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TECHNICAL
ADVISOR COPY

December 11th, 1981

Giant Yellowknife Mines Limited
Yellowknife, N.W.T.
X0E 1H0

Attention: Mr. D. Emery
President

Re: Mine Backfill Sampling Programme
Yellowknife Mine

Dear Sirs:

This letter accompanies our detailed factual report on the above sampling programme.

Included herein, is a detailed description of the drilling and sampling procedures used, together with the results of soil mechanics laboratory testing on recovered samples of the arsenic dust. As arranged, the samples are being returned to you for chemical analysis, and when the results of such work are available, they will be entered on the relevant borehole logs included in this report.

As discussed in the report, interpretive comments will be provided separately as an Addendum hereto, covering geotechnical aspects of recovery of the arsenic dust from the stopes.

We trust that this factual report is sufficient for your purposes in the interval. Should you wish elaboration on any point covered herein, kindly give us a call.

This opportunity to be of further service to you is much appreciated. We would like to thank your Personnel for the excellent cooperation extended to us throughout all phases of the work.

Yours very truly,

GEOCON INC.

M.A.J. Matich, P.Eng.
President

MAJM:bg
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V5820

REPORT TO

GIANT YELLOWKNIFE MINES LIMITED
YELLOWKNIFE N.W.T.

ON

MINE BACKFILL SAMPLING PROGRAMME

Distribution:

4 copies - Mr. D. Emery,
Giant Yellowknife Mines Limited

2 copies - Mr. P.J. Raleigh
Falconbridge Nickel Mines Limited

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December 11th, 1981

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APPENDIX II (cont'd)

APPENDIX III

APPENDIX IV

DRAWINGS (at rear of report)

1.0 GENERAL (continued)

This report includes only the factual results of the field sampling and laboratory testing programme. In the following section of this report, the drilling equipment used will be described along with the general field drilling procedure used. The subsequent sections will give a description of the specific drilling and sampling procedure adopted for each borehole. The boreholes are described in the order in which they were drilled, i.e. Boreholes Nos. 4, 6, 9, 8, 5, 7 and 11. Finally, a description of the laboratory tests carried out will be given.

An interpretive report discussing geotechnical engineering aspects pertinent to recovery of the arsenic from the stopes in question, is being submitted separately as an Addendum to this report.

A diary of progress of field work is given in Appendix IV.

2.0 DRILLING EQUIPMENT

Drilling work was carried out with the use of a Sanderson Cyclone Model TH70 and a 3 man drill crew provided by S.D.S. Drilling of Calgary, Alberta. The drill was truck-mounted and supported by a pipe truck for transportation of drill strings, casing and auxiliary equipment.

The holes were advanced in overburden with an 8-3/4 inch tricone bit using air as the drilling fluid in all but one case when drilling mud was used to support the hole in overburden. The 7 inch casing was run into the hole and cemented into bedrock over a minimum length of one foot to isolate the stope from groundwater inflow and to support the upper section of the hole.

In bedrock, an Ingersoll-Rand downhole hammer model DDC-360 with nominal 5-1/2 inch carbide button bit was used to advance the holes. Drill rods of 5-1/2 inch O.D. and 3.0 inch I.D. CSR duo-tubes were used for air reverse circulation drilling. Compressed air, required to operate the hammer, cool the bit and bail cuttings from the hole was directed down the annulus between the two tubes and through the hammer. Cuttings were blown back through the inner tube to an exhaust hose connected to the swivel at surface.

When the stope backs were penetrated, the downhole bit was replaced by a reverse circulation cutting bit set with 6 tungsten-carbide and

2.0 DRILLING EQUIPMENT (continued)

steel teeth. For the last borehole of the programme, the procedure for recovering bulk samples by suction was modified. Such modifications will be discussed in the detailed Drilling and Sampling Procedures section given for each borehole.

The cutting bit configuration allowed for the passage of both 2 inch split spoon and Shelby tube samplers for the recovery of arsenic dust samples. The duo-tube rods were used as casing to support the holes in the arsenic bearing dust during sampling operations in the stopes. During the advance of the casing through the arsenic dust to each sampling level, the holes were kept clean by a high volume flow of air blowing up the centre of the duo-tube rods set up by the 600 CFM compressor provided with the drill rig. To assist the reverse circulation sample recovery and to reduce or eliminate escape of arsenic bearing dust into the atmosphere, a high capacity Vactor Vacuum Truck was supplied by Giant Yellowknife Mines Limited. The arsenic bearing dust recovered was led directly into the field storage and transport container mounted on the back of the Vacuum Truck.

For sampling of the arsenic dust, standard geotechnical samplers were used. Eighteen inch long standard 1-3/8 inch I.D. split spoon samplers, each equipped with a retaining trap and brass sleeves, were used in most cases. Shelby tubes were also used and were slightly modified by reducing the gauge on the cutting edge to increase wall friction and to provide better recovery.

The sampling rods used, known as HDS rods, are heavier than standard AW sized drill rods normally used in conducting geotechnical investigations. The weight of the rods used per 20 foot length was of the order of 90 pounds as opposed to 82 pounds for AW rods.

All investigated stopes were plugged and sealed on completion of drilling and sampling with Pozani plugs, pneumatic packers set at pre-determined depths in bedrock, and cement. These plugs can be drilled out should access to the stopes again be required. The surface casing was left in each of the boreholes drilled, at the request of Giant Yellowknife Mines Limited.

3.0 BOREHOLE DRILLING AND SAMPLING PROCEDURE

The specific drilling and sampling procedure used for each borehole is described separately below since the procedure was varied somewhat from borehole to borehole. A standard hammer of 140 pounds weight falling through 30 inches was employed for driving split spoon samplers and for carrying out of (Modified)* Standard Penetration Tests.

3.1 Borehole No. 4

Borehole No. 4 was drilled to access Stope No. B2-08. This stope was reportedly filled in four stages with 30,319 tons of impure arsenic trioxide (arsenic dust) from March 16th, 1962 to January 9th, 1976.

Forty-nine feet of overburden and 57 feet of bedrock were drilled before the stope was reached. Twelve bag samples of rock chips and dust were taken and sent to Giant Mines' laboratory for identification and assay. These samples are not indicated on the log for Borehole 4.

After the downhole hammer was replaced by a cutting bit, the double wall drill rods used as casing were lowered into the stope until resistance was encountered at 138 feet 4 inches. The split spoon sampler was lowered and it stopped at 138 feet 2 inches i.e. 2 inches above the bottom of the casing. The sampler was advanced 12 inches with 9 blows of the hammer and then it advanced under self weight for 18 inches. The sampler was advanced 6 inches with 3 blows of the hammer after which it advanced under self weight for 7 feet 8 inches. The sampler was then retrieved and dry light grey arsenic dust (Sample 1) was recovered. It is possible that a thin "crust" occurs at the surface of the arsenic dust and that the crust was of sufficient strength to support the casing. The surface of the arsenic dust was therefore defined at a depth of 138.2 feet although it is possible that some loose arsenic dust was penetrated before the casing and sampler no longer advanced under self weight.

The Vacuum Truck was next connected to the casing as the latter was advanced to 153 feet 4 inches. The casing was run up and down three times between 138 feet 4 inches and 153 feet 4 inches before it was locked in place at 153 feet 4 inches.

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* Note: The Standard Penetration Tests were modified in the sense that the weight per unit length of the drill rods used was non-standard.

3.0 BOREHOLE DRILLING AND SAMPLING PROCEDURE (continued)

3.1 Borehole No. 4 (continued)

The split spoon sampler was lowered inside the casing and it stopped about 6 feet above the bottom of the casing. The sampler was then driven 23 inches so that a sample of the material in the casing could be recovered. Dry light grey arsenic dust (Sample 2) was recovered. The recovered material was thus disturbed because it had been transported part way up the casing while the casing was advanced. A blow count of 32 per foot of advance of the sampler was recorded. It is not representative of the relative density of the material because of its confinement in the casing. Therefore the penetration resistance to advance of the sampler is not recorded on the borehole log in Appendix 1.

Suction was applied again to clean the inside of the casing and the casing was advanced to 168 feet 4 inches. The casing was run up and down between the two levels to ensure good cleaning. The upward and downward velocity of the casing was slow to avoid packing of arsenic dust in the drilling bit.

When the split spoon sampler was lowered in the casing to take a third sample, it stopped about 16 feet above the bottom of the casing. The sampler was driven 2 feet while within the casing. Recovery was complete. The recovered material was light grey dry arsenic dust (Sample 3). The blow count obtained of 81 per foot of advance of the sampler is not representative of the in-place relative density because of the effects of casing confinement, dust packing due to insufficient suction, and vibration of the casing.

The casing was pulled back and maximum suction was turned on to clean out the dust accumulated within the casing. The casing was run up and down three times.

The split spoon sampler was lowered again inside the casing which was at the same depth as for the previous sample, i.e. 168 feet 4 inches. The sampler stopped about 6 inches above the tip of the casing and then advanced 18 inches by driving with the sample hammer. The blow count of 48 for the first foot showed that the material was confined in the casing and had been packed by the drilling action.

3.0 BOREHOLE DRILLING AND SAMPLING PROCEDURE (continued)

3.1 Borehole No. 4 (continued)

However, once beyond this zone, 2 blows for 6 inches were obtained indicating a relatively loose density prevailed. Recovery was about 12 inches and the material was dry, light grey and packed arsenic dust (Sample 4).

The casing was next advanced to a depth of 188 feet 4 inches using the same technique of slow careful advance and re-running over the lower few feet.

The split spoon sampler was lowered into the casing and came to rest 6 inches ahead of the casing. The sampler was advanced 2 feet by driving. The blow count of 12 for the first foot showed that the arsenic dust was probably packed by the drilling operation, but not to the extent of that inside the rods previously. Beneath this packed zone a blow count of 5 was obtained for the next foot indicating a loose relative density. Dry arsenic dust was recovered (Sample 5).

The bottom of the stope was reached at 201 feet 8 inches, as identified by high resistance to further penetration and the "feel" of the drilling bit on the rock.

The dust collected in the Vacuum Truck was dumped on the ground before transferring to storage drums. Some recently processed arsenic dust was present in the truck before any dust from the stope was collected. The newly placed material was found to be lighter in colour than the latter, and thus the two could be easily distinguished from one another. The dust placed on the ground was also found to be contaminated by soil from the ground surface. In order to avoid collecting a contaminated bulk sample, some of the dust recovered from the stope was wasted.

To seal the hole, a pneumatic plug was installed 85 feet below the surface. Four bags of normal Portland cement mixed with water were placed above it to complete the seal.

3.0 BOREHOLE DRILLING AND SAMPLING PROCEDURE (continued)

3.2 Borehole No. 6

Borehole No. 6 was drilled to access Stope B2-33. This stope was filled with an estimated 12,595 short tons of Roaster Feed and tailings from the second Cottrell installed in early 1955. Infilling was started on December 16th, 1952 and ceased on March 1st, 1956.

Four feet of overburden were drilled and water was not encountered. 118 feet of rock was drilled before the stope was reached.

Before the drilling rods (casing) were lowered with the drilling bit for sampling, the split spoon sampler was lowered to sound the top of the arsenic deposit. Resistance to advance of the sampler under the self weight of the sampling rods was encountered at 165 feet 4 inches. A blow count of 1 for the next 2 feet indicated a very loose material. Recovery of the material was low. The recovered material was very loose, reddish and dry arsenic dust (Sample 1). Twenty to 25 feet of sampling rods above the sampler were stained with dry material of the same nature. It appears that the sampler penetrated that depth of dry loose dust before it came to a stop prior to driving the sampler. Thus the surface of the arsenic dust has been defined at a depth of 145 feet 4 inches in this borehole.

The casing was advanced to 178 feet 10 inches employing the same technique as was developed during drilling for Borehole 4.

The split spoon sampler was lowered inside the casing and it stopped about 2 feet ahead of the casing. The sampler penetrated a further 20 inches when the hammer was placed on the sampling rods and thus the sampler was not advanced further by driving with the hammer. Recovery was about 8 inches. The sample material was very loose, reddish, dry at the top and wet and denser at the bottom (Sample 2).

The casing was further advanced with suction to 198 feet 10 inches. The split spoon sampler stopped 9.5 feet inside the casing. The sampler was then driven 18 inches. A blow count of 25 for one foot advance reflected the effect of sampling inside the casing. Recovery was about 12 inches. The recovered material was wet arsenic dust (Sample 3).

3.0 BOREHOLE DRILLING AND SAMPLING PROCEDURE (continued)

3.2 Borehole No. 6 (continued)

The casing was pulled back 10 feet and re-run to clear this portion completely before it was advanced to 218 feet 10 inches. Material was apparently being sucked through the plastic hose connecting the swivel to the Vacuum Truck.

The split spoon sampler was lowered and it stopped 11 inches ahead of the casing. The sampler was then driven 21 inches. A blow count of 12 per foot of penetration indicates a material of compact relative density. Recovery was found to be about 9 inches. The recovered material was saturated arsenic dust (Sample 4). It is assumed that the wall of the casing was not well cleaned as the sampling rods were stained with wet arsenic dust above the sampler.

The casing was then advanced to 238 feet 10 inches. A Shelby tube was lowered and stopped about 9 feet inside the casing. The sampler was easily pushed in 2.5 feet. Recovery was about 12 inches. The recovered material was reddish, saturated arsenic dust (Sample 5).

The unemptied portion of the casing was re-run and the casing was advanced to 253 feet 10 inches. The Vacuum Truck which had been working at maximum output was found to be overheating, and the casing could not be cleared out by suction hence it was decided to take one more Shelby tube sample within the casing. A Shelby tube sampler was lowered and it stopped 31 feet above the tip of the casing and was then advanced 2.5 feet. Recovery was about 12 to 15 inches. The recovered material was wet arsenic dust (Sample 6.) The sampling rods above the tube were covered with a thick mantle of wet, soft arsenic dust.

Since the casing had been advanced to a depth which was close to the anticipated bottom of the stope, and could not be satisfactorily cleaned out as mentioned above, the borehole was terminated.

3.0 BOREHOLE DRILLING AND SAMPLING PROCEDURE (continued)

3.2 Borehole No. 6 (continued)

Approximately one half of a 205 litre drum was recovered from the Vacuum Truck. The recovered material ranged from dry arsenic dust to wet chunks of arsenic dust. The back of the Vacuum Truck had some light-coloured arsenic dust left from a previous operation, some of which mixed with the dark coloured dust from Borehole 6.

A pneumatic plug was set at a depth of 97 feet and four bags of Portland cement slurry were poured on top.

3.3 Borehole No. 9

Borehole No. 9 was drilled to access Stope No. B2-36 which is immediately adjacent to Stope B2-35. These stopes were filled together and tonnages stored in each separately are not known. The estimated total of material stored in the two stopes is 35,156 short tons. Infilling commenced on July 11th, 1958 and ceased on March 15th, 1962.

An overburden thickness of seventeen feet was measured. Permafrost was encountered in this hole and the frozen soil turned to a thick slurry when drilled with the tricone bit. The casing was advanced to 19.5 feet and was cemented into place. Approximately 111 feet of bedrock was drilled before the back of the stope was penetrated.

The split spoon sampler was first lowered through the rods to check the level of the top of the arsenic deposit. The sampler stopped at a depth of 156 feet 1 inch and was pushed through a 2 foot length by hand. Although no recovery was achieved, 12 feet of sampling rods above the sampler were stained with dry, dark grey arsenic dust. Hence, the top of the deposit is inferred to be at about 144 feet below ground surface. A sample of the arsenic dust was obtained from the sampling rods (Sample 1).

The drilling rods (casing) were advanced to 162 feet 6 inches. The split spoon sampler was advanced to 6 feet past the casing before it stopped and thus was retrieved without driving.

3.0 BOREHOLE DRILLING AND SAMPLING PROCEDURE (continued)

3.3 Borehole No. 9 (continued)

Recovery was about 2 inches and the material was found to be dry, dark grey arsenic dust (Sample 2).

The casing was then advanced to a depth of 192 feet 6 inches and the split spoon sampler lowered to about 7 feet ahead of the casing where penetration stopped. The sampler was recovered to determine whether any loose deposits had been penetrated, which was found to have occurred. However, recovery was limited to part of the drive shoe only. The recovered material (Sample 3) was similar to that obtained previously.

The casing was advanced to 222 feet 6 inches. The sampler was lowered and it stopped 3 feet 8 inches ahead of the casing. From there, it was driven through 18 inches. The recorded blow counts were: 1 for the first nine inches, 10 for the next six inches and 8 for the last three inches of penetration. These indicate a relative density generally described as loose to compact. Recovery was made in the drive shoe only and consisted of dark grey arsenic dust (Sample 4).

The bottom of the borehole was reached at a depth of 237.6 feet, where high resistance to further advance was encountered. This was 40 feet higher than predicted from the cross-sections provided by the Mine.

Approximately one-third of a 205 litre drum was recovered from the Vacuum Truck. The inside of the truck had been cleaned prior to the start of sampling to avoid contamination by arsenic dust recovered previously.

Three attempts were made to set a pneumatic plug at 117 feet. All of the pneumatic plugs burst, probably due to puncturing by roughness in the bedrock.

One attempt was made to set a pneumatic plug at 97 feet on the last day on site. Since the plug burst, an improvised

3.0 BOREHOLE DRILLING AND SAMPLING PROCEDURE (continued)

3.3 Borehole No. 9 (continued)

cardboard and cloth plug was made up by the Drillers on site and pushed down with rods to a depth of 25 feet.

3.4 Borehole No. 8

Borehole No. 8 was drilled to access Stope No. B2-35 which was filled simultaneously with Stope No. B2-36 as stated in Section 3.3.

In this borehole, 32 feet of overburden was encountered with permafrost occurring below a depth of 12.5 feet. Because of the slurried condition of the thawed permafrost, the casing was set and cemented 1.5 feet into bedrock. Drill cuttings were found to have accumulated on the walls of the 8 inch casing causing the downhole hammer to jam. The surface casing was therefore replaced. The bedrock was drilled to a depth of 78 feet before the stope was reached.

The split spoon sampler was lowered to locate the top of the arsenic deposit and stopped at 148 feet 4 inches where the sampler was driven in 18 inches for a blow count of 6 per foot of penetration, indicating very loose material. Arsenic dust was recovered only in the drive shoe of the sampler and some cuttings, presumably from the overburden or bedrock, were also recovered. Material recovered in the drive shoe was dry and dark grey arsenic dust (Sample 1). Twenty-five feet of sampling rods above the sampler were stained with the same material. Hence it is inferred that the sampler penetrated at least 25 feet in the loose arsenic dust deposit. Therefore the surface of the arsenic dust was estimated to be at a depth of about 123 feet.

The casing was advanced to a depth of 178 feet 3 inches and the split spoon sampler was lowered and stopped about 2 feet inside the casing. The sampler was then advanced 18 inches by driving with the hammer. A blow count of 36 was obtained for the last foot of penetration reflecting the confinement due to sampling

3.0 BOREHOLE DRILLING AND SAMPLING PROCEDURE (continued)

3.4 Borehole No. 8 (continued)

within the casing. Recovery was complete and the material was dry and dark grey in colour (Sample 2). A small piece of wet mud was found at the tip of the sampler which is believed to have originated from the overburden. This material was stored in a separate bag for subsequent laboratory identification.

The casing was advanced to 198 feet 3 inches. The split spoon sampler was lowered and stopped about 4 feet inside the casing. The sampler was advanced 18 inches by driving with the hammer. A blow count of 33 for the last foot of advance reflects confinement due to sampling inside the casing. Full recovery of dry, dark grey arsenic dust was maintained (Sample 3).

The casing was then advanced to a depth of 218 feet 3 inches. The split spoon sampler stopped about 5 feet inside the casing and was driven for 18 inches. A blow count of 16 per foot of advance reflects confinement due to sampling inside the casing. Material recovery was complete. The recovered material (Sample 4) was similar to that obtained in the previous samples.

The bottom of the stope was reached at 231.3 feet, about 53 feet higher than predicted from the cross-sections. The casing was pulled back to 223 feet 3 inches and the split spoon sampler lowered inside. The sampler stopped 5.5 feet inside the casing. Blow counts of 46 per foot of penetration within the casing indicate the confined condition. Recovery was complete and the material (Sample 5) was similar to that described above.

After the casing was pulled out, a large rock fragment was found to be jammed in the drill bit, presumably picked up at the foot of the stope.

One half of a 205 litre drum was recovered from the Vacuum Truck. Contamination from other sources of impure arsenic tri-oxide was minimized while contamination from soil on which the

3.0 BOREHOLE DRILLING AND SAMPLING PROCEDURE (continued)

3.4 Borehole No. 8 (continued)

truck dumped the arsenic dust was avoided by leaving a layer of arsenic dust on the ground. This procedure was followed for each borehole as directed by Giant Yellowknife Mines Limited. The arsenic dust left on the ground was subsequently covered with soil by Mine Personnel. The dumping points were located in the interior of the existing Tailings Area.

To seal the hole, a pneumatic plug was set at a depth of 97 feet. Four bags of mixed normal Portland cement slurry were placed in the hole above the plug.

3.5 Borehole No. 5

Borehole No. 5 was drilled to access Stope No. B2-30 which was the first stope to be backfilled by Giant Mines. An estimated 3,125 tons were placed in this stope from October 28th, 1951 to December 15th, 1952.

Overburden and bedrock at this location were drilled twice because the drilling rods and hammer were lost in the first hole before sampling could be attempted. The drill string and downhole hammer were lost after breakthrough into the stope when a hoisting cable snapped during recovery. All attempts to fish out the lost equipment were unsuccessful due to the presence of the broken hoist cable and hoisting plug obstructing the hole above the rods. In the first hole, 5.5 feet of overburden and 206.5 feet of bedrock were drilled.

The drill rods, which could not be recovered, extend from a depth of 34 feet below ground surface to a depth of 12 feet into the stope itself. After the decision to abandon the equipment was taken, the hole was sealed as instructed by Giant Yellowknife Mines Limited.

In the hole used for sampling, located about 8 feet from the abandoned hole, 4-1/2 feet of overburden and 216 feet of bedrock

3.0 BOREHOLE DRILLING AND SAMPLING PROCEDURE (continued)

3.5 Borehole No. 5 (continued)

were drilled. The split spoon sampler was lowered into the stope to sound the surface of the arsenic deposit. After penetrating the stope through a depth of 31 feet under weight of rods, the sampler was pulled out. Recovery of Sample 1 was full within the sampler. The sampling rods immediately above the sampler were stained with wet arsenic dust for a length of 11 feet from the tip of the sampler above which dry arsenic dust was observed on the rods. The surface of the wet arsenic dust was inferred at a depth below the ground of 240 feet and of dry dust at 225 foot depth. The material was found to be reddish, dry and loose at the top and wet and cohesive at the bottom of the sampler.

The casing was advanced to 253 feet 6 inches with the Vacuum Truck suction on. Before the suction was turned off, the drill string was left at a depth of 253 feet 6 inches for 8 minutes in an attempt to improve cleaning of the casing.

A modified Shelby tube* for Sample 2 was lowered. Under its own weight it went down to 265 feet depth. Full recovery of wet, reddish arsenic dust was achieved in the sampler. Sampling rods were covered with a thick layer of loose and wet arsenic dust over a length of 40 feet. The material in the tube appeared to be denser and stiffer than that collected on the rods. It is possible that wet arsenic dust collected at the bottom of the casing and that the sampler picked up this material during the lowering of the sampler. It is also likely that the material on the rods was picked up from the wet arsenic dust smearing the inner walls of the Duo tube drilling string.

As another joint of rod was added to advance the borehole further, the clamp holding the casing broke resulting in 255 feet

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* The modified Shelby tube had a straight inside wall instead of having gauge at the tip. This gauge yields a sample diameter of slightly less than that of the sampler to minimize disturbance of cohesive materials due to side friction.

3.0 BOREHOLE DRILLING AND SAMPLING PROCEDURE (continued)

3.5 Borehole No. 5 (continued)

of casing falling to the bottom of the stope. The casing was fished out and clamped at 268 feet 6 inches. A modified Shelby tube was lowered inside the casing to 270 feet, however, no recovery was achieved. The sampling tube was covered with approximately 3/8 inch of saturated, very soft, reddish arsenic dust and Sample 3 was taken from the surface of the sampler.

Vacuum suction was set up for a period of 20 minutes to recover a bulk sample. However, pick-up, as indicated from movement of the suction hose, was judged to be poor. The borehole was terminated at this point.

About one-third of the 205 litre drum was recovered from the Vacuum Truck. The material in the truck was found to be in a much drier state than indicated from material recovered in-situ. Besides, some lumps were found in the dust picked up. It is considered possible that the circulating air and vacuum may have had a drying effect on the material. Wet arsenic trioxide, the main component of arsenic dust, tends to conglomerate and recrystallize upon drying. This may explain the presence of hardened chunks of accumulated arsenic dust in the bulk sample.

A pneumatic plug was set at a depth of 197 feet. The cement plug on top of the pneumatic plug was prepared with four bags of normal Portland cement mixed with water and poured into the hole.

3.6 Borehole No. 7

Borehole No. 7 was drilled to access Stope No. B2-34. This stope was filled with an estimated 13,281 short tons of arsenic dust between March 2nd, 1956 and July 10th, 1958.

A first hole was drilled to a depth of 141 feet without reaching the stope due to incorrect location of the stope in plan. The surveyed location for the hole as initially drilled was found to be outside the stope limits.

3.0 BOREHOLE DRILLING AND SAMPLING PROCEDURE (continued)

3.6 Borehole No. 7 (continued)

A new borehole was commenced at a distance of about 10 feet west of the first borehole. The depth of overburden at the new location of the borehole was 23-1/2 feet and ice-rich permafrost was encountered within the overburden at a depth of 15 feet. The casing was set and cemented to a depth of 1-1/2 feet within the bedrock. The bedrock was drilled through 93-1/2 feet at which level the stope was intercepted.

Upon breaking through the crown pillar into the stope, considerable air mixed with sand size particles gushed out of the borehole in a jet which streamed to 8 or 10 foot height. This rate of air bleeding continued for about twenty minutes. A few minutes afterwards, the air stream decreased to insignificant level. Dust was also seen to be coming out of the abandoned borehole indicating close proximity of that borehole to the stope.

A plumb bob was lowered through the casing and by soundings the surface of the arsenic was established at a depth of 125 feet below the ground.

A modified Shelby tube was lowered with the intention of sampling the top of the arsenic backfill. An error in measurement led to advancing the tube through 6 feet 4 inches rather than 30 inches with zero recovery resulting. A split spoon sampler was then lowered to 18 inches below the surface of the arsenic deposit, and again recovery was zero except for slight staining on the sampler sides. The material appeared to be very loose, dry and dark brown. These were Samples 1 and 2 respectively.

The casing was advanced with suction to 132 feet 8 inches During advance of the drill string back pressure vented from the first borehole. Suction used was in the mid-range of the truck capacity. Soundings taken inside of the casing indicated the arsenic dust to be stacked to a height of 22 feet. Maximum Vacuum Truck suction was applied for 10 minutes following which the top of the arsenic was plumbed flush with bottom of the casing.

3.0 BOREHOLE DRILLING AND SAMPLING PROCEDURE (continued)

3.6 Borehole No. 7 (continued)

A modified Shelby tube sample was taken at a depth of 132 feet 8 inches. The tube was easily pushed in and 6 inch recovery of Sample 3 obtained. The material was dark brown-red, loose to compact, dry arsenic dust. It is possible that vibrations and arching within the tube may have packed the material to a greater density than the in-situ density and that the layer immediately below the bottom of the casing may have been disturbed by the applied suction.

The casing was advanced to 147 feet 8 inches, slowly running up and down with maximum suction. Dust was plumbed to 4.5 feet inside the casing. Suction was hooked on for 5 minutes. This brought the stack down to about 30 inches above the bottom of the casing. Suction was applied for another 8 minutes. The dust level was 3 feet above the tip of the casing and a split spoon sampler was lowered for sampling. The split spoon sampler was pushed through this dust for a distance of 2 feet, however recovery was confined to the sampler drive shoe. This was Sample 4. The material was dry, inferred compact, dark reddish-brownish and had an apparent grain size* near the fine sand/silt border.

The casing was advanced slowly to a depth of 162 feet 8 inches running up and down slowly three times and leaving suction on at the final level for 12 minutes before shutting off. By use of a plumb bob, the top surface of the arsenic dust was sounded at a level 15 feet above the bottom of the casing. The casing was pulled back and re-run twice very slowly. Suction was left on for 18 minutes at 162 feet 8 inches following which, arsenic dust was plumbed at 19 feet inside the casing. The casing was pulled back 15 feet. Dust was plumbed to bottom of the casing. Another 15 feet of casing was pulled out. The plumb bob indicated that top of the dust was 15 feet ahead of the casing. The casing was next run down to depth of 177 feet 8 inches with moderate suction so as not to overly disturb the surrounding material. Arsenic dust was plumbed 5 feet inside

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* apparent, because dust particles could be conglomerated or recrystallized.

3.0 BOREHOLE DRILLING AND SAMPLING PROCEDURE (continued)

3.6 Borehole No. 7 (continued)

the casing. Moderate suction was applied for 8 minutes at 177 feet 8 inches and low suction for 2 minutes following which, arsenic was still plumbed at 5 feet inside the casing. The split spoon sampler advanced about 4 feet under its own weight and recovery of Sample 5 was about 9 inches behind the trap. The material was very loose, dry and slightly lighter in colour than the material lying above it.

The casing was slowly advanced to 192 feet 8 inches. Maximum suction was applied for 15 minutes at the sampling depth (192 feet 8 inches). Arsenic dust was plumbed to 14 feet inside the casing. The split spoon sampler was lowered and run down to the bottom of the casing (Sample 6). Recovery from this 14 foot column was about 6 inches. The material was disturbed, very loose, dry and dark reddish-brown.

The casing was again slowly advanced to 207 feet 8 inches passing 205 feet with difficulty. Suction was maintained for 20 minutes. Arsenic was plumbed to 19 feet inside the casing and the split spoon sampler (for Sample 7) was lowered to the bottom of the casing. Recovery in the body of the sampler was complete but the sampler drive shoe was empty. The material was loose, dry and dark in colour.

The casing was pulled back with some difficulty between 207 feet and 205 feet with the intention of re-running the last section to attempt to clean out the casing. At the next attempt, the casing would not pass the 205 foot level. There appeared to be a rock ledge or other obstacle past which the casing could not be advanced. This obstacle was 63 feet above the anticipated bottom of the stope.

One half of a 205 litre drum of arsenic dust was recovered from the vacuum truck.

A pneumatic plug was set at 98 feet below surface and four bags of mixed cement and water grout were placed. The first hole was cemented and backfilled with soil above the 110 foot level.

3.0 BOREHOLE DRILLING AND SAMPLING PROCEDURE (continued)

3.7 Borehole No. 11

Borehole No. 11 was drilled to access Stope C-9. This stope was filled with 19,846 short tons of arsenic dust between May 21st, 1976 and May 31st, 1980.

Fourteen feet of rockfill with groundwater surface 6 inches below the ground level was drilled before hitting bedrock. Due to severe groundwater conditions, and the instability of the overburden hole, it was necessary to ensure that casing was well seated into bedrock below any weathered zone that may have been present. The casing was thus set and cemented 8 feet into rock. The bottom of the casing was built up and strengthened to allow for penetration through the caving hole and 20 bags of high-strength, fast setting non-metallic grout were pumped through the casing into the rock socket to seal the casing. A full day was spent in allowing the grout to cure properly.

Ninety-five feet of bedrock was drilled before the stope was reached. The top of the arsenic was plumbed right at the crown pillar. This established the arsenic dust surface at a depth below ground of 109 feet. A split spoon sampler was pushed in for recovering Sample 1. Approximately 2 inches of dry, light grey and loose to very loose material was recovered.

The split spoon sampler was driven in order to carry out a penetration test from 110 feet 6 inches to 118 feet. No penetration resistance was encountered for the first 2 feet 6 inches beyond which blow count per foot was found to be about 1. Results of this penetration test and of other tests mentioned herein are given on the Office Report for Soil Exploration in Appendix I. A relative density described as very loose is therefore inferred. Recovery from the penetration test was about 6 inches and the material was found to be a very loose, light beige, dry arsenic dust. This was Sample 1A.

The casing was advanced to 118 feet 7 inches while maintaining moderate vacuum suction. The drill bit used was equipped with

3.0 BOREHOLE DRILLING AND SAMPLING PROCEDURE (continued)

3.7 Borehole No. 11 (continued)

inside air jets directed upwards rather than the previously used downward directed jets. Arsenic was plumbed to 4 feet ahead of casing. A modified Shelby tube was pushed in by hand but no recovery was achieved (Sample 2). The hoisting cable jumping on the winch during rod recovery may have contributed to the loss of the sample. The split spoon sampler was used for a penetration test from 122 feet 6 inches to 128 feet. The material is described as very loose since the sampler penetrated under its own weight. Recovery of the material (Sample 2A) included 4 inches in the sampler in addition to the full length of the driving shoe and trap.

The casing was advanced with moderate suction to 128 feet 7 inches. Arsenic was plumbed to 4.5 feet ahead of the casing. The split spoon sampler was pushed in 18 inches under its own weight and a recovery of about 1 inch in the sampler and the fully length of the drive shoe was achieved (Sample 3). The material was dry, very loose, light beige arsenic dust.

The split spoon sampler was used again for a penetration test from 134.5 feet to 138.5 feet deep (Sample 3A) Blow counts averaged 4 per foot of penetration indicating a relative density described as very loose. Recovery was 12 inches plus about half the length of the drive shoe and the material was found to be the same as described above.

The casing was advanced to a depth of 138 feet 7 inches and arsenic dust was plumbed to 1.5 feet ahead of the casing. A modified Shelby tube was taken and a recovery of about 16 inches achieved (Sample 4). The material was also loose, light beige and dry. A penetration test was taken with the split spoon sampler from 142 feet 3 inches to 158 feet 9 inches and blow counts indicate a loose material. Recovery was complete and the material was similar to that recovered in the previous sample. This was Sample 4A.

The casing was advanced to 158 feet 7 inches with low suction. Arsenic dust was plumbed flush with the bottom of the casing and a

3.0 BOREHOLE DRILLING AND SAMPLING PROCEDURE (continued)

3.7 Borehole No. 11 (continued)

modified Shelby tube which could not be advanced by hand, was pushed in with the assistance of the top drive of the drill rig, and broke through (Sample 5). It was later found that the end of the sampling tube was indented and it is speculated that the cutting end of the tube was hung up on the inside of one of the bit cutting teeth. Recovery was found to be about 15 inches and the material was loose, dry and light beige in colour.

The split spoon sampler was used to conduct a penetration test between 162 feet 9 inches and 167 feet 9 inches (Sample 5A). An average blow count of 8 per foot of penetration was recorded indicating a loose material. Recovery was 12 inches plus one half length of the drive shoe.

The casing was advanced to 168 feet 7 inches, however, from 166 feet onward, considerable resistance to rotation and penetration of casing was encountered. Arsenic dust was plumbed to 2 feet 4 inches ahead of the casing. A modified Shelby tube was taken at the end of the casing (Sample 6) and again had to be pushed using top drive of the drill rig. Recovery was about 11 inches and the material was inferred to be loose to compact, dry, light beige arsenic dust.

The split spoon sampler was used for a penetration test between 174 feet 1 inch and 178 feet 7 inches (Sample 6A). An average blow count of 7 per foot of penetration was recorded indicating a loose material. Recovery was 14 inches plus one half length of the driving shoe.

The casing was advanced with difficulty to 170 feet beyond which no further penetration was possible. Several attempts were made to pass the obstacle encountered but were unscuessful and it was later found that the bottom part of the drill string was bent in the attempt. Since the split spoon sampler had previously passed a depth of 170 feet, it was again lowered for a penetration test which took place between 170 feet 11 inches and 242 feet 3 inches (Sample 7). These test results are plotted on the Office Report on Soil Exploration

3.0 BOREHOLE DRILLING AND SAMPLING PROCEDURE (continued)

for Borehole 11. Blow counts from 170 feet 9 inches to 171 feet 9 inches were 43 and probably reflect friction of the sampler while being deflected around the obstacle rather than the real density of the material. From 174 feet 9 inches to 177 feet 9 inches, the arsenic was very loose as indicated by blows between 5 and 6 for each foot of penetration. From 177 feet 9 inches to 197 feet 3 inches, the relative density was loose to compact based on blow counts ranging between 6 and 13 per foot of penetration and the relative density was in the compact range for the rest of the hole. Relative density increased slightly with depth. Recovery from the split spoon was complete and the material was described as dry, light beige arsenic dust.

Before pulling casing out, it was run up and down twice between 150 feet and 170 feet with maximum suction, however recovery did not appear to be extensive. The casing was pulled back 20 feet and run up and down between 130 feet and 150 feet for about forty five minutes. Suction was left on at 130 feet for fifteen minutes during which only 60 pounds of dust were picked up.

One quarter of a 205 litre drum was picked up from the Vacuum Truck.

3.7.1 Pneumatic Pumping Test - Borehole No. 11

After completion of Borehole 11 a pneumatic test was carried out. A drilling bit combining outward and inward jetting was adapted on the bottom of the casing. Air was blown directly into the arsenic deposit and maximum truck suction was applied. The casing was run up and down between 110 feet and 130 feet for one hour during which 700 pounds of arsenic were recovered.

The drill bit was then changed for an outward jetting bit. Air was blown into the stope for 45 minutes between 110 feet and 130 feet. Subsequently, the air was turned down to a minimum to keep the hole clean and suction was turned on to a maximum. Suction was applied between 110 feet and 130 feet for about one and a half hours and 620 pounds of arsenic dust were recovered.

At the end of the working day, the double wall casing was clamped at 110 feet and the following day the casing was lowered to 130 feet without blowing air or applying suction. It was found that

3.0 BOREHOLE DRILLING AND SAMPLING PROCEDURE (continued)

3.7 Borehole No. 11 (continued)

3.7.1 Pneumatic Pumping Test - Borehole 11 (continued)

this caused arsenic dust to pack at the bottom of the casing and clog the inner tube which was used for suction. The plug was removed and the test resumed. The casing was run down very slowly from 110 feet to 130 feet and 140 pounds of arsenic dust was recovered.

Air was blown between 130 feet and 150 feet for 1-1/4 hours and suction was next applied for one and a half hours. 160 pounds of arsenic dust were picked up during this process.

Following this phase of the work, it was decided to go deeper with a different bit. Since the drilling bit could not be modified before the next day, the same drilling bit (set with outward blowing jets) was used to run between 130 feet and 165 feet. Air was blown into the deposit for one half of an hour without suction on and for another hour with maximum suction on. Only 40 pounds of dust were picked up by the Vacuum Truck.

The final device used for bulk recovery of arsenic dust was a bit with 3 inward jets directed upwards at 20 degrees from the horizontal. Air was blown in at full capacity of the pump simultaneously with the application of full suction. The casing was taken down very slowly from 110 feet to 150 feet (in about two hours). Another two hours were spent in running repeatedly between 150 feet and 168 feet. Eighty pounds of arsenic dust was picked up by the Vacuum Truck during this test period.

4.0 LABORATORY TEST RESULTS

4.1 General

Some general comments given below about the physical properties of arsenic trioxide are relevant as background in regard to the laboratory test results discussed later.

Pure arsenic trioxide is white in colour. On account of admixtures, the colour of the material recovered from the stopes varied from light

4.0 LABORATORY TEST RESULTS (continued)

4.1 General (continued)

grey to light pink. Arsenic trioxide may be amorphous or crystalline. When pure it has a specific gravity of 3.738 and a melting point of 312.3 degrees Centigrade. It has a solubility of 3.7 grams per 100 cubic centimetres in cold water and of 10.14 grams per 100 cubic centimetres in hot water*. Arsenic trioxide dust sublimates if heated to a temperature over 90 degrees Centigrade; pure arsenic trioxide solid is known to sublime freely above 135 degrees centigrade. Arsenic trioxide dust is slightly soluble in alcohol, acetone, kerosene and Varsol. It does not mix readily with water; good agitation is required to wet it. It tends to conglomerate in limited quantities of water and crystallizes upon drying.

4.2 Water Content and Atterberg Limits

Because of the sublimation of arsenic trioxide dust above 90 degrees Centigrade, the laboratory procedure for drying of a wet arsenic dust sample consisted in maintaining oven temperature at 88 degrees Centigrade and drying the samples for a period of 20 minutes. This is the proceudre used by Giant Yellowknife Mines Limited to determine water content of wet arsenic dust. In order to check that the time of drying was sufficient, dry arsenic trioxide dust was mixed with measured quantities of water and then the samples were left for different intervals of time in an oven maintained at 88 degrees Centigrade. The results obtained are given in the tables below.

A. 5 Percent Water Added by Weight of Dry Arsenic Dust

Period of Drying in Oven at 88°C

	20 Minutes		1 Hour		24 Hours		
Borehole	4	5	7	11	6	8	9
Sample	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
'w' from test (%)	6.8	5.6	5.0	11.6	10.9	20.4	6.9

* Chemical Engineers' Handbook.

4.0 LABORATORY TEST RESULTS (continued)

4.2 Water Content and Atterberg Limits (continued)

B. 10 Percent Water Added by Weight of Dry Arsenic Dust

Period of Drying in Oven at 88°C

	20 Minutes			1 Hour		24 Hours	
Borehole	4	5	8	7	11	6	9
Sample	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
'w' from test (%)	6.8	5.6	5.0	11.6	10.9	20.4	6.9

Values of water contents obtained from the tests which are higher than the true water contents indicate probable loss of arsenic trioxide by sublimation during the drying process.

Conclusions drawn from these tests are:

i) The optimum drying period for water contents in the range of 5 percent or less is about 20 minutes; longer drying periods induce sublimation of the arsenic dust.

ii) The optimum drying period for water contents in the range of about 10 percent is 1 hour.

iii) The values for water contents as determined are only approximate.

Based on these test results, the standard laboratory procedure of drying the wet samples of arsenic dust for 20 minutes was adopted since the natural water content in most of the samples tested was of the order of 5 percent of less. The results of determination of moisture contents on a large number of samples from various boreholes are indicated on the Office Reports on Soil Exploration of the respective boreholes. The maximum water content in recovered samples which were tested was 6.3 percent.

The results of tests for Liquid Limits were inconclusive. Plastic Limits were 24, 20 and 19 percent for bulk samples from Boreholes 5, 7 and 9 respectively.

4.3 Grain Sizes

Wet sieve analysis was carried out to determine the fraction of the arsenic dust finer than the number 325 sieve size (sieve opening 0.045 mm).

4.0 LABORATORY TEST RESULTS (continued)

4.3 Grain Sizes (continued)

The liquid used was alcohol instead of water. The following results were obtained:

Borehole	4	4	5	6	7	8	9
Sample	1	4	1	4	3	2	Bulk
Percent finer than 0.045 mm	98.2	100	100	100	100	90.8	100

4.4 Unit Weight

4.4.1 Maximum and Minimum Density

Procedures recommended by ASTM* were followed for determination of maximum and minimum density of bulk samples from various boreholes. The tests were carried out in a mold of 4.06 inch diameter and 4.60 inch height. For the maximum density tests the mold was filled in five layers, tapping it 25 times with a rubber mallet after filling of each layer and maintaining a surcharge load of 12 kg (26.5 pounds) during the tapping. For minimum density the same mold was used and the test material was loosley poured into it.

Results of the tests are given below:

Bulk Sample From Borehole	4	5	6	7	8	9	1
Maximum Dry Unit Weight (p.c.f.)	69.1	77.3	82.3	85.3	84.2	74.6	91.1
Minimum Dry Unit Weight (p.c.f.)	39.7	48.3	50.7	55.6	53.3	41.6	55.1

4.4.2 In-Place Unit Weight

The recovered Shelby tube samples were not suitable to determine representative in-place unit weight because the tube samples contained compressed material. The Shelby samples taken from within the casing were of material which had been disturbed during the advance of the casing. The Shelby samples of sizeable lengths recovered from zones below the tip of the casing were invariably drawn from lengths greater than that of the samples recovered.

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* ASTM (1973), Relative Density Involving Cohesionless Soils ASTM STP No. 523.

4.0 LABORATORY TEST RESULTS (continued)

4.4 Unit Weight (continued)

4.4.2 In-Place Unit Weight (continued)

Consequently, the unit weights of in-situ material determined from weight and volume of recovered samples in Shelby tubes are not considered to be completely representative, with the probable exception of the unit weight test on Sample 5 from Borehole 11. The values as obtained from tests are given below:

Borehole	5	11	11
Sample	1	2	5
Dry Unit Weight (p.c.f.)	101.3	96.2	83.7
Moisture Content %	10.1	1.6	0.6

4.5 Specific Gravity

Standard procedure was employed for determination of specific gravity of the arsenic dust with the exception that the liquid used was alcohol (specific gravity 0.64) instead of water. This was necessary because arsenic dust is difficult to test with water. Following results were obtained:

Borehole	4	5	6	7	8	9	11
Sample	1	1	3	3	2	Bulk	3
Specific Gravity	3.22	3.17	3.15	3.23	2.59	3.79	3.06

The variations in the results, apart from being due to experimental scatter, are probably due to admixtures in the arsenic dust.

4.6 Angle of Repose

Two different methods for determination of angle of repose were adopted. One method consisted in placing a thickness of 1/4 to 3/8 inches of loose material to be tested on a wooden board having a prepared surface consisting of a thin layer of the test material glued to the board. One edge of the board was gradually raised and the angle determined at which sliding of the particles down the board commenced. This was the "Board Method". The second method consisted in pouring

4.0 LABORATORY TEST RESULTS (continued)

4.6 Angle of Repose (continued)

through a funnel the material to be tested such that at any time the free fall of the material was about 1 inch. The angle of inclination of the pile thus formed was measured, this being the angle of repose. The "Funnel Method" was used for two different base diameters of cones of material, one being 4-1/2 inches and the other about 10 inches. Test results using the Funnel Method and 10 inch base of cone gave the lowest values. Test results are given below:

Test Results for Angle of Repose

Method	Bulk Sample From Borehole						
	4	5	6	7	8	9	11
Board	-	-	58.0°	55.5°	52°	57°	49°
Cone 4½" Base	-	-	49.4°	55.5°	48°	52°	50°
Cone 10" Base	46.4°	47.7°	46.7°	46.1°	46.7°	48.7°	48°

Average Ø loose from results of 10 inch cone base = 47°

Notes: 1. Test by the Board Method yielded consistenly higher values than tests by the Cone Method. Testing for Samples 4 and 5 was consequently not carried out.

2. Tests by the 10 inch base cone were found more consistent than those with the 4½ inch base cone. Consequently tests with the 4½ inch base cone were not completed for samples from all boreholes.

4.7 Angle of Internal Friction

Direct shear tests for angle of internal friction were carried out on dry bulk samples from Boreholes 5, 9 and 11. One or two specimens from each sample were tested under normal pressures 3.6, 18.1 and 29.0 p.s.i. The test results are plotted on Figures 1, 2 and 3 for samples from Boreholes 5, 9 and 11, respectively. In each case the cohesion intercept was zero, the angle of friction was 35, 33 and 34 degrees for samples from Boreholes 5, 9 and 11, respecively. The average angle of friction for all direct shear tests was 34 degrees as is summarized on Figure 4. These

4.0 LABORATORY TEST RESULTS (continued)

4.7 Angle of Internal Friction (continued)

results are not consistent with the angle of repose discussed above. It is probable that presence of moisture in the dust and/or the shape of the arsenic dust particles contributes to this difference.

4.8 Consolidation

A laboratory consolidation test was carried out on the bulk sample recovered from each borehole. The consolidation tests carried out were non-standard in that these were on dry samples of the material. The object of the tests was to determine a relationship between applied pressure and void ratio and consequently, between dry unit weight versus depth.

The equipment used for the consolidation test was a container of 4 inch diameter which could accommodate a sample of 4.6 inch height. Direct loads were applied on the sample through a plate at the top and changes in height of the sample were recorded.

These tests were carried out on specimens prepared from the bulk samples from the various boreholes. Figures 5 and 6 in Appendix II show plots of void ratio 'e' against logarithm of the unit pressure 'p' applied. The curves obtained are similar to those of loose sand. These void ratio-pressure curves were computed assuming the specific gravity of each specimen was the same as the corresponding specific gravity given earlier in Section 4.5 of this report. With the exception of the specimen from Borehole 9, these specific gravities were determined on discrete samples and thus may vary somewhat from the average specific gravity of the bulk samples tested.

It is pointed out that variations in specific gravity (ranging between a low of 2.59 for Borehole 8 and a high of 3.79 for Borehole 9) have an influence on the spread in values of void ratios which ranged between 0.92 for Borehole 8 and 2.15 for Borehole 9 at a pressure of about 2000 pounds per square foot at the termination of the consolidation test in each case.

4.0 LABORATORY TEST RESULTS (continued)

4.8 Consolidation (continued)

The dry unit weights obtained during the consolidation tests have been plotted against pressure on Figure 7 of Appendix II. Extrapolation of curves on this Figure (based in turn on extrapolation of the curves on Figures 5 and 6 of Appendix II,) indicates a trend for the unit weights to increase only gradually at pressures in excess of about 2000 pounds per square foot. The values of unit weight at a surcharge of 2000 pounds per square foot range between 73 and 88 pounds per cubic foot which compare to maximum unit weights between 69 and 87 pounds per cubic foot obtained in laboratory tests to determine maximum dry unit weight as discussed in Section 4.4.1.

The results of the plot on Figure 7 were used to plot Figures 8 and 9. Figure 8 is a plot of dry unit weight versus depth below surface of arsenic dust computed by using average unit weight for discrete pressure increments of 100 pounds per square foot over the pressure range of 0 to 500 pounds per square foot and 500 pounds per square foot over the pressure range of 3000 to 50000 pounds per square foot. Figure 9 is a plot of pressure versus depth computed by using average unit weight for discrete pressure increments and incrementally converting this average unit weight to equivalent depth.

The relationships presented on Figures 7, 8 and 9 are based on one test per borehole. Variations in physical properties of arsenic within each stope are to be expected. Nevertheless it is considered that the results reasonably reflect the in-situ dry unit weight condition of the arsenic dust in the stopes.

5.0 CLOSURE

The field work for this project was carried out under the supervision of Mr. S. Dufour and under the direction of Mr. R.B. German. This report was written by Mr. S. Dufour, Mr. R.B. German and Dr. A.S. Gill with assistance from Mr. H.L. MacPhie. This report was reviewed by Mr. M.A.J. Matich.

5.0 CLOSURE (continued)

We trust this factual report is sufficient for your present purpose. Should you have any questions we shall be pleased to respond.

Yours very truly,
GEOCON INC.

A.S. Gill, Ph.D., P.Eng.
Senior Project Manager

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APPENDIX I

Office Reports on Soil Exploration

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EXPLANATION OF THE FORM "OFFICE REPORT ON SOIL EXPLORATION"

This form summarizes both field information and selected laboratory test results obtained from each boring. An explanation of the various columns of the report follows.

ELEVATION AND DEPTH

This column gives the elevation and depth of inferred geologic contacts. The elevation is referred to the datum shown in the general heading.

WATER CONDITIONS

In this column the water level in the ground at the time of boring is indicated to scale by the symbol ▼ for the date shown. In pervious soils the indicated elevation may be considered as a reliable ground water level. In impervious soils the accurate determination of ground water elevations by standpipe, casing or open-hole readings is not possible within the normal time frame of completion of site work and the true static level may be higher or lower than indicated. Where both pervious and impervious soil strata are penetrated, the groundwater levels in each layer may be at different levels and sealed piezometers or standpipes within the individual layers are required to establish water conditions. Water levels determined by a piezometer can be considered as reliable groundwater levels for the layer in which the piezometer tip is located.

DESCRIPTION

A description of the soil, using standard geotechnical terminology, is contained in this column. The consistency of cohesive soils and the relative density of non-cohesive soils are described by the following terms:

	Undrained Shear Strength			Standard Penetration Resistance
Consistency	kPa	psf.	Relative Density	Blows/0.30m or Blows/ft.
Very soft	0 to 12	0 to 250	Very loose	0 to 4
Soft	12 to 25	250 to 500	Loose	4 to 10
Firm	25 to 50	500 to 1000	Compact	10 to 30
Stiff	50 to 100	1000 to 2000	Dense	30 to 50
Very stiff	100 to 200	2000 to 4000	Very dense	over 50
Hard	over 200	over 4000		

Terminology used for describing soil strata is based on the proportion of individual particle sizes present:

Trace, or occasional	Less than 10%
Some	10 to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And (e.g. sand and gravel)	35 to 50%

Classification of soil strata is based on the following particle size distribution:*

Clay	less than 0.002 mm	———
Silt	from 0.002 to 0.075 mm	(0.002 mm to #200 sieve)
Sand	from 0.075 to 4.75 mm	(#200 sieve to #4 sieve)
Gravel	from 4.75 mm to 75 mm	(#4 sieve to 3 in.)
Cobbles	from 75 to 200 mm	(3 in. to 8 in.)
Boulders	larger than 200 mm	(over 8 in.)

*Unified Soil Classification System ASTM D2487-75.

(Continued on reverse)

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT V8520 BORING # 4* DATUM MINE CASING 7 IN. I.D.
BORING DATE AUG. 9,10,12/81 REPORT DATE NOV. 24, 1981 COMPILED BY PAD CHECKED BY ASG
SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN-LBS. ENERGY)

SAMPLE CONDITION
- DISTURBED
- FAIR
- GOOD
- LOST

SAMPLE TYPES
A.S. - AUGER SAMPLE; S.T. - SLOTTED TUBE; W.S. - WASHED SAMPLE; D.O. - DRIVE-OPEN; D.F. - DRIVE-FOOT VALVE; C.S. - CHUNK SAMPLE; F.S. - FOIL SAMPLE; S.O. - SLEEVE OPEN; S.F. - SLEEVE-FOOT VALVE; T.O. - THIN WALLED OPEN; R.C. - ROCK CORE

ABBREVIATIONS
V - IN-SITU VANE TEST; M - MECHANICAL ANALYSIS; U - UNCONFINED COMPRESSION; Qc - TRIAXIAL CONSOLIDATED UNDRAINED; Q - TRIAXIAL UNDRAINED; S - TRIAXIAL DRAINED; Gs - SPECIFIC GRAVITY; γ - WET UNIT WEIGHT; K - PERMEABILITY; C - CONSOLIDATION; WL - WATER LEVEL IN CASING; WT - WATER TABLE IN SOIL

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	ELEVATION SCALE	WATER CONTENT W% (2, 4, 6, 8) ⊙ NAT. ⊡ LW △ PW / DYNAMIC PENETRATION TEST BLOWS PER FOOT	OTHER TESTS	SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
6016.5 / 0.0		GROUND LEVEL								
		OVERBURDEN								
5967.2 / 49.3		BEDROCK								
5910.5 / 106.0		VOID		5910						
				5900						
				5890						
		APPROXIMATE (SEE REPORT)		5880						
5878.3 / 138.2						M Gs		2"DO	1	9/12" WT. OF RODS LB 3/6" WT. OF RODS 7.8
				5870				"DO SWC	2	
		ARSENIC DUST IN STOPE		5860		W (SEE NOTE.)		"DO SWC	3	
				5850		M W (SEE NOTE.)		"DO SWC	4	
				5840						
				5830						
5825.5 / 190.0		(continued)						"DO	5	5

* NOTE: BOREHOLE NUMBERING BEGINS AT BOREHOLE No. 4

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT V8520 BORING # 4 (cont.) DATUM MINE CASING 7 IN. I.D.
BORING DATE AUG. 9,10,12/81 REPORT DATE NOV. 24, 1981 COMPILED BY PAD CHECKED BY ASG
SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION: DISTURBED; FAIR; GOOD; LOST

SAMPLE TYPES: A.S. - AUGER SAMPLE; S.T. - SLOTTED TUBE; W.S. - WASHED SAMPLE; D.O. - DRIVE-OPEN; D.F. - DRIVE-FOOT VALVE; C.S. - CHUNK SAMPLE; F.S. - FOIL SAMPLE; S.O. - SLEEVE-OPEN; S.F. - SLEEVE-FOOT VALVE; T.O. - THIN WALLED OPEN; R.C. - ROCK CORE

ABBREVIATIONS: V - IN-SITU VANE TEST; M - MECHANICAL ANALYSIS; U - UNCONFINED COMPRESSION; Qc - TRIAXIAL CONSOLIDATED UNDRAINED; Q - TRIAXIAL UNDRAINED; S - TRIAXIAL DRAINED; γ - WET UNIT WEIGHT; K - PERMEABILITY; C - CONSOLIDATION; WL - WATER LEVEL IN CASING; WT - WATER TABLE IN SOIL

SOIL PROFILE: ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE	WATER CONTENT W% ○ NAT. ⊙ Lw △ Pw; DYNAMIC PENETRATION TEST BLOWS PER FOOT	OTHER TESTS	SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
5825.5 / 191.0		(continued)		5820						
5814.8 / 201.7		END OF HOLE (HIGH RESISTANCE TO FURTHER ADVANCE)		5810						

NOTE:
1) SWC INDICATES SAMPLE RECOVERED FROM WITHIN THE CASING.
2) W. INDICATES WATER CONTENT BETWEEN 0 AND 1%
3) $\phi = 46 \pm 4^{\circ}$
$\gamma_{max.} = 89.1$ p.c.f. *
$\gamma_{min.} = 39.7$ p.c.f. *
* FROM BULK SAMPLE
4) PNEUMATIC PLUG @ EL. 5930±

APPENDIX I

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT V8520 BORING # 5 DATUM MINE CASING 7 IN. I.D.
BORING DATE SEPT. 8-10/81 REPORT DATE NOV. 24, 1981 COMPILED BY PAD CHECKED BY ASG
SAMPLER HAMMER WT 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION: DISTURBED; FAIR; GOOD; LOST

SAMPLE TYPES: A.S. - AUGER SAMPLE; S.T. - SLOTTED TUBE; W.S. - WASHED SAMPLE; D.O. - DRIVE-OPEN; D.F. - DRIVE-FOOT VALVE; C.S. - CHUNK SAMPLE; F.S. - FOIL SAMPLE; S.O. - SLEEVE-OPEN; S.F. - SLEEVE-FOOT VALVE; T.O. - THIN WALLED OPEN; R.C. - ROCK CORE

ABBREVIATIONS: V - IN-SITU VANE TEST; M - MECHANICAL ANALYSIS; U - UNCONFINED COMPRESSION; QC - TRIAXIAL CONSOLIDATED UNDRAINED; Q - TRIAXIAL UNDRAINED; S - TRIAXIAL DRAINED; γ - WET UNIT WEIGHT; K - PERMEABILITY; C - CONSOLIDATION; WL - WATER LEVEL IN CASING; WT - WATER TABLE IN SOIL

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE
6032.1 / 0.0		GROUND LEVEL		
6027.6 / 4.5		SAND AND GRAVEL FILL		
		BEDROCK		
5811.8 / 220.3		VOID		5810
5807.1 / 225.0		ARSENIC DUST IN STOPE		5800
5792.1 / 240.0		ARSENIC DUST IN STOPE (WET)		5790, 5780, 5770, 5760
5755.1 / 277.0		END OF HOLE		5750

WATER CONTENT W% ⊙ NAT. ⊡ LW △ PW
DYNAMIC PENETRATION TEST BLOWS PER FOOT

OTHER TESTS: M, G_s, γ_d = 101.3

SAMPLES

CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
	2"	TO 1	WT. OF RODS
	"	TO 2	WT OF RODS
(SEE NOTE 3)	"	TO 3	WT OF RODS

Sample from tip of Sampler

NOTE: 1) $\phi_{LOOSE} = 47.7°$
$\gamma_{max} = 77.3$ pcf *
$\gamma_{min} = 48.3$ pcf *
* FROM BULK SAMPLE
2) PNEUMATIC PLUG @ EL. 5835 ±
3) SAMPLE 3 WAS COLLECTED FROM THE SURFACE OF THE SAMPLER

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT V8520 BORING # 6 DATUM MINE CASING 7 IN. I.D.
BORING DATE AUG. 13-15/81 REPORT DATE NOV. 24, 1981 COMPILED BY PAD CHECKED BY ASG
SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION: DISTURBED; FAIR; GOOD; LOST

SAMPLE TYPES: A.S. - AUGER SAMPLE; S.T. - SLOTTED TUBE; W.S. - WASHED SAMPLE; D.O. - DRIVE-OPEN; D.F. - DRIVE-FOOT VALVE; C.S. - CHUNK SAMPLE; F.S. - FOIL SAMPLE; S.O. - SLEEVE-OPEN; S.F. - SLEEVE-FOOT VALVE; T.O. - THIN WALLED OPEN; R.C. - ROCK CORE

ABBREVIATIONS: V - IN-SITU VANE TEST; M - MECHANICAL ANALYSIS; U - UNCONFINED COMPRESSION; Qc - TRIAXIAL CONSOLIDATED UNDRAINED; Q - TRIAXIAL UNDRAINED; S - TRIAXIAL DRAINED; G_S - SPECIFIC GRAVITY; γ - WET UNIT WEIGHT; K - PERMEABILITY; C - CONSOLIDATION; WL - WATER LEVEL IN CASING; WT - WATER TABLE IN SOIL

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT
6027.2 / 0.0		GROUND LEVEL	
		ROCK FILL	
6023.2 / 4.0		BEDROCK	
5905.2 / 122.0		VOID	
		APPROXIMATE (SEE REPORT)	
5881.9 / 145.3		ARSENIC DUST IN STOPE	
5845.7 / 181.5		ARSENIC DUST IN STOPE (WET)	
5817.2 / 210.0		(continued)	

ELEVATION SCALE: 5910, 5900, 5890, 5880, 5870, 5860, 5850, 5840, 5830, 5820

WATER CONTENT W% — ⊙ NAT. ⊡ LW △ PW
DYNAMIC PENETRATION TEST BLOWS PER FOOT

OTHER TESTS: G_S

SAMPLES	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
		2'DO	1	WT. OF RODS ~20' 1/2'
		"DO	2	WT. OF RODS ~2'
		"DO	3 SWC	WT. OF HAMMER 20"

0 12 13 14 15 16 17 18 19 20 21

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT V8520 BORING # 6 (cont.) DATUM MINE CASING 7 IN. I.D.
BORING DATE AUG. 13-15/81 REPORT DATE OCT. 16, 1981 COMPILED BY PAD CHECKED BY ASG
SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS ENERGY)

SAMPLE CONDITION
DISTURBED
FAIR
GOOD
LOST

SAMPLE TYPES
A.S. - AUGER SAMPLE
S.T. - SLOTTED TUBE
W.S. - WASHED SAMPLE
D.O. - DRIVE-OPEN
D.F. - DRIVE-FOOT VALVE
C.S. - CHUNK SAMPLE
F.S. - FOIL SAMPLE
S.O. - SLEEVE-OPEN
S.F. - SLEEVE-FOOT VALVE
T.O. - THIN WALLED OPEN
R.C. - ROCK CORE

ABBREVIATIONS
V - IN-SITU VANE TEST
M - MECHANICAL ANALYSIS
U - UNCONFINED COMPRESSION
QC - TRIAXIAL CONSOLIDATED UNDRAINED
Q - TRIAXIAL UNDRAINED
S - TRIAXIAL DRAINED
γ - WET UNIT WEIGHT
K - PERMEABILITY
C - CONSOLIDATION
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL

SOIL PROFILE: ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE	WATER CONTENT W% (2 4 6 8) ⊙ NAT. ⊠ LW △ PW; DYNAMIC PENETRATION TEST BLOWS PER FOOT	OTHER TESTS	SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
5817.2 / 210.0		(continued)		5810	⊙	M		2"DO	4	12
								2"TO	6 SWC	WT. OF RODS ~ 1'
										(SEE NOTE 2)
				5800	⊙			2"TO	5 SWC	PUSH
				5790						
				5780						
5773.4 / 253.8		END OF HOLE (BOREHOLE TERMINATED IN ARSENIC DUST SEE REPORT)		5770						

NOTE: 1) SWC INDICATES SAMPLE RECOVERED FROM WITHIN THE CASING.

2) SAMPLE 6 WAS TAKEN FROM WITHIN THE CASING AFTER APPLICATION OF VACUUM FOLLOWING RECOVERY OF SAMPLE 5.

3) $\phi_{LOOSE} = 46.7°$
$\gamma_{max.} = 82.3$ pcf *
$\gamma_{min.} = 50.7$ pcf *
* FROM BULK SAMPLE

4) PNEUMATIC SEAL @ EL 5930±

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT V8520 BORING # 7 DATUM MINE CASING 7 IN. I.D.
BORING DATE SEPT. 14-16/81 REPORT DATE NOV. 24, 1981 COMPILED BY PAD CHECKED BY ASS
SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS ENERGY)

SAMPLE CONDITION: DISTURBED, FAIR, GOOD, LOST

SAMPLE TYPES: A.S. - AUGER SAMPLE; S.T. - SLOTTED TUBE; W.S. - WASHED SAMPLE; D.O. - DRIVE-OPEN; D.F. - DRIVE-FOOT VALVE; C.S. - CHUNK SAMPLE; F.S. - FOIL SAMPLE; S.O. - SLEEVE-OPEN; S.F. - SLEEVE-FOOT VALVE; T.O. - THIN WALLED OPEN; R.C. - ROCK CORE

ABBREVIATIONS: V - IN-SITU VANE TEST; M - MECHANICAL ANALYSIS; U - UNCONFINED COMPRESSION; Qc - TRIAXIAL CONSOLIDATED UNDRAINED; Q - TRIAXIAL UNDRAINED; S - TRIAXIAL DRAINED; Gs - SPECIFIC GRAVITY; γ - WET UNIT WEIGHT; K - PERMEABILITY; C - CONSOLIDATION; WL - WATER LEVEL IN CASING; WT - WATER TABLE IN SOIL

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE
6019.5 / 0.0		GROUND LEVEL		
		OVERBURDEN (PERMAFROST @ 15 FT.)		
5996.0 / 23.5		BEDROCK		
5902.5 / 117.0		VOID		
5894.5 / 125.0		ARSENIC DUST IN STOPE		
5819.5 / 200.0		(continued)		

WATER CONTENT W% (2, 4, 6, 8) ⊙ NAT. ⊡ LW △ PW
DYNAMIC PENETRATION TEST BLOWS PER FOOT

OTHER TESTS: M, Gs

SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
	2"DO	2	PUSH
	2"TO	1	PUSH
	"TO	3	PUSH
	"DO SWC	4	HYD. PUSH
	"DO SWC	5	WT. OF RODS
	"DO SWC	6	—
	"DO SWC	7	—

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT V-8520 BORING # 7 (cont.) DATUM MINE CASING 7 IN. I.D.
BORING DATE SEPT. 14-16/81 REPORT DATE NOV. 24, 1981 COMPILED BY PAD CHECKED BY ASG
SAMPLER HAMMER WT 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION
DISTURBED
FAIR
GOOD
LOST

SAMPLE TYPES
A.S. - AUGER SAMPLE
S.T. - SLOTTED TUBE
W.S. - WASHED SAMPLE
D.O. - DRIVE-OPEN
D.F. - DRIVE-FOOT VALVE
C.S. - CHUNK SAMPLE
F.S. - FOIL SAMPLE
S.O. - SLEEVE-OPEN
S.F. - SLEEVE-FOOT VALVE
T.O. - THIN WALLED OPEN
R.C. - ROCK CORE

ABBREVIATIONS
V - IN-SITU VANE TEST
M - MECHANICAL ANALYSIS
U - UNCONFINED COMPRESSION
Qc - TRIAXIAL CONSOLIDATED UNDRAINED
Q - TRIAXIAL UNDRAINED
S - TRIAXIAL DRAINED
γ - WET UNIT WEIGHT
K - PERMEABILITY
C - CONSOLIDATION
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL

SOIL PROFILE				ELEVATION SCALE	WATER CONTENT W% ○ NAT. ⊡ Lw △ Pw / DYNAMIC PENETRATION TEST BLOWS PER FOOT	OTHER TESTS	SAMPLES			
ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT				CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
5819.5 / 200.0		(continued)		5820				2"DO	7	—
5812.5 / 207.0		END OF HOLE		5810						

NOTE: 1) SWC INDICATES SAMPLE RECOVERED FROM WITHIN THE CASING.

2) ϕ = 46.1° (DOSB)
$\gamma_{max.}$ = 85.3 p.c.f. *
$\gamma_{min.}$ = 55.6 p.c.f. *
* FROM BULK SAMPLE

3) PNEUMATIC SEAL @ EL. 5921 ±

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT V.8520 BORING # 8 DATUM MINE CASING 7 IN. I.D.
BORING DATE SEPT. 6-8/81 REPORT DATE NOV. 24, 1982 COMPILED BY PAD CHECKED BY ASG
SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION
DISTURBED
FAIR
GOOD
LOST

SAMPLE TYPES
A.S. - AUGER SAMPLE
S.T. - SLOTTED TUBE
W.S. - WASHED SAMPLE
D.O. - DRIVE-OPEN
D.F. - DRIVE-FOOT VALVE
C.S. - CHUNK SAMPLE
F.S. - FOIL SAMPLE
S.O. - SLEEVE-OPEN
S.F. - SLEEVE-FOOT VALVE
T.O. - THIN WALLED OPEN
R.C. - ROCK CORE

ABBREVIATIONS
V - IN-SITU VANE TEST
M - MECHANICAL ANALYSIS
U - UNCONFINED COMPRESSION
Qc - TRIAXIAL CONSOLIDATED UNDRAINED
Q - TRIAXIAL UNDRAINED
S - TRIAXIAL DRAINED
G_s - SPECIFIC GRAVITY
γ - WET UNIT WEIGHT
K - PERMEABILITY
C - CONSOLIDATION
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE
6029.7 / 0.0		GROUND LEVEL		
		OVERBURDEN (PERMAFROST @ 12.5 FT)		
5997.9 / 31.8		BEDROCK		
5920.2 / 109.5		VOID — APPROXIMATE (SEE REPORT)		
5906.7 / 123.0		ARSENIC DUST IN STOPE		
5829.7 / 200.0		(continued)		

WATER CONTENT W_c — ⊙ NAT. ⊠ LW △ PW (scale 2, 4, 6, 8)
DYNAMIC PENETRATION TEST BLOWS PER FOOT

OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
				WT. OF RODS ~2.5'
		2" DO	1	6
M	⊠	" DO SWC	2	—
G_s W (SEE NOTE)	⊠	" DO SWC	3	—

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT V-8520 BORING # 8 (cont.) DATUM MINE CASING 7 IN. I.D.
BORING DATE SEPT. 6-8/81 REPORT DATE NOV. 24, 1981 COMPILED BY PAD CHECKED BY ASG
SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION
DISTURBED
FAIR
GOOD
LOST

SAMPLE TYPES
A.S. - AUGER SAMPLE
S.T. - SLOTTED TUBE
W.S. - WASHED SAMPLE
D.O. - DRIVE-OPEN
D.F. - DRIVE-FOOT VALVE
C.S. - CHUNK SAMPLE
F.S. - FOIL SAMPLE
S.O. - SLEEVE-OPEN
S.F. - SLEEVE FOOT VALVE
T.O. - THIN WALLED OPEN
R.C. - ROCK CORE

ABBREVIATIONS
V - IN-SITU VANE TEST
M - MECHANICAL ANALYSIS
U - UNCONFINED COMPRESSION
Qc - TRIAXIAL CONSOLIDATED UNDRAINED
Q - TRIAXIAL UNDRAINED
S - TRIAXIAL DRAINED
γ - WET UNIT WEIGHT
K - PERMEABILITY
C - CONSOLIDATION
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL

SOIL PROFILE: ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	ELEVATION SCALE	WATER CONTENT W% ○ NAT. ▲ LW △ PW / DYNAMIC PENETRATION TEST BLOWS PER FOOT	OTHER TESTS	SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
5829.7 200.0		(continued)		5830						
				5820						
						W (SEE NOTE.)	☒	2"DO SWC	4	–
				5810		W	☒	"DO SWC	5	1
5198.4 231.3		END OF HOLE		5800						
				5790						

NOTE: 1) SWC INDICATES SAMPLE RECOVERED FROM WITHIN THE CASING.

2) W INDICATES WATER CONTENT BETWEEN 0 AND 1%

ϕ = 46.7° Loose

$\gamma_{max.}$ = 84.2 pcf. *

$\gamma_{min.}$ = 53.3 pcf. *

* FROM BULK SAMPLE

3) PNEUMATIC SEAL @ EL. 5933 ±

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT V.8520 BORING # 9 DATUM MINE CASING 7 IN. I.D.
BORING DATE AUG. 31-SEPT. 4/81 REPORT DATE NOV. 24, 1981 COMPILED BY PAD CHECKED BY ASG
SAMPLER HAMMER WT 140 LBS DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN.-LBS ENERGY)

SAMPLE CONDITION: DISTURBED, FAIR, GOOD, LOST

SAMPLE TYPES:
A.S. - AUGER SAMPLE
S.T. - SLOTTED TUBE
W.S. - WASHED SAMPLE
D.O. - DRIVE-OPEN
D.F. - DRIVE-FOOT VALVE
C.S. - CHUNK SAMPLE
F.S. - FOIL SAMPLE
S.O. - SLEEVE-OPEN
S.F. - SLEEVE-FOOT VALVE
T.O. - THIN WALLED OPEN
R.C. - ROCK CORE

ABBREVIATIONS:
V - IN-SITU VANE TEST
M - MECHANICAL ANALYSIS
U - UNCONFINED COMPRESSION
Qc - TRIAXIAL CONSOLIDATED UNDRAINED
Q - TRIAXIAL UNDRAINED
S - TRIAXIAL DRAINED
γ - WET UNIT WEIGHT
K - PERMEABILITY
C - CONSOLIDATION
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE	WATER CONTENT W% ○ NAT ◇ LW △ PW / DYNAMIC PENETRATION TEST BLOWS PER FOOT	OTHER TESTS	SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
6027.3 / 0.0		GROUND LEVEL								
		OVERBURDEN (PERMAFROST @ ABOUT 11 FT.)								
6010.3 / 17.0		BEDROCK		5900						
5899.3 / 128.0		VOID		5890						
5883.3 / 144.0		APPROXIMATE (SEE REPORT)		5880						
		ARSENIC DUST IN STOPE		5870	NO SAMPLE RECOVERY IN SPLIT SPOON, TOOK SAMPLE OF ARSENIC DUST FROM RODS OVER APPROXIMATE DEPTH OF 144' TO 156'					WT OF RODS 12'
								2" DO	1	PUSH 2'
				5860		W (SEE NOTE)		" DO	2	WT OF RODS
				5850						
				5840						
				5830		W (SEE NOTE)		" DO	3	WT. OF RODS
5827.3 / 200.0		(continued)								

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT V-8520 BORING # 9 (cont.) DATUM MINE CASING 7 IN. I.D.
BORING DATE AUG. 31 - SEPT. 6, 81 REPORT DATE NOV. 24, 1981 COMPILED BY PAD CHECKED BY ASG
SAMPLER HAMMER WT 140 LBS DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS ENERGY)

SAMPLE CONDITION: DISTURBED, FAIR, GOOD, LOST

SAMPLE TYPES: A.S. - AUGER SAMPLE; S.T. - SLOTTED TUBE; W.S. - WASHED SAMPLE; D.O. - DRIVE-OPEN; D.F. - DRIVE-FOOT VALVE; C.S. - CHUNK SAMPLE; F.S. - FOIL SAMPLE; S.O. - SLEEVE-OPEN; S.F. - SLEEVE-FOOT VALVE; T.O. - THIN WALLED OPEN; R.C. - ROCK CORE

ABBREVIATIONS: V - IN SITU VANE TEST; M - MECHANICAL ANALYSIS; U - UNCONFINED COMPRESSION; Qc - TRIAXIAL CONSOLIDATED UNDRAINED; Q - TRIAXIAL UNDRAINED; S - TRIAXIAL DRAINED; γ - WET UNIT WEIGHT; K - PERMEABILITY; C - CONSOLIDATION; WL - WATER LEVEL IN CASING; WT - WATER TABLE IN SOIL

SOIL PROFILE: ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE	WATER CONTENT W% ○ NAT ▽ LW △ PW / DYNAMIC PENETRATION TEST BLOWS PER FOOT	OTHER TESTS	SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
5827.3 / 200.0		(continued)		5820						
				5810						
				5800		W (SEE NOTE)		2"OD	4	WT. OF RODS 2'-8" 1/9"
5789.7 / 237.6		END OF HOLE (HIGH RESISTANCE TO FURTHER ADVANCE)		5790						
				5780						

NOTE: 1) W INDICATES WATER CONTENT BETWEEN 0 AND 1%

2) $\phi_{LOOSE} = 48.7°$
$\gamma_{max} = 74.6$ pcf *
$\gamma_{max} = 41.6$ pcf *
* FROM BULK SAMPLE

3) PNEUMATIC SEAL @ EL. 5998 ±

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT V8520 BORING # 11 * DATUM MINE CASING 7 IN. I.D.
BORING DATE ____ REPORT DATE NOV. 24, 1981 COMPILED BY PAD CHECKED BY ASG
SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN.-LBS. ENERGY)

SAMPLE CONDITION: DISTURBED; FAIR; GOOD; LOST

SAMPLE TYPES: A.S. - AUGER SAMPLE; S.T. - SLOTTED TUBE; W.S. - WASHED SAMPLE; D.O. - DRIVE-OPEN; D.F. - DRIVE-FOOT VALVE; C.S. - CHUNK SAMPLE; F.S. - FOIL SAMPLE; S.O. - SLEEVE-OPEN; S.F. - SLEEVE-FOOT VALVE; T.O. - THIN WALLED OPEN; R.C. - ROCK CORE

ABBREVIATIONS: V - IN-SITU VANE TEST; M - MECHANICAL ANALYSIS; U - UNCONFINED COMPRESSION; Qc - TRIAXIAL CONSOLIDATED UNDRAINED; Q - TRIAXIAL UNDRAINED; S - TRIAXIAL DRAINED; γ - WET UNIT WEIGHT; K - PERMEABILITY; C - CONSOLIDATION; WL - WATER LEVEL IN CASING; WT - WATER TABLE IN SOIL

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	ELEVATION SCALE	WATER CONTENT W% (⊙ NAT. ▽ LW △ PW) / PENETRATION TEST BLOWS PER FOOT	OTHER TESTS	SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
6009.5 / 0.5										
6010.0 / 0.0	▽	GROUND LEVEL		6010						
		OVERBURDEN								
5996.0 / 14.0										
		BEDROCK		5990						
5901.0 / 109.0										
		ARSENIC DUST IN STOPE		5900		W		2"DO	1	PUSH
								"DO	1A	1
				5890		W		"TO	2	PUSH
						Y=96.2		"DO	2A	0/2"-6" 1/2"-6"
				5880		M				
						W		2"DO	3	PUSH
						W		"DO	3A	4
				5870	⊙			"TO	4	PUSH
				5860	PENETRATION RESISTANCE IN BLOWS PER FOOT FOR SAMPLE 4A WHERE SPLIT SPOON SAMPLER OVERDRIVEN			"DO	4A	SEE REPORT
				5850	⊙ 5 BLOWS FOR 6"	Y 83.7		"TO	5	HYD. PUSH
					⊙			"DO	5A	8
				5840	6A	W		"TO	6	HYD. PUSH
						W G				
					PENETRATION RESISTANCE IN BLOWS PER FOOT FOR SAMPLE 7 WHERE SPLIT SPOON SAMPLER OVERDRIVEN	6A		"DO	6A	SEE REPORT 7
				5830						
5820.0 / 190.0		(continued)		5820						

* NOTE: BOREHOLE No. 10 NOT CARRIED OUT

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT V8520 BORING # 11 (cont.) DATUM MINE CASING 7 IN. I.D.
BORING DATE _____ REPORT DATE NOV. 24, 1981 COMPILED BY _____ CHECKED BY ASG
SAMPLER HAMMER WT 140 LBS DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN. LBS ENERGY)

SAMPLE CONDITION
DISTURBED
FAIR
GOOD
LOST

SAMPLE TYPES
A.S. - AUGER SAMPLE
S.T. - SLOTTED TUBE
W.S. - WASHED SAMPLE
D.O. - DRIVE-OPEN
D.F. - DRIVE-FOOT VALVE
C.S. - CHUNK SAMPLE
F.S. - FOIL SAMPLE
S.O. - SLEEVE-OPEN
S.F. - SLEEVE FOOT VALVE
T.O. - THIN WALLED OPEN
R.C. - ROCK CORE

ABBREVIATIONS
V - IN SITU VANE TEST
M - MECHANICAL ANALYSIS
U - UNCONFINED COMPRESSION
QC - TRIAXIAL CONSOLIDATED UNDRAINED
Q - TRIAXIAL UNDRAINED
S - TRIAXIAL DRAINED
γ - WET UNIT WEIGHT
K - PERMEABILITY
C - CONSOLIDATION
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL

SOIL PROFILE							SAMPLES			
ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	ELEVATION SCALE	WATER CONTENT W% ○ NAT △ PW; PENETRATION TEST BLOWS PER FOOT 20 40 60 80	OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
5820.0 / 190.0		(continued)		5820				D.O.	7 (cont.)	
				5810	PENETRATION RESISTANCE IN BLOWS PER FT. FOR SAMPLE 7 WHERE SPLIT SPOON SAMPLER OVERDRIVEN					
				5800						
				5790						
				5780						
5767.8 / 242.2		END OF PEN. TEST		5770						
				5760						

SEE REPORT

NOTE: 1) W INDICATES WATER CONTENT BETWEEN 0 AND 1%

2) $\phi_{Loose} = 48.1°$
$\gamma'_{max.} = 91.1$ pcf *
$\gamma'_{min.} = 55.1$ pcf *
* FROM BULK SAMPLE

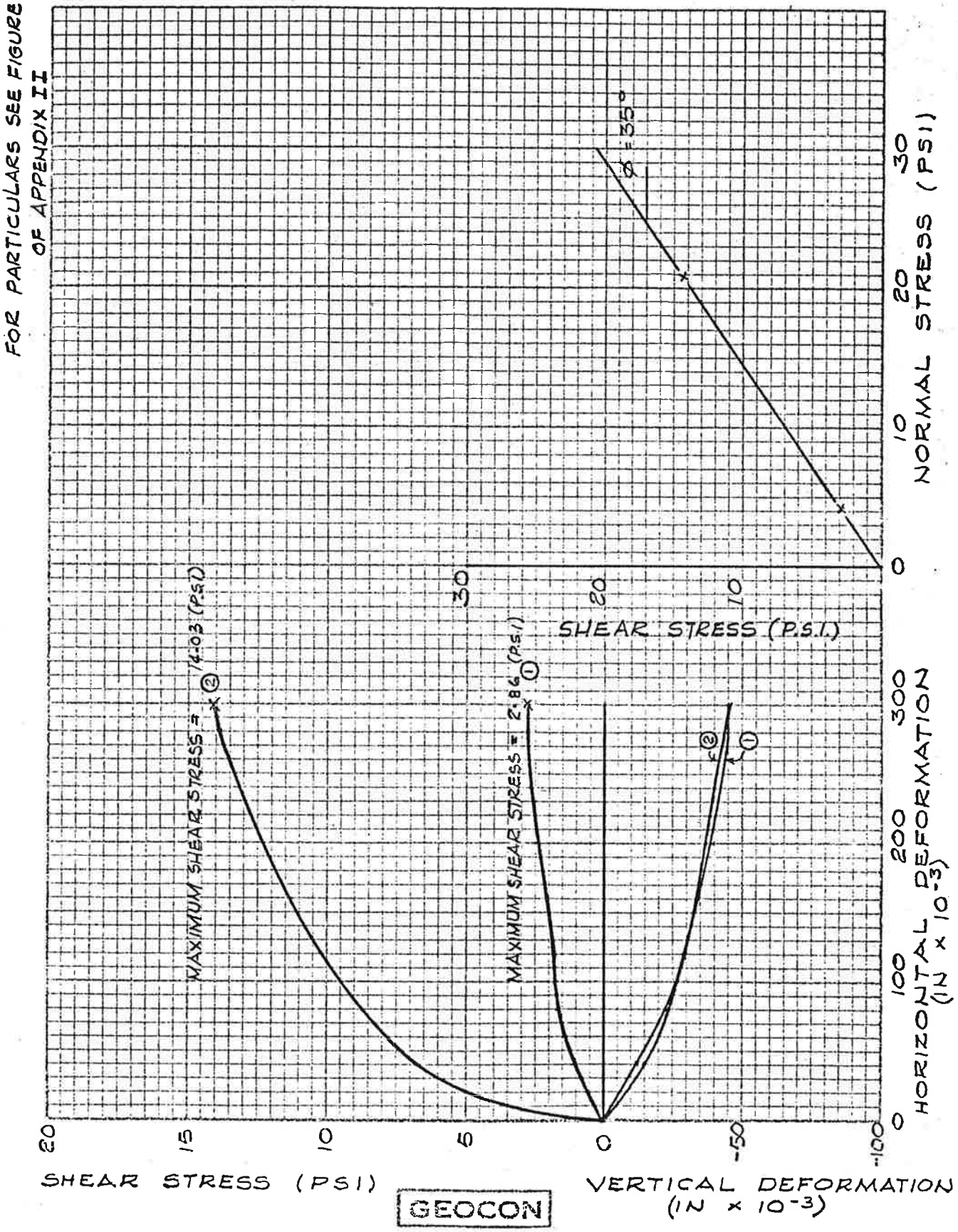
3) PNEUMATIC SEAL @ EL. 5913 ±

APPENDIX II

Figures

DIRECT SHEAR TEST
ARSENIC DUST
BULK SAMPLE - BOREHOLE No 5

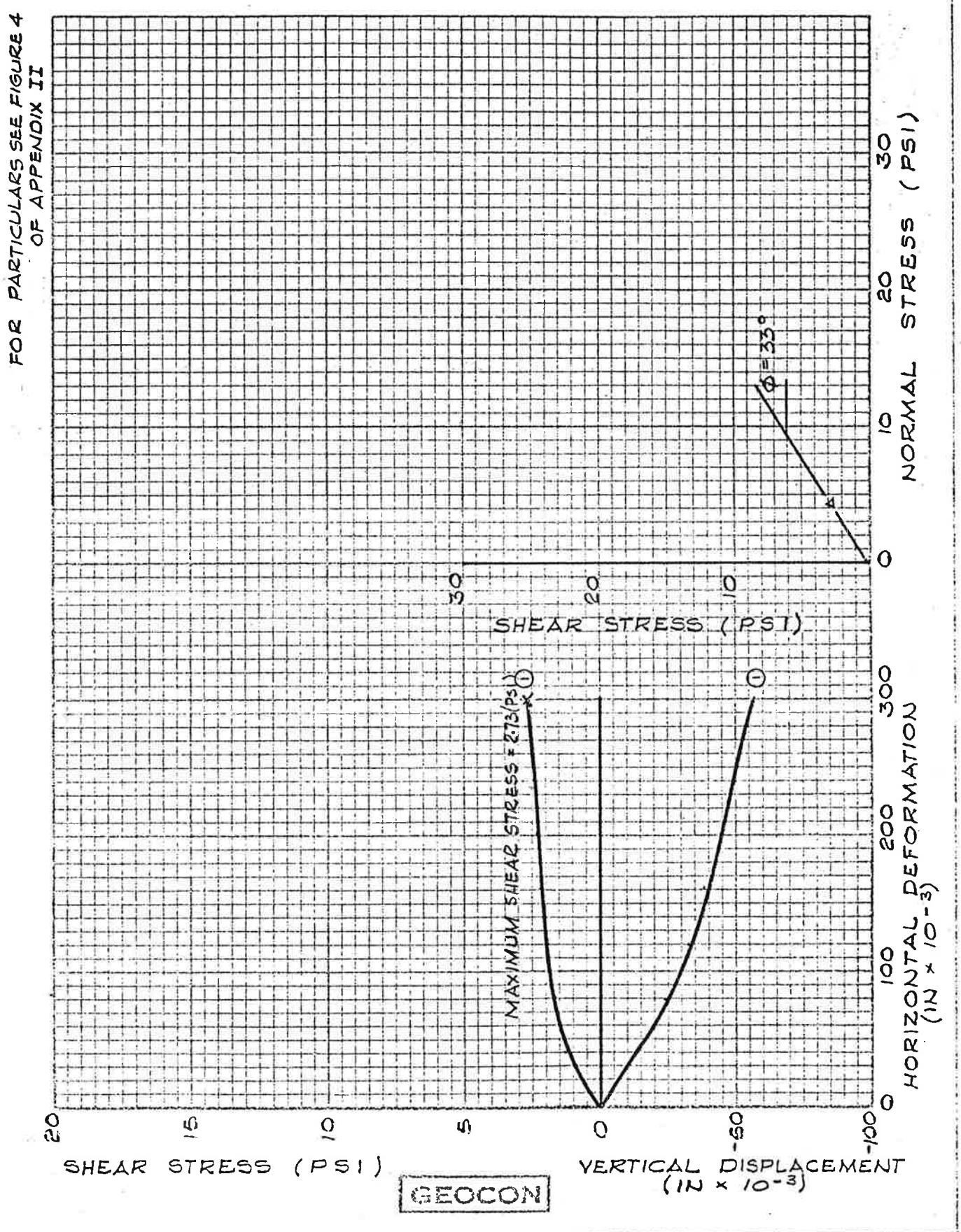
APPENDIX II
FIGURE 1
PROJECT V8520



GEOCON

DIRECT SHEAR TEST
ARSENIC DUST
BULK SAMPLE - BOREHOLE No. 9

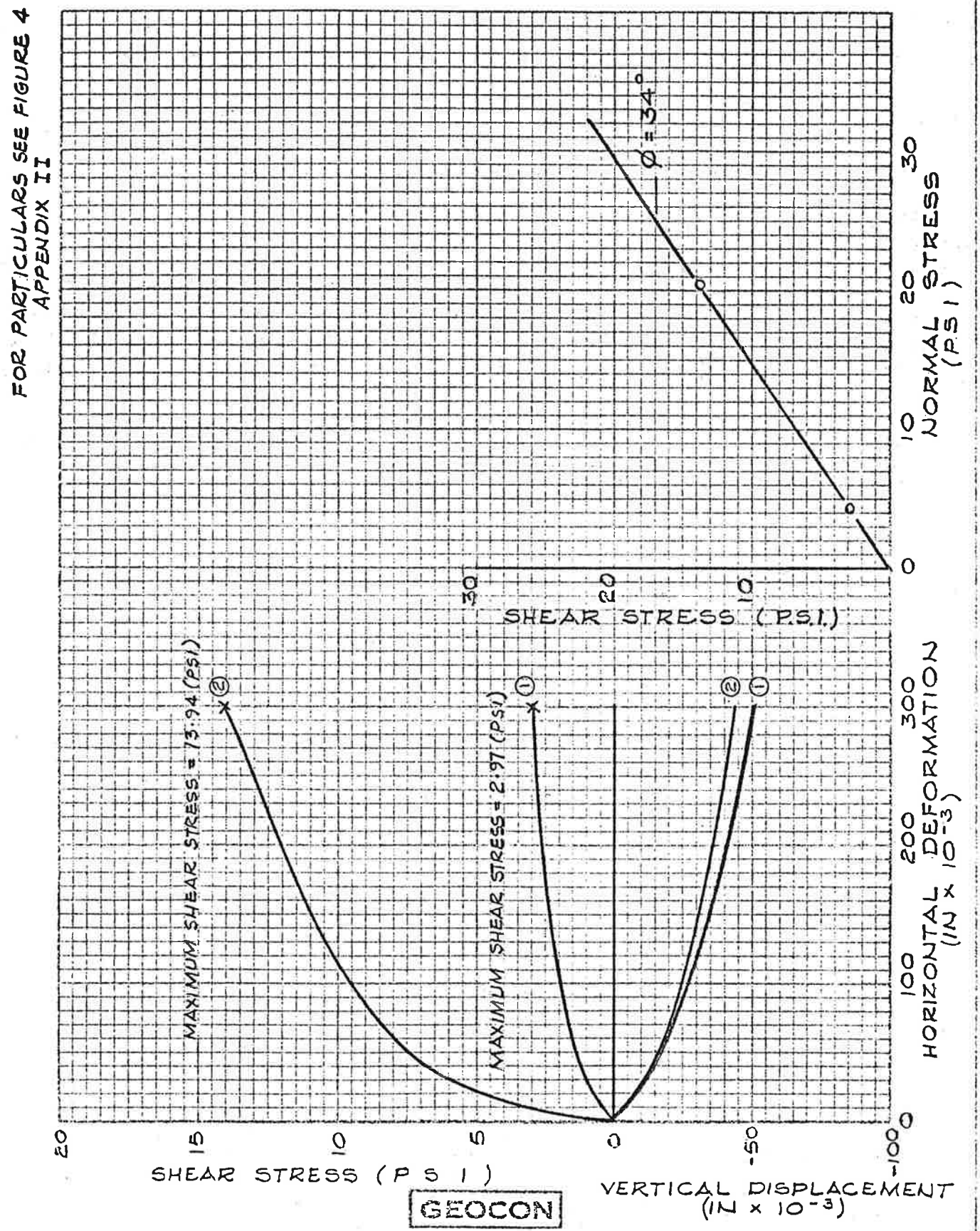
APPENDIX II
FIGURE 2
PROJECT V8520



GEOCON

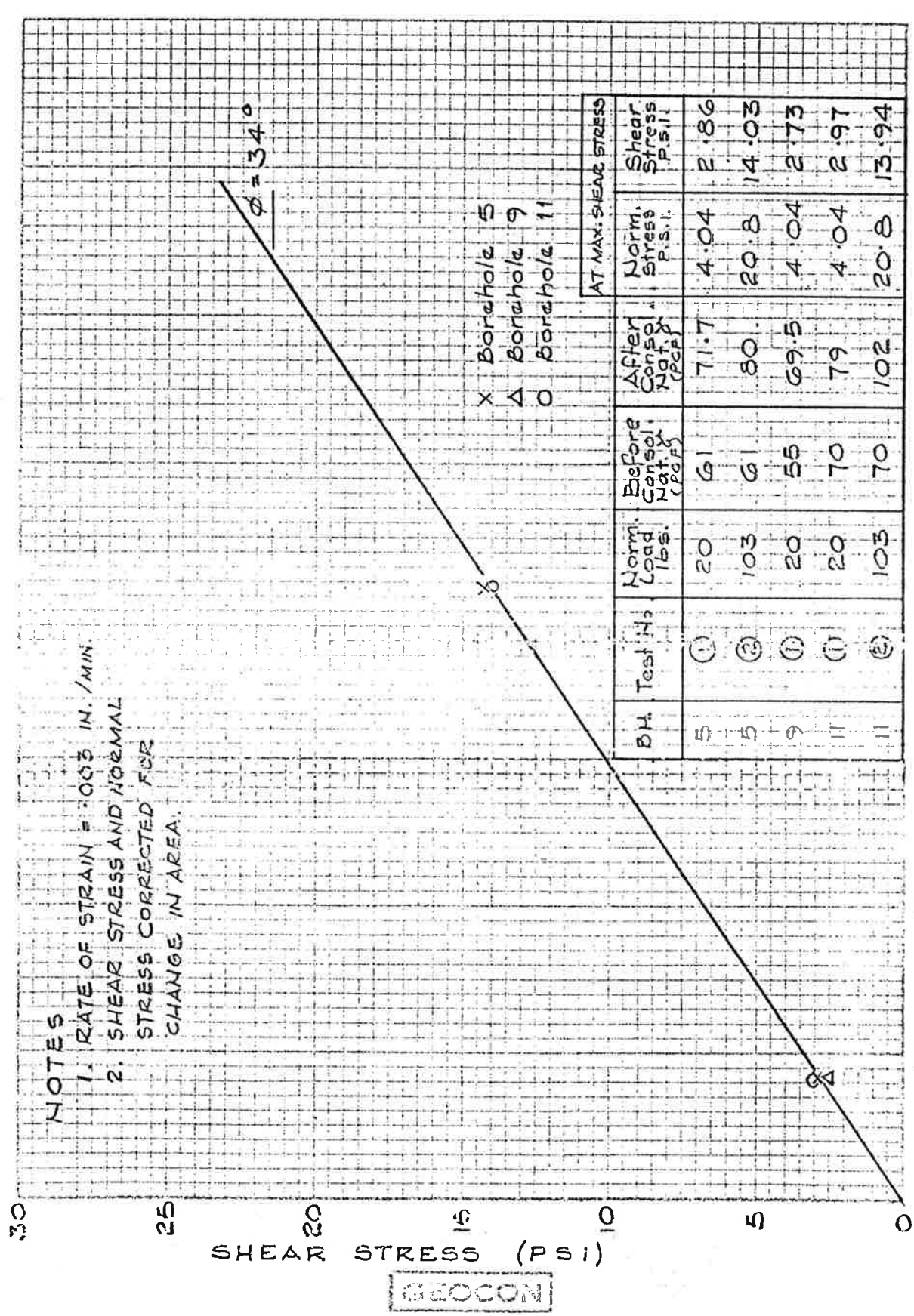
DIRECT SHEAR TEST
ARSENIC DUST
BULK SAMPLE - BOREHOLE No. 11

APPENDIX II
FIGURE 3
PROJECT V8520



DIRECT SHEAR TEST
ARSENIC DUST
SUMMARY PLOT

APPENDIX II
FIGURE 4
PROJECT V8520

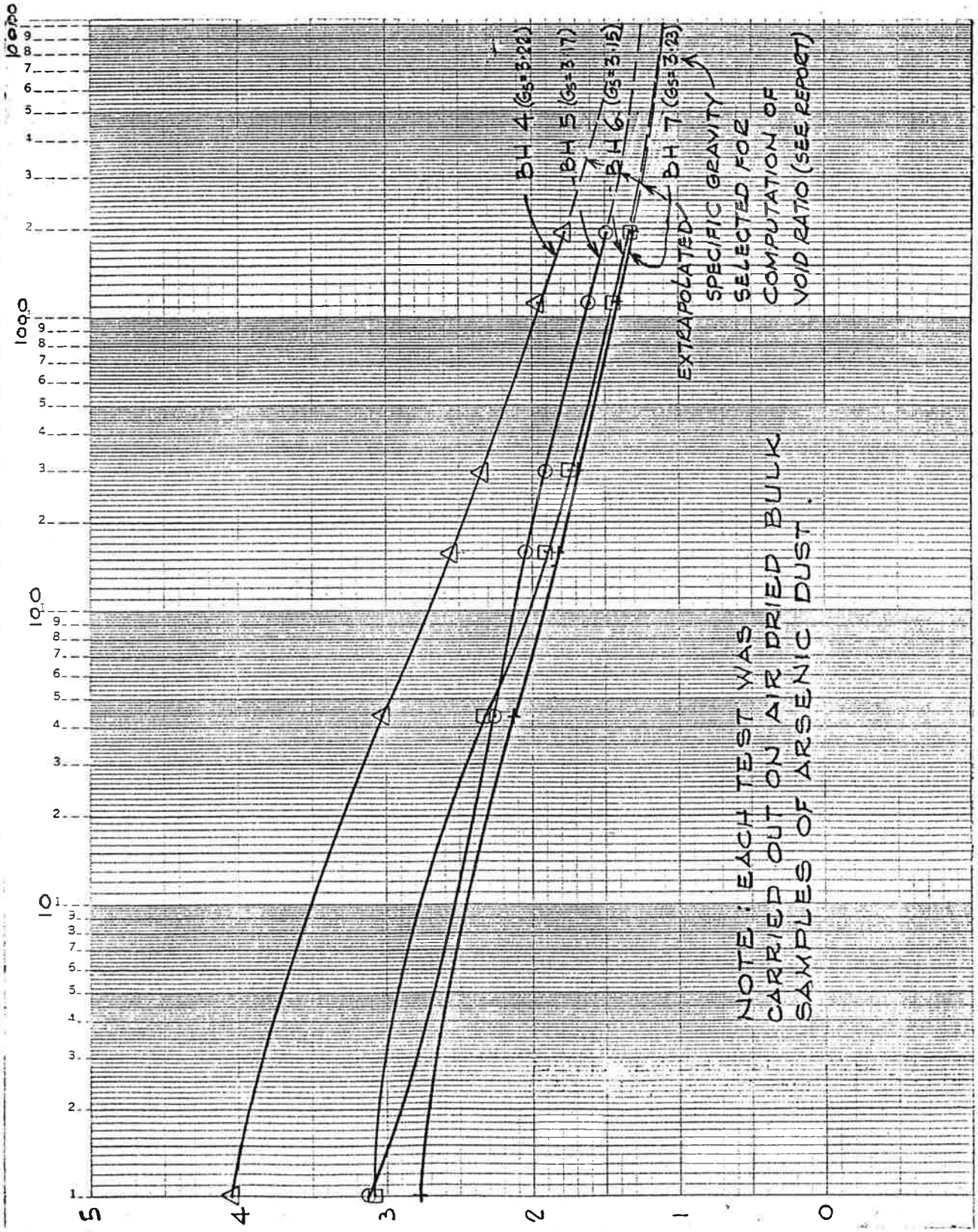


BH.	Test No.	Norm. Load lbs.	Before Consol. Nat. γd (pcf)	After Consol. Nat. γd (pcf)	AT MAX. SHEAR STRESS: Norm. Stress P.S.I.	Shear Stress P.S.I.
5	(1)	20	61	71.7	4.04	2.86
5	(2)	103	61	80	20.8	14.03
9	(1)	20	55	69.5	4.04	2.73
11	(1)	20	70	79	4.04	2.97
11	(2)	103	70	102	20.8	13.94

GEOCON

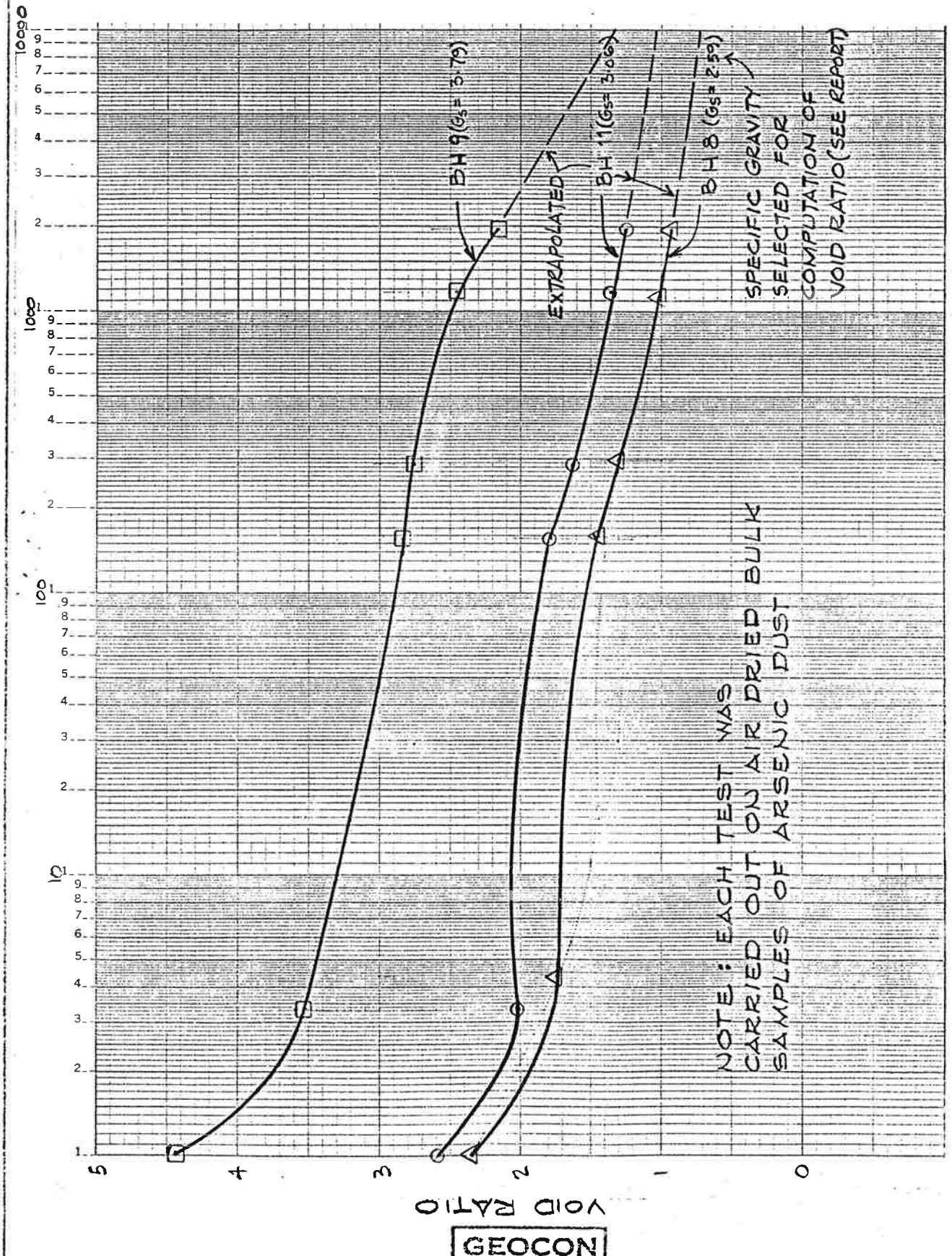
CONSOLIDATION TESTS
ARSENIC DUST
VOID RATIO VERSUS PRESSURE

APPENDIX II
FIGURE 5
PROJECT V8520



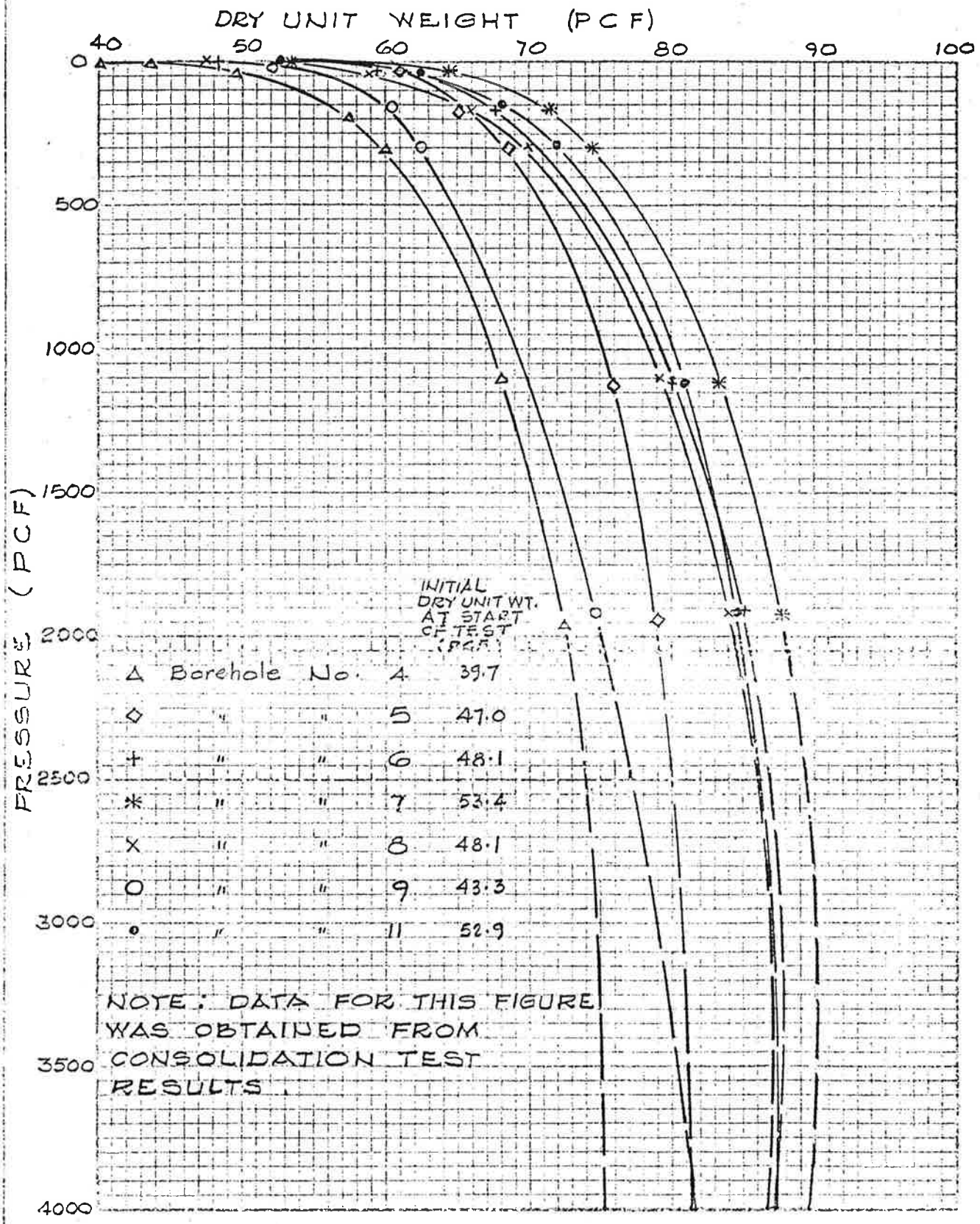
CONSOLIDATION TESTS
ARSENIC DUST
VOID RATIO VERSUS PRESSURE

APPENDIX II
FIGURE 6
PROJECT V8520



PRESSURE VERSUS UNIT WEIGHT FOR ARSENIC DUST FROM LABORATORY CONSOLIDATION TESTS

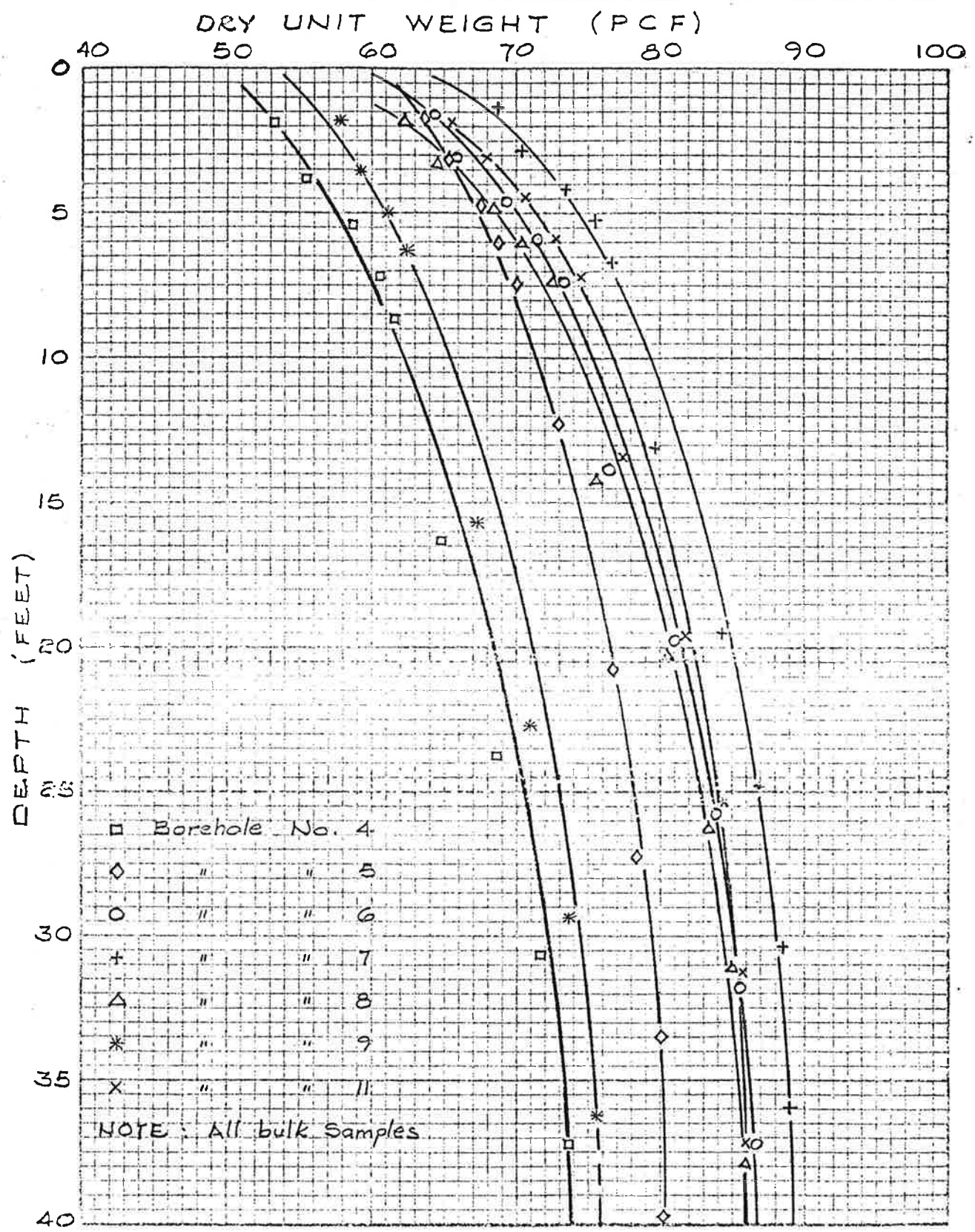
APPENDIX 11
FIGURE 7
PROJECT V8520



SEOCON

UNIT WEIGHT VERSUS DEPTH
FOR ARSENIC DUST
FROM LABORATORY CONSOLIDATION TESTS

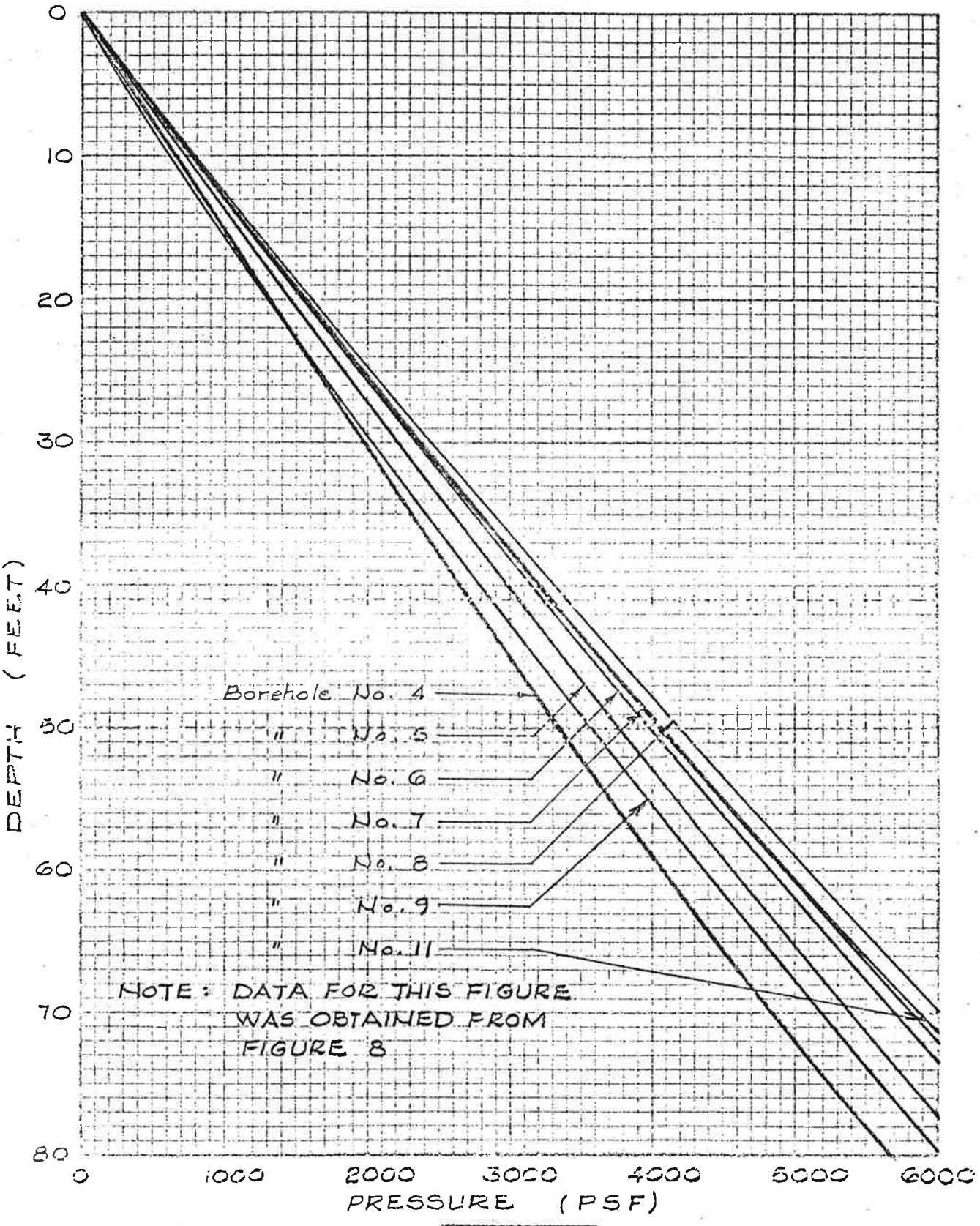
APPENDIX II
FIGURE 8
PROJECT V8520



GEOCON

PRESSURE VERSUS DEPTH FOR ARSENIC DUST FROM LABORATORY CONSOLIDATION TESTS

APPENDIX II
FIGURE 9
PROJECT V8520



GEOCON

APPENDIX III

Tables

TABLE 1

SUMMARY OF RETURNED SAMPLES

Shipping Container Indentification	Sample Container	Marking on Sample Container		Identification on Borehole Log		Depth of Sample (See also Table 2)	Remarks
		Borehole	Sample	Borehole	Sample		
Tin 1	Bag	TH 4	1	BH 4	1	138'4" to 148'4"	
1	Bag	TH 4	1	BH 4	1	138'4" to 148'4"	
1	Bag	TH 4	2	BH 4	2	147'7" to 149'6"	Sampled within casing
1	Bag	TH 4	3	BH 4	3	152'4" to 154'4"	Sampled within casing
1	Bag	TH 4	3	BH 4	3	152'4" to 154'4"	Sampled within casing
1	Bag	TH 4	4	BH 4	4	167'10" to 169'4"	Sampled within casing
1	Bag	TH 4	5	BH 4	5	188'10" to 190'10"	
1	Bag	TH 4	5	BH 4	5	188'10" to 190'10"	
1	Bag	TH 4	Vacuum Truck	-	-	138'2" to 201'8"	Bulk sample

TABLE 1

Shipping Container Indentification	Sample Container	Marking on Sample Container		Identification on Borehole Log		Depth of Sample (See also Table 2)	Remarks
		Borehole	Sample	Borehole	Sample		
Tin 2	Bag	TH 5	Bulk From Rods	-	-	--	
-	-	-	-	BH 5	3	268'6" to 270'	**
Tin 2	Bag	TH 5	Vacuum Truck	-	-	225'0" to 277'2"	Bulk sample
Tin 3	Bag	TH 6	1	BH 6	1	145'3" to 167'4"	
Tin 3	Bag	TH 6	2	BH 6	2	178'10" to 182'3"	
Tin 3	Bag	TH 6	3	BH 6	3	189'2" to 190'8"	Sampled within casing
Tin 3	Bag	TH 6	4	BH 6	4	218'10" to 221'6"	
Tin 3	Bag	TH 6	4	BH 6	4	218'10"to 221'6"	
Tin 3	Bag	TH 6	Vacuum Truck	BH 6	-	165'3" to 253'10"	Bulk sample

**No sample recovery in Shelby tube. Took sample of arsenic dust from rods over approximate depth range of 268'6" to 270'0".

TABLE 1

Shipping Container Indentification	Sample Container	Marking on Sample Container		Identification on Borehole Log		Depth of Sample (See also Table 2)	Remarks
		Borehole	Sample	Borehole	Sample		
-	-	-	-	BH 7	1	125'0" to 131'4"	Shelby tube sample no recovery
-	-	-	-	BH 7	2	125'0" to 126'6"	Split spoon sample, no recovery
Tin 4	Bag	TH 7	4	BH 7	4	144'8" to 146'8"	Sampled within casing
Tin 4	Bag	TH 7	5	BH 7	5	172'8" to 176'6"	Sampled within casing
Tin 4	Bag	TH 7	6	BH 7	6	178'8" to 192'8 "	Sampled within casing
Tin 4	Bag	TH 7	7	BH 7	7	188'8" to 207'0"	Sampled within casing
Tin 4	Bag	TH 7	Vacuum Truck 1	-	-	125'0" to 207'8"	Bulk sample
Tin 5	Bag	TH 8		BH 8	1	123'0" to 149'10"	-

TABLE 1

Shipping Container Indentification	Sample Container	Marking on Sample Container		Identification on Borehole Log		Depth of Sample (See also Table 2)	Remarks
		Borehole	Sample	Borehole	Sample		
Tin 5	Bag	TH 8	2	BH 8	2	176' to 177'6"	Sampled within casing
Tin 5	Bag	TH 8	2	BH 8	2	Approx. 177'6"	Driving shoe
Tin 5	Bag	TH 8	3	BH 8	3	194'2" to 195'8"	Sampled within casing
Tin 5	Bag	TH 8	4	BH 8	4	213'6" to 215'0"	Sampled within casing
Tin 5	Bag	TH 8	5	BH 8	5	217'9" to 219'3"	Sampled within casing
Tin 5	Bag	TH 8	Vacuum Truck	BH 8	-	123'0" to 231'4"	Bulk sample
Tin 6	Bag	TH 9	1	BH 9	1	144'0" to 157'9"	**
Tin 6	Bag	TH 9	2	BH 9	2	162'6" to 168'8"	
Tin 6	Bag	TH 9	3	BH 9	3	192'6" to 199'4"	

** No sample recovery in split spoon, took sample of arsenic dust from rods over approximate depth of 144 to 156 feet.

TABLE 1

Shipping Container Indentification	Sample Container	Marking on Sample Container		Identification on Borehole Log		Depth of Sample (See also Table 2)	Remarks
		Borehole	Sample	Borehole	Sample		
Tin 6	Bag	TH 9	4	BH 9	4	222'6" to 227'8"	
Tin 6	Bag	TH 9	Vacuum Truck	-	-	144'0" to 237'7"	Bulk sample
Box 1	Bag	TH 11	SSI 109'-110'6"	BH 11	1	109'to 110'6"	
Box 1	Bag	TH 11	Bulk 109'-120'	BH 11	1A	110'6" to 118'	
				BH 11	2	122'6" to 125'	Shelby tube sample no recovery
Box 1	Bag	TH 11	Bulk (SPT) 122'6" to 128'	BH 11	2A	122'6" to 128'	
-	-	-	-	BH 11	3	133' to 134'6"	Recovery 1 inch. Sample expended during testing.
Box 1	Bag	TH 11	Bulk (SPT) 133'- 138'	BH 11	3A	134'6" to 138'6"	

TABLE 1

Shipping Container Indentification	Sample Container	Marking on Sample Container		Identification on Borehole Log		Depth of Sample	Remarks
		Borehole	Sample	Borehole	Sample		
Box 1	Bag	TH 11	Bulk (SPT) 138'-158'	BH 11	4A	142'3" to 158'9"	
Box 1	Bag	TH 11	Bulk SPT5 160'-170'	BH 11	5A	162'9" to 167'9"	
Box 1	Bag	TH 11	Bulk SPT 6 170'-180'	BH 11	6A	174'1" to 178'7"	
Box 1	Bag	TH 11	SPT 7 170'-240'	BH 11	7	170'11" to 242'3"	
Box 1	Bag	TH 11	Vacuum Truck	-	-	109' to 178'7"	Bulk sample
Box 2	Shelby Tubes						
		TH 5	ST 1	BH 5	1	225' to 251'	
		TH 5	ST 2	BH 5	2	253'6" to 265'	
		TH 6	ST 1	BH 6	5	230' to 232'6"	Sampled within casing

TABLE 1

Shipping Container Indentification	Sample Container	Marking on Sample Container		Identification on Borehole Log		Depth of Sample	Remarks
		Borehole	Sample	Borehole	Sample		
Box 2	Shelby Tubes						
		TH 6	ST 2	BH 6	6	222'1" to 224'7"	Sampled within casing
		TH 7	ST 3	BH 7	3	132'8" to 135'2"	
		TH 11	ST 4	BH 11	4	140' to 142'6"	
		TH 11	ST 5	BH 11	5	158'7" to 161'5"	
		TH 11	ST 6	BH 11	6	170'11" to 173'5"	

TABLE 2

Particulars of Samples Recovered from Within the Casing (SWC Samples)

B.H.	Sample No.	Bottom of Casing When Sample Taken Depth	Bottom of Sampler Within Casing Before Sampler Advanced Depth	Depth of Sample	Bottom of Preceding Sample Taken Below The Casing Depth	Possible Vertical Interval of Arsenic Dust Sampled Depth
4	2	153' 4"	147' 7"	147' 7" to 149' 6"	148' 4"	148' 4" to 153' 4"
	3	168' 4"	152' 4"	152' 4" to 154' 4"	148' 4"	148' 4" to 168' 4"
	4	168' 4"	167'10"	167'10" to 169' 4"	148' 4"	148' 4" to 168' 9"
5	-	-	-	-	-	-
6	3	198'10"	189' 2"	189' 2" to 190' 8"	182' 3"	182' 3" to 198'10"
	5	238'10"	230' 0"	230' 0" to 232' 6"	221' 6"	221' 6" to 238'10"
	6	253'10"	222' 1"	221' 1" to 224' 7"	221' 6"	221' 6" to 253'10"
7	4	147' 8"	144' 8"	144' 8" to 146' 8"	135' 2"	135' 2" to 147' 8"
	5	177' 8"	172' 8"	172' 8" to 176' 6"	135' 2"	135' 2" to 177' 8"
	6	192' 8"	178' 8"	178' 8" to 192' 8"	135' 2"	135' 2" to 192' 8"
	7	207' 8"	188' 8"	188' 8" to 207' 8"	135' 2"	135' 2" to 207' 8"
8	2	178' 3"	176' 0"	176' 0" to 177' 6"	149'10"	149'10" to 178' 3"
	3	198' 3"	194' 2"	194' 2" to 195' 8"	149'10"	149'10" to 198' 3"
	4	218' 3"	213' 6"	213' 6" to 215' 0"	149'10"	149'10" to 218' 3"
	5	223' 3"	217' 9"	217' 9" to 219' 3"	149'10"	149'10" to 223' 3"

APPENDIX IV

Diary

August 7-8, 1981

Mobilization Calgary - Yellowknife

August 9, 1981

0930	Set-up on TH4
1030	Drill overburden
1345	Replace rig fuel line
1545	Set and cement casing
1930	End of day

August 10, 1981

0730	Service rig
0800	Drill bedrock
1145	Standby - wait for vacuum truck
1800	End of day

August 11, 1981

0730	Standby - wait for vacuum truck
1730	End of day

August 12, 1981

0730	Standby - wait for vacuum truck
0830	Punch hole through stope
	Trip out, change bit
	Trip in
1030	Sample arsenic dust
1415	Repair vacuum discharge hose
1500	Sample arsenic dust
2100	End of day

August 13, 1981

0730	Trip out
0830	Set pneumatic plug and cement hole
1030	Move and set-up on TH6
1200	Drill overburden
	Move rig back because hole would be off stope
	Drill overburden again
	Set and cement casing
1745	Service rig
1815	End of day

August 14, 1981

0730	Drill bedrock
1300	Air loss; trip out; change 2 drilling rods and one "O" ring; trip in
1400	Drill bedrock
1545	Reach stope; change bit
1600	Sample top of arsenic deposit
1645	Service rig
1715	Standby - wait for Giant to take temperature readings in stope; vacuum truck not available to work tonight.
1900	End of day

August 15, 1981

0730	Standby - wait for Giant taking temperature readings in stope
0800	Sample arsenic dust
0845	Repair compressor belts
1015	Sample arsenic dust
1700	Set pneumatic plug at 97' and cement hole
1815	Move to TH5
1845	Drill overburden Set and cement casing
1945	End of day

August 16, 1981

0730	Service rig
0800	Drill bedrock
0845	Broken compressor belts Get parts from Calgary

August 17, 1981

1130	Receive new belts Repair compressor
1500	Drill bedrock
2130	Air loss; trip out to check "O" rings
2215	End of day

August 18, 1981

0730	Drill bedrock
1130	Repair blown hydraulic fitting
1230	Drill bedrock
1300	Air loss; trip out to check "O" rings, trip in
1400	Drill bedrock
1545	Repair hydraulic fitting (15 min) Trip out for air loss; check "O" rings Take top drive coupling apart
1930	End of day.

August 25, 1981

1215	SDS field superintendent arrives with tools
	Try to grab cable; unsuccessful attempts
1445	Get tools modified at machine shop
	Order more tools from Edmonton

August 26, 1981

0830	Attempt to fish cable out
	Fish out 2' of cable
1145	Grab cable; treads strip while pulling up
	Magnet needed to get steel disk out before fishing tool can be recovered
	Order magnet from Calgary (not available in Yellowknife).

August 27, 1981

1300	Magnet arrives from Calgary
	Fish out steel disk
	Overshoot fishing tool; downhole cable brakes
	Attempt to unscrew hoisting plug
1730	Tools have to be modified at shop
	End of day

August 28, 1981

0800	Get shop to reverse teeth on drill bit
1100	Attempts to unscrew hoisting plug
1600	All attempts were unsuccessful
	Get tool specialist from Calgary

August 29, 1981

1145	Tool specialist examines situation
	Get shop to modify some tools he brought up
	Order more tools from Calgary
1700	Modified tool ready

August 30, 1981

0800	Mill cable in hole
1030	No recovery; tungsten carbide all worn out
	Wait for new tools
1700	Mill cable and attempt to overshoot
	Unsuccessful
	All tungsten carbide worn out
2000	End of day

August 31, 1981

0800	Clean up for move
0900	Seal hole with sand and cement
1030	Move and set-up on TH9
1130	Drill overburden
	Set casing at 18.5'
1530	Wait for cement to cure

September 1, 1981

1215	Receive and set-up new hammer
1315	Drill rock
1915	Service rig
1930	End of day

September 2, 1981

0730	Service rig
0800	Drill rock
0915	Reach stope
	Trip out; change bit; trip in
1100	Wait for new drilling rods
	change rig oil

September 3, 1981

	Wait for new drilling rods

September 5, 1981

1000	Look for delivery truck
	Find truck 30 km out of town
	Tow truck in
1600	Unload new drilling rods
	Load returning equipment
1800	Sample arsenic dust
2130	End of day

September 6, 1981

0700	Service rig
0730	Sample arsenic dust
1000	Trip out, prepare to move
1145	Lunch
1215	Attempt to set pneumatic plugs;
	2 plugs blow up; will come back later
1430	Move and set-up on TH8
1600	Repair hydraulic fitting
1800	Drill overburden
2200	Set and cement casing
2300	End of day