Underground Storage of Arsenic Dust -- Physical Features

Introduction

In the 36 years that arsenic dust has been stored underground at Giant, a number of external factors have combined to affect the physical characteristics of the stored dust; eg. moisture content, consolidation, angle of repose, etc. It is the physical nature of the material that will determine the ease or difficulty of reclaim operations and will probably dictate the reclaim methods that will be used.

Physical handling is recognized as being a key factor in a successful reclaim program and quite a lot of study has therefore gone into the conceptual planning of the underground reclaim facility.

History of Arsenic Reclaim Testwork

In October of 1981, Geocon was engaged to conduct a sampling program of the dust in selected arsenic stopes and to perform a number of geotechnical tests on the samples recovered. The testwork was not intended to result in a design for reclaim of the dust but was to provide samples for metallurgical testwork and to provide information as to the physical nature and condition of the material stored underground.

In early 1982, the recognized authority on flow characteristics of dry solids, Jenike and Johanson, performed a complete range of tests on the flow properties of arsenic trioxide dust, using a sample from B2-35 having a moisture content of 0.7%. Tests showed that the material "has a strong tendency to ratholing" and "has the capacity for arching over a slot of 2.1 ft. width after storage at rest for 168 hours."

Using the Jenike and Johanson test results, the engineering firm, H.G. Engineering Ltd conducted a feasibility study in April 1982, which proposed a number of possible methods for reclaiming the arsenic dust. None of the methods were entirely satisfactory to Giant though one method, which combines vacuum pickup of the dust with air guns and explosive charges to break up compacted material, is somewhat similar to the system that is now favoured .

Gatx-Fuller, in Oct of 1985, was asked to review the data and make recommendations for a reclaim system. Not surprisingly, their proposal included a lot of Fuller equipment in the design, but was very similar to the recent GYK design, differing mainly in the fact that the equipment would be somewhat smaller and would be located on surface.

One encouraging aspect of the various proposals is the similarity in their essential features, especially when one considers that the GYK conceptual design was arrived at independently of the earlier studies. When the H.G.Engineering and Gatx-Fuller studies were made available, their recommendations served to confirm the practicality of the design.

History of Dust Collection at Giant

In the early years of the Giant operation, dust collection technology in gold roasting plants was rather rudimentary and it is not surprising that early efforts were not particularly effective. As the operation expanded and technology was developed, dust collection efficiencies improved to the point where gold recoveries in roaster exhaust products now exceed 85% and arsenic trioxide recoveries are greater than 99.8%.

The various changes in operating equipment and procedures affected the dust quality so much that it is almost possible to date a particular dust sample simply by chemical analysis.

The following extract is from the record maintained by the Engineering department entitled "Collection and Storage of Arsenic Bearing Dust". It provides a fairly complete history of dust collection and storage at Giant.

The Development of Dust and Arsenic Collection Systems

Initial gas cleaning commenced in October, 1951 with installation of a Cottrell electrostatic precipitator to collect the combined dust and arsenic from the exit gases of the Edwards-type, duplex, flat-hearth roaster. Collection efficiencies were in the order of 90 percent from a roaster feed of 40 tons per day.

Early in 1952, a two-stage Fluo-Solids roaster was added to the plant to handle expanded production. With the roaster expansion, a new 9-foot diameter by 150-foot high brick stack was added, together with a booster fan and an enlarged flue system. It was hoped that the new system would improve Cottrell performance with better control of draft and air tempering. However, with the added burden of increased production, the Cottrell efficiency dropped by approximately 10 percent. It appeared that the fluo-solids roasting of arsenopyrite under ideal conditions for gold extraction did not produce good conditions for Cottrell opeation. This was explained by examination of the chemical reactions occurring in the second stage of the roaster. Over-oxidation of the calcine was avoided, as this impaired extraction, and consequently the atmosphere was controlled to give approximately 0.5 percent oxygen in the exit gases. This was not favourable to sulphur trioxide formation, which aids Cottrell performance by condensing as acid on the dust particles, thereby improving their conductivity.

In 1955, a second Cottrell was installed to operate as a hot precipitator for the selective recovery of the gold-bearing dust prior to the collection of arsenic in the original unit. At this time, roaster tonnage was 100 tons per day and the dust and fume burden had increased to 15 tons per day. It was thought that the extra Cottrell capacity would aid collection and restore efficiency.

The tandem operation of the hot and cold Cottrells gave good dust collections, however, through depletion of the meagre acid supply, an even poorer collection of arsenic resulted. Efforts were made to increase the acidity of the gases through the use of fumed sulphuric acid and water vapour, but the tests were only partly successful and the idea was abandoned. When the over-all collection efficiency dropped to 60 percent, it was found necessary to operate both precipitators at low temperatures for a more efficient combined dust and fume collection.

A further plant expansion in 1957 was to almost double the quantity of concentrates to be roasted. It was planned to install a new Dorrco Fluo-Solids roaster which would be capable of handling all concentrates. To collect the added burden of arsenic, it was decided to investigate the use of a cloth baghouse. A baghouse test unit was then placed in continuous operation for 1500 hours on a fraction of the roaster gases. Tests were conducted with and without electrostatic precipitators ahead of the test unit. Results were most encouraging and indicated an arsenic collection efficiency of 99 percent and a satisfactory bag life. Consequently, construction of a Dracco baghouse was started in mid-1958 and went into operation in November of that year - just prior to the new roaster start-up.

For a short period, the baghouse operated alone on bulk collection. However, as soon as the new roaster was operating satisfactorily, one Cottrell was again put on-stream as a hot precipitator. From that time, selective collection of dust and aarsenic has been carried out without interruption. In the spring of 1962, the original cold Cottrell was converted and now operates in parallel with the other as a hot precipitator. Over-all collection is very satisfactory.

Current Selective Dust Collection Practice

The two Cottrell units currently operate in parallel as hot precipitators, handling the gases and dust from the two-stage Dorrco Fluo-Solids roaster which now treats 140 tons per day of auriferous sulphide concentrates. After passing through the hot Cottrells, the roaster gases are air cooled to 220 deg F for arsenic fume condensation before entering the Dracco baghouse. Filtered gases from the baghouse continue on through a booster fan to a 150 foot high brick stack. The dust in the hot Cottrell is processed for gold recovery, and the arsenic collected in the baghouse is either pumped to underground storage or to a surface silo.

The two Cottrell precipitators are identical type K, rod-curtain units, each having two compartments which operate in paralled. Each compartment has two sections in series, which have seventeen ducts formed by 8 foot by 12 foot collecting curtains. The power supply (550 volts) is rectified by two mechanical units which also transforms the voltage to 70,000 volts. Rapping hammers, used to dislodge the dust from the electrodes, is collected in V-shaped hoppers below the

Cottrells and is removed by screw conveyor to a quench tank from which it is pumped to a special treatment plant.

The baghouse for collection of arsenic is an eight-compartment, No. 30 Dracco type. Each compartment contains 300, five-inch diameter by 10 foot Orlon bags. A pressure drop actuated shaking device is provided for dislodging the dust from the bags. Each two compartments are provided with a V-shaped hopper and screw conveyor for the collection and removal of the arsenic. A cross-collection conveyor and a Fuller-Kenyon pump is provided to transfer the arsenic to underground storage.

The gas volume leaving the roaster is approximately 20,500 c.f.m. at 840 deg. F. These gases are air-tempered to a volume of approximately 25,500 c.f.m. at 685 deg. F. before entering the hot Cottrell. The temperature drop across the Cottrell is 130 deg. F. The average of 14 tons of dust collected daily in the Cottrells contains 89 percent of the gold in the roaster exit gases. Further air tempering at the mixing fan gives a volume entering the baghouse of approximately 56,000 c.f.m. at 220 deg. F. An average of 12 tons per day of material is collected in the baghouse. This product contains 99.8 percent of the arsenic content in the gases leaving the hot precipitator. The collection efficiency of the system is checked periodically by stack filtration tests.

Underground storage of Arsenic Dust

Arsenic dust is stored underground in specially prepared stopes with the following specifications:

1. The stopes are enclosed within an envelope of permafrost.

2. All openings from the arsenic stopes, to other mine workings are sealed to prevent any escape of arsenic bearing dust to them.

3. The storage stopes are excavated in competent ground, and the area is dry before arsenic dust storage is commenced.

Transportation of arsenic dust is achieved by means of a Fuller-Kenyon pump, delivering the material through a 4-inch diameter standard weight pipe. The delivery pipe passes through air-tight bulkheads at entries to the storage stope, or is directly connected to 3-inch diameter drill holes to attain maximum distribution over the storage area. Displaced air is returned through a parallel 6-inch diameter pipe to the baghouse filter system. The system is therefore, completely enclosed and no dust loss occurs during transportation.

Bulkhead Design for Underground Storage

Bulkheads in Arsenic Storage Stopes B2-30/33/34/35/36/08/12/13/14, C#9 and C#10 are of reinforced concrete construction with specifications as set out by the Ontario Department of Mines.

The bulkheads in C2-12 storage stope are of a massive plug design, using one part cement to two parts mine tailings, with no reinforcing material and no hatches. The design criteria is based on South African practice, and on the theory that load is transferred from the concrete to the rock in the form of punching shear around the periphery of the plug, and over its full length.

All bulkheads for retaining arsenic dust have been designed to withstand the full hydrostatic head up to surface. Approval from the Mining Inspector has been received for all bulkheads currently installed.

Physical Characteristics of the Dust

Some important physical characteristics of the dust have not been included in the official record but are contained in Geocon Report V8520/01913-63. This report details the results of a sampling program conducted in August and September, 1981 by Geocon for the purpose of determining the physical characteristics of dust contained in several selected stopes.

Information relevent to reclaim of the dust has been summarized in the following stope by stope review of the data.

B2-08

Density (lbs/cu.ft.)

maximum	minimum	S.G.	angle of repose	% moisture	tons
69.1	39.7	3.22	46.4 deg.	2.8	32,368

Prior to being topped up with fresh baghouse dust in 1986, the surface of the arsenic dust was 32 feet below the back of the stope and the sampler penetrated 64 feet of dust before encountering rock. It seems that B2-08 had quite a rigid crust about a foot thick, the remainder of the dust being loose and dry. Since topping-up, the surface is now light and fluffy and occurs about 5 feet below the back of the stope. When the drillhole sample was collected, in-situ relative density could not be determined as dust became compacted inside the sample casing as it was being driven into the material. This condition applies to all other samples as well.

This stope was visually inspected Nov 16, 1987 and it appears that vacuum recovery should be quite straightforward.

B2-30

Density (lbs/cu.ft.)

maximum	minimum	S.G.	angle of repose	% moisture	tons
77.3	48.3	3.17	47.7 deg.	6.4	3,125

The surface of the dust is only 5 feet below the back of the stope and the sampler penetrated 52 feet of dust.

Though interpretation of the data is not certain, it appears that the top 15 feet of dust is dry and loose, the remainder wet and cohesive. Vacuum sampling of the wet material was very slow and difficult. Since no sample could be collected, the hole was terminated before the bottom of the chamber was reached.

B2-33

Density (lbs/cu.ft.)

maximum	minimum	S.G.	angle of repose	% moisture	tons
82.3	50.7	3.15	46.7 deg.	2 - 6	12,595

The surface of the dust is approximately 22 feet below the back of the stope and consists of very loose, dry, reddish dust. 36 feet below the surface, water saturated dust was encountered and samples could not be recovered by suction. Since samples could not be satisfactorily collected, the hole was terminated before the bottom of the stope was reached. The sampler penetrated 109 feet of arsenic dust overall.

Visual inspection on Nov 16, 1987 revealed that construction of a staging to work from while collecting a sample would be extremely difficult. Full scale recovery may well be accomplished by slurrying the dust and pumping to surface.

B2-34

Density (lbs/cu.ft.)

maximum	minimum	S.G.	angle of repose	% moisture	tons
85.3	53.3	3.23	46.1 deg.	1	13,281

The surface of the dust is approximately 31 feet below the back and, whe sampled, was very loose, dry and dark brown in colour. The sampler penetrated about 80 feet of dust before encountering a rock ledge estimated to be 63 feet above the bottom of the stope. The top 20 feet of dust had moisture levels approaching 4% while the remainder was dry.

B2-35

Density (lbs/cu.ft.)

maximum	minimum	S.G.	angle of repose	% moisture	tons
84.2	53.3	2.59	46.7 deg.	<2	17,578

Arsenic dust was encountered 14 feet below the back of the stope and the borehole was terminated in rock 108 feet later, about 53 feet higher than predicted from cross sections. The material was loose, dry and dark grey throughout the length of the hole. Particle size of the dust in this stope was coarser than all the others, 91% <.045 mm compared to 100% <.045 mm. Perhaps this has a bearing on the unusually low specific gravity of the dust.

The access hatch to this stope is easy to get to via the B2-33 raise and upon visual inspection of the access hatch, vacuum recovery is not expected to be difficult.

B2-36

Density (lbs/cu.ft.)

maximum	minimum	S.G.	angle of repose	% moisture	tons
74.6	41.6	3.79	48.7 deg.	<1	17,578

The surface of the dust was found to be 24 feet below the back of the stope and consists of dry, dark grey material. samples were collected from 94 feet of dust, 40 feet higher than predicted from cross sections. Material was consistent throughout the length of the hole.

Visual inspection on Nov 16, 1987 confirmed that sample collection and full scale recovery from this stope should not be difficult.

C-9

Density (lbs/cu.ft.)

maximum	minimum	S.G.	angle of repose	% moisture	tons
91.1	55.1	3.06	48.1 deg.	1 - 2	20,276

The stope was filled right to the back. Depth of dust sampled was 133 feet and the top 3 feet was found to be very loose, dry and light beige in colour, similar to the material currently being produced. Relative density of the next 20 feet was loose to compact, the dust in the remainder of the hole was compacted.

Reclaim Considerations

No other sampling of the stopes has been conducted and thus very little is known about the in-situ status of dust contained in some of the other major stopes such as B2-12/13/14 and C-12.

Indeed if high moisture contents are encountered in these large stopes, it is very unlikely that vacuum reclaim will be possible, just as sample recovery was not possible from saturated dust in stopes B2-30 and B2-33.

In order to recover dust from these stopes, it will likely be necessary to develop alternate reclaim methods

One idea for an alternate method is to slurry the saturated dust and pump it to surface for treatment. It is possible that thickener overflow can be recirculated to liquify the dust while filter cake or slurry is fed to the roaster for fuming.

Recommendations and Conclusions

It is recommended that the fuming pilot test be expanded to include testing of slurry and filter cake as well as dry dust and, if technically and economically feasible, the necessary equipment should be included in the design for the reclaim plant. This equipment will likely include an agitated storage tank, pressure filter, thickener, and a modified reactor feed system.

It may also be necessary to install pressure relief pumps at 2nd level bulkheads to control hydrostatic head pressures. Though the bulkheads are designed to prevent inflow of water, seepage around the bulkheads could cause unwanted contamination of the mine workings.

Removal of the last vestiges of baghouse dust from the stopes, whether wet or dry, will probably require washing down with high pressure water. The resulting slurry will likely have to be treated in a system such as described above. Complete removal, though perhaps not economically justified, is still very desireable as it will remove an environmental threat, however remote, and will settle forever what otherwise could be an extremely sensitive issue.

Table I
Summary of Arsenic Storage by Stopes

Stope	Volume Cu. Ft.	As Dust Dust Filled	Cumulative Tons	Date
B2-30	100,000	3,125	3,125	Oct. 28/51 - Dec. 15/52
B2-33	434,626	12,595	15,720	Dec. 16/52 - Mar. 1/56
B2-34	425,000	13,281	29,001	Mar. 2/56 - Jul. 10/58
B2-35/36	1,125,000	35,156	64,157	Jul. 11/58 - Mar. 15/62
B2-08	806,840	25,033		Mar. 16/62 - Dec. 31/64
		4,704		Jan. 1/72 - Sep. 1/72
		394		Jul. 1/75 - Jul. 31/75
		355		Dec. 17/75 - Jan. 9/76
		1626		Mar. 11/86 - Aug. 31/86
		256		Sep. 1/86 - Sep. 26/86
		32,368	96,525	
B2-12/13/14	1,920,000	60,410		Jan. 1/65 - Dec. 31/71
		4,945		Sep. 1/72 - Jun. 14/73
		65,355	161,880	
C2-12	638,139	10,243		Jun. 14/73 - Jun. 30/75
		1,794		Aug. 1/75 - Dec. 17/75
		1,875		Jan. 9/76 - May 21/76
		3,757		Jun. 1/80 - Jan. 9/82
		1,011		May 22/85 - Mar. 11/86
		18,680	180,560	
C#9	471,000	20,276	200,836	May 21/76 - May 31/80
C#10	200,000	10,360		Apr. /82 - Apr. 30/85
		188		May 1/85 - May 22/85
		10,548	211,384	
B#11	347,250	3,084		Sep. 26/86 - Aug. 31/87
		3,084	214,468	

Note: 1. Records initiated January 1,1961. Tons arsenic placed prior to this have been estimated using volume available divided by a tonnage factor of 32 cu. ft./ton for arsenic dust. (This factor appears to be high on the basis of recent data.)

2. The dust from the Jan. 9/82 to mid April/82 period was sold.

Table II

Summary of Arsenic Storage by Years

Year	Tons	Cum. Tons	Stope	Remarks
1951	467	467	B2-30 (3,125)	1. First Cottrell installed as Cold Precip. 2. Roaster Feed 40 t.p.d.
1952	2,778	3,245	B2-33	
1953	2,778	6,023	(12,595)	
1954	2,778	8,801		
1955	5,935	14,736		1. Second Cottrell installed as Hot Precip. 2. Roaster Feed 100 t.p.d.
1956	5,678	20,414	B2-34	
1957	5,592	26,006	(13,281)	
1958	7,979	33,985		1. Baghouse installed November 1958.
1959	9,500	43,485	B2-35/36	2. Roaster Capacity Doubled. 3. Roaster Feed 170 t.p.d.
1960	9,500	52,985	(35,156)	
1961	9,377	62,362		1. Records Started
1962	8,617	70,979		1. Cold Cottrell converted to Hot Cottrell & operated in parallel with 2nd Hot
1963	8,998	79,977		Cottrell for Selective treatment of dust.
1964	8,552	88,529		
1965	9,101	97,630		
1966	8,385	106,015		
1967	7,794	113,809		
1968	8,792	122,601		
1969	8,881	131,482		
1970	8,782	140,264		
1971	8,491	148,755		

Table III

Giant Yellowknife Mines Limited - Daily Record Summary

Stope	Date Filled	Volume (Cu.Ft.)	Tonnage By Vol. Calc.	Tonnage Fr. Prod. Rec.	Avg. Assay Au Oz/Ton	Record As %	Number of Samples	Geocon Samples Au Oz/Ton	Geocon Samples As %	Geocon Samples Oz. Au	
											As_2O_3
82-30	Oct. 28/51 - Dec. 15/52	100,000	3,125	-	0.724	-	5	0.766	45.32	2,262	
82-33	Dec. 16/52 - Mar. 1/56	434,626	12,595	-			8	1.325	36.93	16,688	
82-34	Mar. 2/56 - Jul. 10/58	425,000	13,281				6	2.38	36.1	31,609	
82-35	Jul. 11/58 - Mar. 15/62						6	0.776	55.2		
82-36	Jul. 11/58 - Mar. 15/62	1,125,000	35,156 (Tonnage & Volume Records for these 2 stopes combined)		0.79		4	0.66	50.62	27,773	
			64157		1.22	45.69			45.69	78,332	38705

Stope	Period	Tons of Dust	Avg % As	Tons of As (Prod. Records)	Avg. Au Oz/Ton	Total Ozs. Au	Stope	Geocon Samples Au Oz/Ton	Geocon Samples % As
82-08	Sep. 1/86 - Sep. 26/86	256.40	69.69	178.68	0.081	20.77			
806,840 cu.ft.	Mar. 11/86 - Aug. 31/86	1,626.02	66.48	1,081.00	0.126	204.25	82-08	----	-----
	Dec. 17/75 - Jan. 9/76	355.26	62.99	233.79	0.195	69.15		0.03	45.19
	Jul. 1/75 - Jul. 31/75	393.95	63.72	251.03	0.120	47.95		0.28	46.77
	Jan. 1/72 - Sep. 1/72	4,703.82	65.07	3,051.09	0.330	1,600.07		0.30	56.25
	Jan. 1/64 - Dec. 31/64	9,414.07	67.51	6,355.42	0.292	2,748.05		0.42	68.89
	Jan. 1/63 - Dec. 31/63	8,997.66	64.89	5,838.95	0.377	3,392.17		0.39	65.73
	Mar. 16/62 - Dec. 31/62	6,621.65	64.38	4,263.31	0.511	3,385.30		0.38	57.83
		--------	-----	--------	-----	--------		0.19	51.51
	Total	32,368.83	65.66	21,253.27	0.354	11,467.71		-----	-----
								0.293	57.24

Stope	Period	Tons of Dust	Avg % As	Tons of As (Prod. Records)	Avg. Au Oz/Ton	Total Ozs. Au	Stope	Au Oz/Ton	% As
82-12/13/14	Jan 1/65 - Dec. 31/65	9,098.28	65.47	5,939.17	0.384	3,309.53			
1720000 cu ft.	Jan. 1/66 - Dec. 31/66	8,598.62	64.73	5,592.14	0.315	2,731.62	No Geocon Sampling data available.		
	Jan. 1/67 - Dec. 31/67	7,794.21	62.50	4,882.88	0.440	3,268.33			
	Jan. 1/68 - Dec. 31/68	8,774.37	62.74	5,507.82	0.443	3,985.35			
	Jan. 1/69 - Dec. 31/69	8,880.90	60.67	5,377.21	0.492	4,437.06			
	Jan. 1/70 - Dec. 31/70	8,781.83	58.51	5,144.60	0.551	4,835.28			
	Jan. 1/71 - Dec. 31/71	8,481.72	55.92	4,697.41	0.628	5,505.91			
	Sep. 1/72 - Dec. 31/72	1,975.20	67.57	1,334.44	0.215	427.25			
	Jan. 1/73 - Jun. 14/73	2,969.77	63.52	1,879.44	0.285	866.71			
		--------	-----	--------	-----	--------			
	Total	65,354.90	61.75	40,355.11	0.452	29,567.04			

Stope	Period	Tons of Dust	Avg % As	Tons of As (Prod. Records)	Avg. Au Oz/Ton	Total Ozs. Au	Stope	Geocon Samples Au Oz/Ton	Geocon Samples % As
C2-12	Jun. 14/73 - Dec. 31/73	3,229.46	66.39	2,151.99	0.214	672.18	No Geocon Sampling of C-12.		
638,139 cu.ft.	Jan. 1/74 - Dec. 31/74	4,576.00	63.90	2,926.75	0.235	1,088.12			
	Jan. 1/75 - Jun. 30/75	2,437.29	61.37	1,500.05	0.192	463.47			
	Aug. 1/75 - Dec. 17/75	1,793.50	65.01	1,174.02	0.130	233.88			
	Jan. 10/76 - May 21/76	1,874.76	65.20	1,220.59	0.140	257.78			
	Jun. 1/80 - Dec. 31/80	716.47	68.45	522.15	0.090	65.79			
	Jan. 1/81 - Jan. 9/82	3,040.40	67.94	2,095.62	0.100	312.42			
	May 22/85 - Mar. 11/86	1,010.67	65.47	661.67	0.120	120.60			
		--------	-----	--------	-----	--------			
		18,678.63	65.15	12,252.84	0.172	3,214.24			

Stope	Period	Tons of Dust	Avg % As	Tons of As (Prod. Records)	Avg. Au Oz/Ton	Total Ozs. Au	Stope	Geocon Samples Au Oz/Ton	Geocon Samples % As
C-9	Jan. 1/80 - May 31/80	1,793.15	69.62	1,254.97	0.090	161.38	C-9	0.20	40.76
471,000 cu.ft.	Jan. 1/79 - Dec. 31/79	4,460.71	70.44	3,139.41	0.080	325.98		0.17	66.13
	Jan. 1/78 - Dec. 31/78	4,782.28	67.16	3,237.21	0.110	521.68		0.09	73.06
	Jan. 1/77 - Dec. 31/77	5,727.66	64.76	3,702.31	0.190	1,088.26		0.08	74.21
	May 21/76 - Dec. 31/76	3,512.19	67.02	2,348.85	0.120	414.42		0.06	50.56
		--------	-----	--------	-----	--------		0.07	68.44
		20,276.00	67.48	13,682.75	0.124	2,511.72		0.05	70.06
								0.06	56.25
								0.09	71.52
								0.14	70.36
								0.16	59.60
								----	-----
								0.10	64.12

Stope	Period	Tons of Dust	Avg % As	Tons of As (Prod. Records)	Avg. Au Oz/Ton	Total Ozs. Au	Stope	Geocon Samples Au Oz/Ton	Geocon Samples % As
C-10	May 1/85 - May 22/85	187.97	60.54	113.80	0.170	31.95	No Geocon Sampling of C-10.		
200,000 cu.ft.	Apr. /82 - Apr. 30/85	10,360.03	66.94	6,935.40	0.133	1,376.03			
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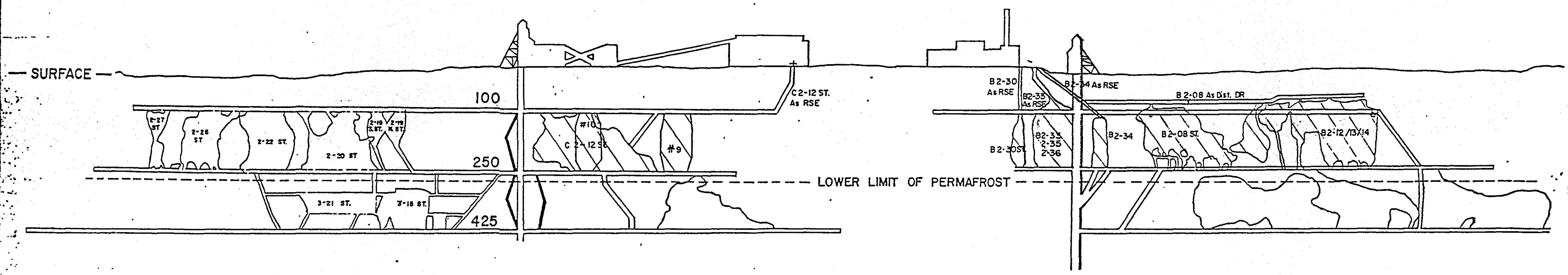
	Oct. 28/51 - May 22/85 (Total to May 22/85)	207,233.97	58.93	122,124.80	0.609	126,154.95			

Stope	Period	Tons of Dust	Avg % As	Tons of As (Prod. Records)	Avg. Au Oz/Ton	Total Ozs. Au	Stope	Geocon Samples Au Oz/Ton	Geocon Samples % As
B-11 347,250 cu.ft.	Sep. 26/86 - Aug. 31/87	3,084.20	68.42	2,110.24	0.133	411.65	No Geocon sampling data available.		
	Total	3,084.20	68.42	2,110.24	0.133	411.65			



LEGEND:

EXISTING ARSENIC STORAGE

MINE OPENINGS

GENERAL SECTION — ARSENIC STORAGE

SCALE: 1" = 200'

APRIL 1984

GIANT YELLOWKNIFE MINES LTD. YELLOWKNIFE, N.W.T.		
SHAFT C & B	LEVEL 100 & 250	
SUBJECT GENERALIZED SECTION OF ARSENIC STORAGE		
Scale 1" = 200'	Drawn by REK	DRWG NO.
Date APR 1984	Ch'd by	B10-0584-30