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TRIP REPORT 10/28/87

NOV 24 1987

MEMORANDUM TO: Mysore Nataraja, Section Leader
Geotechnical Engineering/Design Section
Technical Review Branch

FROM: John T. Buckley/ David Tiktinsky
Geotechnical Engineering/Design Section
Technical Review Branch

SUBJECT: TRIP TO SUDBURY ONTARIO

PLACE VISITED: DATES OF TRIP:

Strathcona Mine near Sudbury, Ontario 10/20/87 - 10/22/87

PERSON CONTRACTED:

Chuck Steed, Falconbridge Ltd.

BACKGROUND

In the early 1980's, the NRC identified the potential for problems associated with high deviatoric stresses at the Hanford site. The significance of core disking which is related to the high state of stress, and can be indicative of potential rockbursting problems, was pointed out by the NRC in 1982. The NRC again pointed out the potential for rock bursting problems following a Hanford site visit in 1984 and in comments on DOE's Draft and Final Environmental Assessments in 1986. In an effort to more fully understand the conditions surrounding rockbursting activity, the NRC staff is visiting operating mines which have underground conditions similar to those expected at the Hanford site and deal with rockbursting on a continuing basis. In 1986 the NRC staff visited the Lucky Friday Mine near Wallace, Idaho to discuss current rockbursting problems. Since there are so few case histories of deep excavations in basalt, it is important that the staff continue to take advantage of opportunities to visit mining operations with ground conditions similar to those expected at the Hanford site.

PURPOSE OF TRIP:

The purpose of this trip was to tour the Strathcona mine near Sudbury, Ontario and to discuss with mine engineers the problems associated with rockbursting. Rockbursting has been a common occurrence at the mine since about 1975. Although there are significant design differences between the Strathcona mine and the proposed underground facility at the Hanford site, the similarities in in situ conditions may help one understand the rockbursting potential problem at the Hanford Site. Discussions were held with Strathcona engineers regarding the prediction, frequency and location of rockbursting as well as the mitigative measures used to reduce the effects of rockbursts.

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ACCOMPLISHMENTS:

The tour of the Strathcona mine was very informative. Our guide for the tour was Mr. Chuck Steed from the ground control engineering group. Before going underground, Mr. Steed presented an overview of the mining operations and the local and regional geology. Appendix A is a geologic map of the Sudbury Basin which also shows the location of the Strathcona mine.

The Strathcona mine is a copper-nickel mine located on the northern rim of the Sudbury Basin. The country rock is a strong brittle fractured norite. The ore is a massive sulfide which lies 570-900 m below surface. The ore has been mined above and below the main sill pillar which is located about 790 m below surface. Ore is removed from the mine via cut-and-fill and transverse blasthole stoping mining methods.

Rockbursting generally occurs in the main sill pillar following blasting. The structure responsible for most of the seismic activity is a 1m wide olivine diabase dyke which transects the ore body. The dyke tends to be very blocky in some spots and friable in others. Slickensided shear planes can be seen in many locations along the dyke.

Our underground tour started at the 2000 ft. level of the mine where we saw the results of a past rockburst. On the 2125 ft. level Mr. Steed brought us to a stope which currently shows a lot of seismic activity. Production was curtailed in this stope pending completion of a modeling study using the 3-DEC computer code to predict the ground response following the next blasting round. From the 2125 ft. level we descended to the 2250 ft. level where Mr. Steed showed us a ground support technique known as lacing. Lacing support utilizes a steel mesh held in place with fully grouted non-tensioned rockbolts. Steel cable is then laced between the rockbolts to form a soft support system. On this level we also saw a tomography investigation being run by researchers from Queens University. From the 2250 ft. level we continued on to the 2375 ft. level. At this level we saw an undercut stope roughly 100 ft. long and 80 ft. high. We then proceeded to the surface to continue discussion.

During our discussions, Mr. Steed brought up some very interesting points. First, the seismic activity and subsequent rockbursting occurs as a result of slippage along the diabase dyke or very small undetected stringer dykes associated with the main dyke. Second, rockbursting generally occurs within five days of blasting. All blasting in the large blasthole stopes takes place at end of shift on Fridays to allow readjustment of stresses over the weekend. Most of the recent rockbursts have occurred on the weekends. Third, rockbursting was not really a problem at the mine until the extraction ratio reached about 70% or so. This is important because it suggests that rockbursting may not be a significant problem at the Hanford site due to the very low extraction ratio (10%).

CONCLUSIONS:

1. A low extraction ratio at the Hanford site may result in significantly reduced potential for rockbursting. The fact that rockbursting at the Strathcona mine was not a problem prior to reaching a very high extraction ratio indicates that high in situ stresses, strong, brittle and highly fractured rock, while being necessary conditions, may not be sufficient to cause a serious rockbursting problem at Hanford.

2. If bursting does occur at the Hanford site it may take place along undetected structures. Recognizing this, is important because even an adequate site characterization program will not detect all structures which can cause ground control problems.

3. A ground control engineer is not capable of effectively predicting the location, time or magnitude of seismic (rockburst) events even with the aid of a seismic monitoring network. However, a seismic monitoring system may be very useful for locating undetected structures along which seismic events take place.

4. A soft support system such as the rockbolt-mesh-lacing system seems to be very effective in limiting the damage caused by seismic (rockburst) events.

PROBLEMS ENCOUNTERED:

No problems were encountered.

PENDING ACTIONS:

Review document titled, "Rockburst Research at Falconbridge Limited", by D.M. Morrison, April 1987 (Attached as Appendix B)

RECOMMENDATIONS:

Brief the BWIP team and the BWIP On-Site Representative

Signature-Traveler /S/ Date

NOV 24 1987

OFFICIAL CONCURRENCE AND DISTRIBUTION RECORD

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CONCURRENCES

ORGANIZATION/CONCUREE	INITIALS	DATE CONCURRED
HLTR/JBuckley/jm	JTB	87/11/19
HLTR/DTiktinsky	DT	87/11/19
HLTR/MNataraja	Raj	87/11/27

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