0.2	\$ 79.00	13.17
Fuel			
Materials			
Long Hole Plug	1	\$ 1,650.00	1,650.00
Opportunity Cost			
Production Drilling (m)	0.2	\$ 40.00	6.67
Development (m)			-
Services			-
TOTAL COST			\$ 1,707.63
Strengths			
Engineered solution			
Removes the hazard instantly with out the demobilisation of the production drill			
No personnel risk during installation			
Removes costs associated with other methods			
Opportunities			
Demonstrate proactive solution to clients			
Demonstrating employee duty of care			
Weaknesses			
Additional stock item			
Risk			
Manual handling, slips, trips and falls			

Figure 5

Analysis data from a prominent Australian mining contractor used to assess the suitability of the Long Hole Plug across its operations. A summary of this data is shown in figure 4.

SUMMARY

The Long Hole Plug can provide safety, cost and operational efficiency advantages to your Production Drilling Operation.

This can be achieved by providing an engineered solution to remove a common workplace hazard which increases operator safety and reduces production drill down time.

Myself and the team look forward to discussing this product with you and if you have any questions please do not hesitate to contact us.

Kind regards,



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