UNDERTAKING RESPONSE

EA No: 0809-001 **Undertaking No: 7**

Date Received

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Undertaking:

The Giant Mine Project Team to provide a copy of the document referred to on pages 6-92 of the Developer's Assessment Report (demolition assessment for the roaster). Any costs or proprietary information to be removed.

Response:

Please see attached documents:

Estimated Volumes of Waste and Debris

An Examination of Arsenic Contamination in the Roaster and Gas Handling Complex at the Giant Mill, February 2003

Tos Kor. 04/21/11

QUANTUM MURRAY
REMEDIATION SERVICES

6.0 Estimated Volumes of Waste and Debris (Loose)

The following table demonstrates estimated loose volumes (in cubic meters) of arsenic trioxide waste, asbestos (free of arsenic trioxide) as well as steel, debris, concrete brick and soil that may contain residual arsenic trioxide. Arsenic trioxide dust/waste includes co-mingled loose asbestos and residuals in vessels, tanks and containers.

Component	Arsenic Trioxide Dust/Waste	Asbestos	Demolition Steel and Debris	Concrete, Brick and Soil
Mill Pipe Shop	580	80	470	440
Calcine Plant	520	70	210	190
Dorrco Roaster	630	70	240	380
Cottrell	870	60	220	160
Cottrell Flues	200	40	0	0
Roaster Stack	15	0	0	300
Silo Load-Out	15	10	100	30
Bag House	200	0	300	150
Roaster Compound Surface Scrape	0	0	0	500
Total	***3030***	***330***	***1540***	***2150***

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REMEDIATION SERVICES

7.0 Estimated Volumes of Waste and Debris (Packaged)

The following table demonstrates estimated packaged volumes (in cubic meters) of arsenic trioxide waste, asbestos (free of arsenic trioxide) as well as steel, debris, concrete brick and soil that may contain residual arsenic trioxide.

Component	Arsenic Trioxide Dust/Waste	Asbestos	Demolition Steel and Debris	Concrete, Brick and Soil
Mill Pipe Shop	790	140	470	440
Calcine Plant	720	150	210	190
Dorrco Roaster	870	140	240	380
Cottrell	1190	120	220	160
Cottrell Flues	280	70	0	0
Roaster Stack	20	0	0	300
Silo Load-Out	20	20	100	30
Bag House	280	0	300	150
Roaster Compound Surface Scrape	0	0	0	500
Total	***4170***	***640***	***1540***	***2150***

Packaging assumptions include:

- Arsenic trioxide dust/waste to be packaged in double-lined 2.72 cubic meter hazardous material containers (1.22m x 1.83m x 1.22m)
- Flues to be cut to 2.5 meter lengths and doubled wrapped with poly
- Soil to be packaged in lined 1 cubic meter soil bags
- Asbestos to be packaged in lined 1 cubic meter hazardous waste bags
- Demolition steel and debris will be cut to less than 1.2 meter sections and stockpiled
- Concrete will broken into 0.3 meter sections and stockpiled

Specifications and pictures for Sea-Cans (arsenic trioxide dust/waste containers) are presented in ***Appendix D.***

2/6

AN EXAMINATION OF ARSENIC CONTAMINATION IN THE ROASTER AND GAS HANDLING COMPLEX AT THE GIANT MILL

February, 2003

Table of Contents

1.0 Summary

Northwest Consulting Limited conducted a study of arsenic contamination in the roaster and gas-handling complex of the Giant mill during the third quarter of 2002. The study is intended to provide information necessary for the evaluation of cleanup requirements prior to demolition of the plant.

Gas cleaning at Giant was not undertaken until 1951, when a Cottrell electrostatic precipitator was installed, some three years after the plant began operation. Some of the changes made during Giant's 50 years of operation included replacement of the roasters, erection of the 150 ft stack, installation of a baghouse, implementation of two stage electrostatic precipitation, installation of a CIP circuit, etc.

In 1981, an opportunity arose to market some of the crude arsenic trioxide product to the wood preservative industry, and surface storage and loading facilities were constructed. Major items of equipment included a 300-ton silo and a 100-ton electronic scale.

At the time of plant closure, the conventional metallurgical processes included crushing, grinding, flotation, cyanidation and precipitation. Roasting of flotation concentrates was required to expose the gold to cyanide solutions for dissolution, the gold being locked up in sulphides, mostly arsenopyrite.

The roasting process caused arsenic trioxide to be evolved from the arsenopyrite concentrates. After cleaning in the Cottrell electrostatic precipitator, the gas was cooled to cause the arsenic trioxide to be precipitated. The arsenic dust was then captured in a fabric baghouse for subsequent underground storage.

Over the years, arsenical materials were accumulated in many areas of the plant. This sampling program has identified concentrations of arsenic present throughout the plant. The summary of the sampling program details weights of material and arsenic analyses for several locations, so that an informed evaluation may be made as to cleanup requirements.

Selected samples of arsenical materials were collected and arsenic analyses performed by Taiga Environmental Lab in Yellowknife. Some samples of material located in areas other than the roaster and gas-handling complex were also tested. The purpose of this additional testing is to help identify what special precautions, if any, should be taken during demolition to avoid exposure of workers to excessive levels of arsenic in areas traditionally considered to contain only low concentrations of arsenic.

In general, it was found that elevated concentrations of arsenic are, with a few noted exceptions, restricted to the roaster and gas handling facility. A summary of the sampling results is included.

Abandoned exhaust flues from early roasting operations contain substantial quantities of arsenic, as do the CIP tanks, the AC roaster floor, and the Cottrell electrostatic

precipitator. Cleanup of these areas will require a significant effort before demolition can take place. Recommended methodology for cleanup is included in the report. Using bulk density and volume data, it is calculated that the abandoned flues contain approximately 60 tons of material having an average arsenic concentration of 40%. Using an arbitrary cutoff of 5% arsenic, it is calculated that the entire mill/roasting complex (including the highly contaminated roaster flues) contains more than 275 tons of arsenical material. If no cutoff is used, an estimated 3,080 tons of material, as detailed in Appendix B, is contained within the mill/roaster complex. All of this material contains arsenic at concentrations ranging from <1% to > 50%.

Cleanup and demolition of some of the equipment and buildings will be complicated by the presence of asbestos insulation that was in common use when the buildings and equipment were erected. Some asbestos insulation has been removed and the remainder has been professionally encapsulated but fresh surfaces will necessarily be exposed during demolition.

A detailed characterization of the arsenical material found in several areas and items of equipment suggests that cleanup will be labor intensive, and that some specialized equipment will be required. At a minimum, an industrial vacuum system, a mobile crane, and an effective breathing apparatus for each worker are recommended.

2.0 Introduction

Having knowledge of the Giant Mine processing plant, Northwest Consulting Limited has been awarded a contract to examine the plant equipment for the purpose of evaluating the arsenic contamination that will be encountered upon demolition of the plant. Recommended cleanup methodology is included in the report.

Though the roaster and gas handling facility are the main focus of the study, all equipment having a potential to contain arsenic in significant amounts was examined and selected samples of material were taken for arsenic analysis. The samples collected outside of the roaster area are intended as a spot check; an indication of the levels of arsenic contamination that may be expected throughout the mill.

3.0 History

Giant mill was in operation for approximately fifty years, beginning in 1948 and closing down in 1999 due to uneconomic ore reserves. For many years prior to, and during most of the period that Giant was in operation, technology for the processing of refractory arsenical gold ores usually involved high temperature roasting of the ore or concentrate, followed by conventional cyanidation and Merrill Crowe precipitation. Though there were several modifications and upgrades over the years, roasting was the practice followed at Giant throughout its history.

Cleaning of the roaster exhaust gas was not practiced at Giant until October, 1951, with installation of a Cottrell electrostatic precipitator to collect the combined gold bearing dust and arsenic from the exhaust gases of the Edwards type duplex flat-hearth roaster. Dust collection efficiencies were reported to be about 90% from a roaster feed rate of 40 tons/day.

Early in 1952, a two-stage fluosolids roaster was added to the plant to handle expanded production. With the roaster expansion, a new 9-foot diameter by 150 foot high stack was erected, together with a booster fan and an enlarged flue system. It was expected 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 about 10%. It appeared that fluosolids roasting under good conditions for gold extraction did not produce good conditions for Cottrell operation. This can be explained by examination of the chemical reactions occurring in the second stage of the roaster. Over-oxidation of the calcine was to be avoided as this impaired gold extraction. Consequently the atmosphere was controlled to provide approximately 0.5% oxygen in the exit gases. This was not favorable to the formation of sulphur trioxide, which aids Cottrell performance by condensing as acid on the dust particles and 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.

The tandem operation of the hot and cold Cottrells gave good dust collection efficiency, however through depletion of the meager acid supply, an even poorer collection of the arsenic resulted. Efforts were made to increase the acidity of the gases through the use of fumed sulphuric acid and water vapor, but the tests were only partially successful and the idea was abandoned. When the overall efficiency dropped to 60%, 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 fluosolids roaster that 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 operation for 1500 hours on a portion of the roaster exhaust gas. Tests were conducted with and without electrostatic precipitation ahead of the test unit. Results were very encouraging, and indicated an arsenic collection efficiency of 99% and a satisfactory filter 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 startup.

4.0 Recent Dust Collection Practice

At the time of plant closure, the two Cottrell units operated in parallel as hot precipitators, handling gases and dust from the two stage Dorrco fluosolids roaster operating at a feed rate of about 140 tpd of auriferous sulphide concentrates. After passing through the hot Cottrells the roaster gases were cooled to a temperature of 220^{o} F for arsenic fume condensation before entering the Dracco baghouse. Filtered gases from the baghouse continued on through a booster fan and thence to the 150-foot brick stack. The dust collected in the Cottrell was processed for gold recovery in a small carbon-in-pulp circuit, while the arsenic collected in the baghouse was pumped to underground storage. For a short while in the early 1980’s, several hundred tons of crude arsenic trioxide were shipped to markets in USA as a feedstock for arsenical wood preservatives. The poor quality of the product however, led to a cessation of shipments when better quality product became available to the buyers.

The two Cottrell precipitators are identical type K, rod curtain units, each having two compartments which operated in parallel. 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) was rectified by two mechanical units, which also transformed the voltage to 70,000 volts. Rapping hammers, used to dislodge the dust from the electrodes were time controlled on both wire and pipe curtain frames. The dust was collected in V shaped hoppers beneath the Cottrells and was removed by screw conveyor to a quench tank, from which it was pumped as slurry to the carbon-in-pulp circuit.

The baghouse for collection of arsenic trioxide is an eight compartment, No.30 Dracco type. Each compartment contains 300, five-inch diameter by 10 foot long Orlon bags. A pressure-drop-actuated shaking device was used to dislodge the dust from the bags. Each two compartments are equipped with a V shaped hopper and screw conveyor for collection and removal of the arsenic trioxide. A cross conveyor and Fuller Kenyon fluidizing air pump were used to convey the material to underground storage, or to the surface silo during the period when the product was to be marketed.

The gas volume leaving the roaster was approximately 20,500 cfm. At 840^{o} F. these gases were air tempered to a volume of approximately 25,500 cfm at 685^{o} F before entering the hot Cottrell. The temperature drop across the Cottrell was approximately 130^{o} F. An average of 14 tons of dust was collected daily in the Cottrells and approximately 89% of the gold in the roaster exhaust gas was recovered. Further air tempering at the mixing fan increased the gas volume entering the baghouse to approximately 56,000 cfm at 220^{o} F. An average of 12 tpd of crude arsenic trioxide was collected in the baghouse. At the time of plant closure, baghouse collection efficiency was approximately 99.9%.

5.0 Surface Storage of Arsenic Trioxide

In March 1981, a loading facility was constructed near the baghouse building for the purpose of shipping arsenic trioxide to markets in the USA. The facility consisted of a pneumatic conveying system, storage silo, and loadout building complete with a 100-ton electronic scale. The storage silo is a 15,000 ft^{3} capacity bolted steel tank, 26 ft in diameter and 56 ft high, and is capable of containing 300 tons of crude baghouse dust at a bulk density of 40 lb/ft^3. A screw conveyor was used to transfer the material from the silo to a bulk transport truck in the adjacent scale building.

6.0 Plant Process

After crushing and grinding the ore to approximately 80% -200 mesh, the sulphides contained in the ore were concentrated to approximately 10% of the original weight of the ore by flotation. The concentration ratio was controlled to provide a sulphur concentration of about 17%, the level needed to maintain autogenous roasting conditions. The gold, being almost entirely associated with arsenopyrite, was collected with the sulphide concentrates.

Autogenous roasting means that no external fuel source was required to heat the roaster to its normal operating temperature of 925^o F, the only fuel being the sulphur in the ore.

Roasting of the concentrates resulted in the formation of two important roaster products, the most important from an economic viewpoint being a porous iron oxide calcine containing gold, now rendered amenable to the cyanidation process. The other main product of the roaster was an exhaust gas stream containing high concentrations of sulphur dioxide and arsenic trioxide.

The calcines were collected from the roaster bed discharge and from dust collecting cyclones located on the roaster exhaust ducting. After water quenching and additional ball milling, the calcines were washed in fresh water and directed to the three-stage leach circuit, followed by Merrill Crowe precipitation and refining.

The gases from the roaster were directed to the hot Cottrell electrostatic precipitator for additional dust removal. This was intended to limit excessive dust loading on the baghouse dust collector further downstream, and also to recover additional gold that was contained in the dust, about 10% of the total gold production. The dust collected in the Cottrell was quenched with water and directed to a carbon-in-pulp recovery circuit.

The cleaned gas exiting the Cottrell was quenched with air to reduce the temperature to less than 220^o F, which prevented burning of the fabric filter bags, and caused the arsenic trioxide to condense as a fine powder. The crude arsenic trioxide collected in the baghouse was then pumped underground for storage.

7.0 Present Status

Numerous plant changes over the years resulted in several items of equipment becoming obsolete. In most cases, the unwanted equipment was dismantled and removed. In other cases, the equipment was simply left in place and the new equipment was built around it. This is true of most of the gas and dust handling flues that were used in earlier plant configurations. In general, the flues that were in use at the time of plant closure are almost completely free of arsenic accumulation, while those that were abandoned in the past contain large amounts of arsenical dusts and scale.

Arsenical material present within much of the plant equipment has been quantified. The following table lists equipment name, estimated weight of material contained, and arsenic analysis. This table represents a cross section of the mill equipment, and may be used to estimate arsenic present in equipment for which no arsenic analysis is available. Appendix B contains a more comprehensive list of equipment, categorized by area, and indicating estimated tonnage of material present. The tonnages were determined by volumetric calculations using specific gravities in use while the plant was in operation. If additional arsenic analyses are required, the samples collected for the preparation of appendix B are available at the Miramar Con mine assay office

Equipment Name	**Weight of Material**	**Arsenic Analysis (%)**
Cottrells (electrostatic precipitator)	5 tons	21.1
#2 roaster wall	2 tons	4.1
#2 CIP tank	39 tons	6.2
#1 roaster brick	2 tons	2.6
#6 thickener (top tray)	70 tons	1.8
Rotary kiln brick	N/A	<1.0
Calcine in mill yard	5 tons	1.0
Utility tank in mill	15 tons	<1.0
Carbon plant measuring tank	6 tons	10.6
Waste pile outside AC bldg	6 tons	16.1
North carbon plant leach tank	78 tons	7.9
South carbon plant leach tank	26 tons	3.2
Carbon plant flue	15 tons	6.0
Calcine under AC bldg floor	50 tons	10.4
#6 ball mill cyclone u'flow	0.5 tons	2.1
Rotary kiln plant thickener	69 tons	<1.0
#7 thickener (lower tray)	330 tons	2.4
Spare leach tank (#4)	39 tons	6.8
#1 CIP tank	15 tons	3.4
#5 thickener (lower tray)	52 tons	<1.0
Flue between AC and roaster bldg	3.6 tons	16.2
Flue from AC bldg to stack	4.7 tons	44.0
Termination of above flue		43.5
Base of stack - 9'buildup in 9' dia	14 tons	34.2
Transition Cottrell to flue to stack	15 tons	54.8
Remnant of flue, Cottrell to stack	1.7 tons	40.5
Flue to 40'column	4.3 tons	
New flue, baghouse to stack fan	trace	59.3
Flue roaster to Cottrell	1.0 tons	3.6
Flue cooling fan to baghouse	trace	

8.0 Cleanup Required

8.0.1 AC Roaster Floor

The raised portion of the floor in the AC roaster building consists of the calcine bed from the old horizontal hearth roaster capped with a thin layer of concrete. There is no accurate assessment of the amount of arsenic bearing material present in the floor, but a rough estimate, based on dimensions of the floor, is 50 tons. A sample of this material was found to contain 10.4% arsenic, and should be cleaned up prior to demolition of the building. The equipment on the floor should be removed first. The equipment consists of an antique pipe machine, the north and south carbon plant leach tanks, the carbon stripping plant, the roaster feed slurry tank, and the high-pressure water tank.

The concrete should then be broken up and disposed of (in the tailing area?). The arsenical material may then be loaded into drums for disposal.

8.0.2 Arsenic Silo

The arsenic silo contains 8 – 10 drums, perhaps 2500 lbs of arsenic trioxide, mostly in the cone section. The west wall is relatively clean. It is possible that most of the buildup can be dislodged by hammering on the walls of the tank, access being gained by use of a scissor lift or a crane and manbucket. The loosened material can then be removed via the rotary valve and screw conveyor, and placed into drums. Final cleanup before dismantling the silo may require removal of selected top segments and having a worker brush material from the walls while being suspended from the top.

8.0.3 Old flues

It is estimated that 60 tons of dust is contained in the 70” diameter flues. Much of the dust is loose and can be recovered using a heavy duty vacuum system. Some of the material however, is very hard and crusted over, and will have to be broken with hammers and scaling tools. The old flues are covered in insulation, generally in poor condition. There is some contamination associated with parts of the insulation, and care should be taken when removing it. After cleaning, the flues will have to be cut into manageable lengths using a cutting torch. Appropriate breathing apparatus will be required for all of this work.

8.0.4 Roaster Flues

The roaster flues are relatively clean on the inside, but high temperature warping has caused the bolted flanges to leak in several places, resulting in heavy encrustations of arsenic crystals on the exterior. The insulation on these flues is in poor condition and is thoroughly contaminated. The insulation should be carefully removed and placed into drums, and, if possible, the flues should be dismantled by removing the bolts in the flanges. However, it is possible that a cutting torch will be required, and appropriate safety precautions will be necessary. This applies to all flues and cyclones in the area above the roasters.

8.0.5 Arsenic flues

The flues between the gas cooling fan and the baghouse, as well as the flues from the baghouse to the stack fan, are of recent construction and are in excellent condition. They are 42” diameter, 3/8” fiberglass wall and are insulated with 1” of rockwool, clad in aluminum sheet and strapped with stainless steel bands. They contain very little dust, less than ¼” in most places. To remove, they should be cut into convenient lengths using a power saw, and lowered to the ground with a crane. The loose dust may be dumped onto a tarp or prepared pad, and collected into drums. The clean flue sections may then be further cleaned with a water spray prior to disposal.

The cooling fan intake flue will be relatively arsenic free, since the fresh airflow was directed into the Cottrell exhaust stream. The fan paddles and housing will have some arsenic contamination and should be dismantled with appropriate care.

8.0.6 Roaster Vessels

The roaster vessels have some buildup on the interior walls that should be removed prior to unbricking. This can be done using scaffolds and scaling hammers. The insulation on the exterior of the roasters likely contains asbestos. The insulation has been encapsulated, but removal may pose some breathing hazards. This is true of the wall insulation in the roaster building as well.

8.0.7 Carbon Plant

The carbon plant measuring tank, CIP and leach tanks contain an estimated 164 tons of material ranging from 3.2% to 10.6% As. Depending on disposal or storage options, the material can be shoveled into drums after cutting away the top portion of the wooden tanks.

8.0.8 Cottrells

Cleanup of the Cottrells is perhaps the biggest challenge facing the cleanup crew. In the eight Cottrell sections there are 6,400 collecting rods and 2,000 discharge electrodes that must be cut, using a bolt cutter, at top and bottom to remove from the spacer bars. These electrodes have a heavy buildup of arsenical scale, effectively preventing withdrawal through the holes in the spacer bars.

All of the internal framework and sheet metal, including ladders, dampers, partitions, etc. is heavily built up with dust or scale, which will be knocked down into the collecting hoppers as the rods are being removed.

The rods and the internal framing is best removed by opening up the top of the Cottrell, including floor plates and floor support framing, and passing the rods, etc. up to workers at the top. In the past, the built up rods were then pitched to the ground through a window, and later disposed of in the tailing area.

To remove most of the scale from the rods and internal equipment, it is suggested that the contaminated material be laid out on a suitable piece of flat, hard ground, and driven over repeatedly with a tracked dozer. The partially cleaned equipment can then be further cleaned using high-pressure water, steam or sandblasting, or it may be disposed of directly. The loosened arsenical scale can be vacuumed or shoveled into drums, together with any contaminated soil, and placed in storage.

After the rods and spacer bars have been removed from the Cottrells, there will be sufficient room to erect scaffolding to permit cleaning the walls, partitions, etc. This can be accomplished using scaling bars, scaling hammers, etc. The material that is dropped into the hoppers can be removed via the screw conveyors, and placed into drums.

Following cleanup of the Cottrell internals, the insulation can be stripped and the sheet metal cut in to manageable sections for final cleanup and disposal.

8.0.9 Arsenic Baghouse

The baghouse contains twenty four hundred 5” x 10’ fabric filter bags in eight compartments. The compartments are made of sheet metal panels covered in insulation. Each pair of compartments is equipped with a screw conveyor. Cleanout of the equipment first requires removal of the filter bags. The base of each bag is fastened to the tubesheet with gear clamps and attached to the shaking mechanism at the top with a loop of fabric around the hanger. The bags should be manually shaken before removal to dislodge any arsenic that may be adhering to the inner walls of the bags. The bags can then be packed in open top drums for future disposal.

The baghouse shaking mechanism and discharge plenums should be removed before dismantling the wall and partition panels. Final cleanup of the equipment may be done by high-pressure water spray provided that proper water collection facilities are available.

8.0.10 Stack and Stack Fan

The stack has an inside diameter of 9 feet and is 150 feet high. There is an accumulation of damp arsenic dust in the base of the stack measuring about 9 feet high. This can be accessed from above by climbing onto the ducting between the stack fan and the stack, and entering through the open arch. The cleanout access is at ground level and is covered with a hinged door. Cleanout of the entire accumulation from the lower hatch would be very slow and difficult and it is recommended that most of the job be accomplished from above. It is possible that a heavy duty industrial vacuum system can recover the dust. Another, less desirable alternative, is to shovel the dust into drums and hoist them out using a mobile crane, electric hoist, etc.

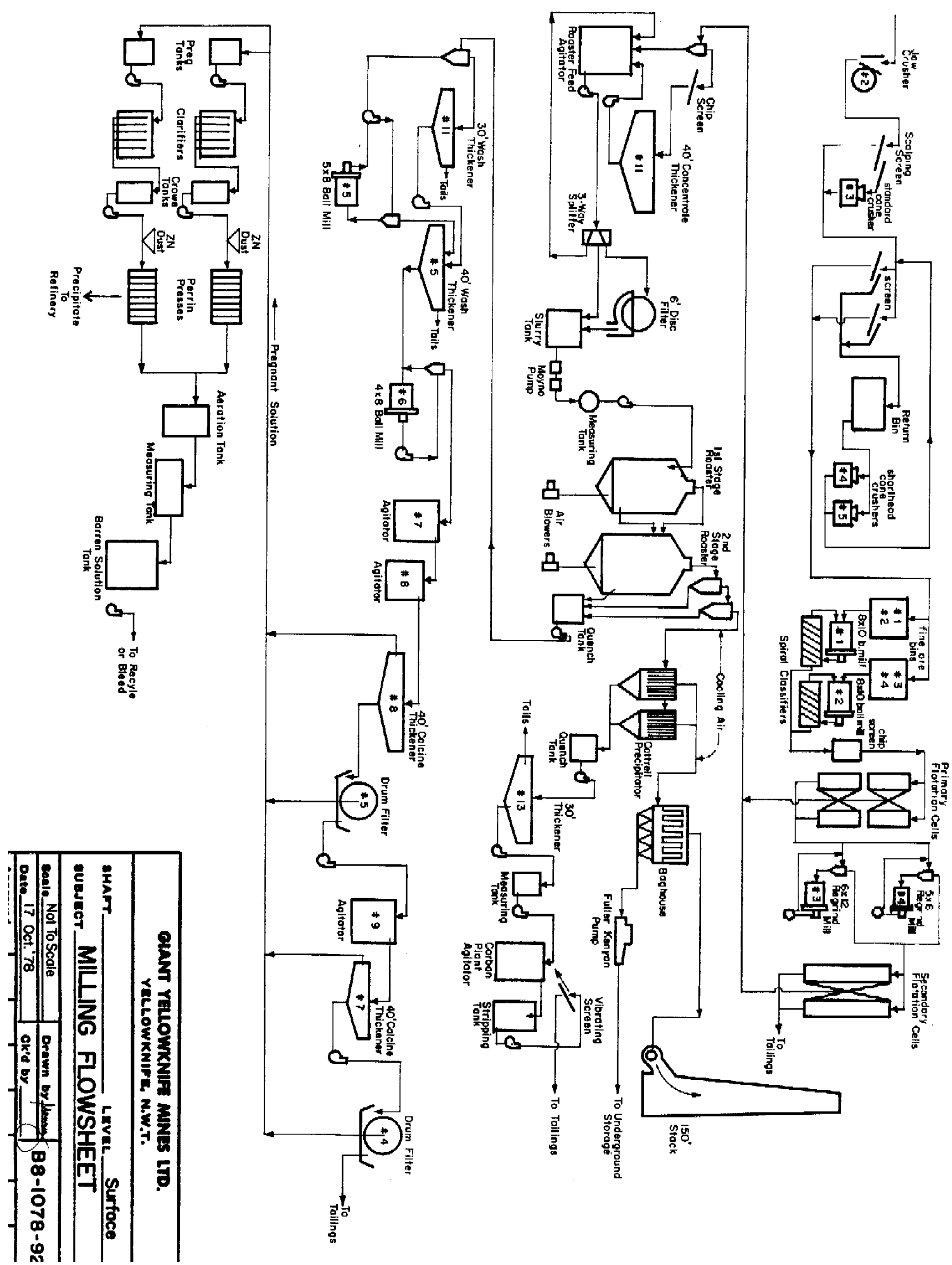
9.0 Recommendations

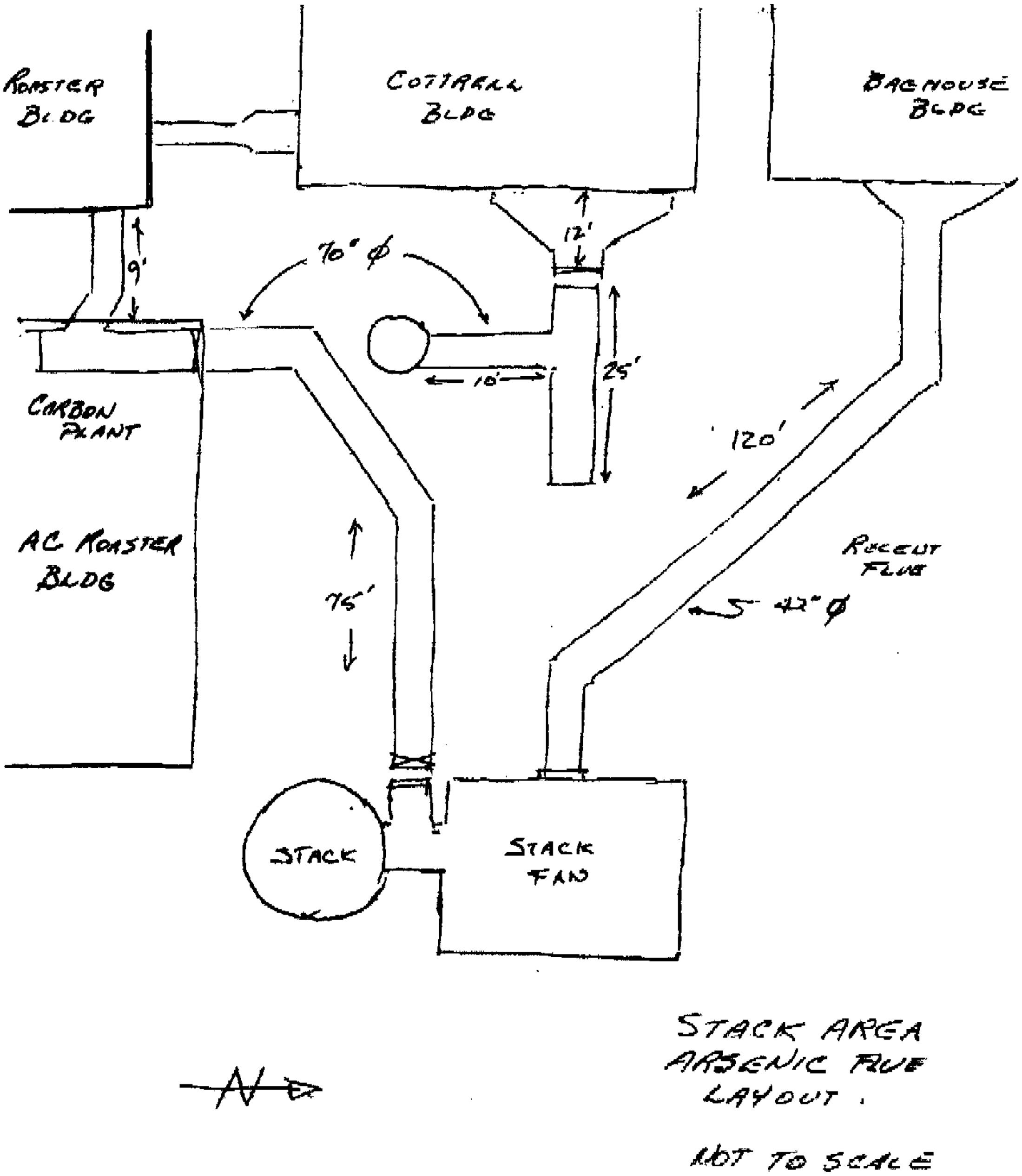
Cleanup of the arsenic contaminated buildings and equipment at Giant can be accomplished safely, but the work will be labor intensive. Workers will be in close contact with high concentrations of arsenic for long periods of time, and personal safety and hygiene will be very important. It is recommended that a full time safety person be assigned to monitor working procedures and to ensure that personal protective equipment, especially breathing apparatus, be kept clean and in good operating condition.

The level of arsenic concentration that should be labeled as hazardous is an important consideration. If material from the thickener and leach areas in the mill is included in that category, cleanup and disposal becomes substantially more difficult, with more than 1,500 tons of additional material to deal with. During plant operation, this material, consisting of leached roaster calcines, was blended with flotation tailing and pumped to the tailing pond. As a possible option for cleanup and disposal, it is suggested that the material contained in the thickeners and leach tanks be flushed out into the main sump using high-pressure water hoses. From the sump, it is a relatively easy matter to pump the slurried material to the tailing pond.

Appendix A

Flowsheet and Flues


GIANT YELLOWKNIFE MINES LTD.
YELLOWKNIFE, N.W.T.
SHAFT
LEVEL Surface
SUBJECT MILLING FLOWSHEET
Scale Not To Scale
Date 17 Oct. '78
Drawn by
Ck'd by
B8-1078-92
Jaw Crusher
Scalping Screen
standard cone crusher
screen
Return Bin
shorthead cone crushers
fine ore bins
Spiral Classifiers
chip screen
Primary Flotation Cells
Secondary Flotation Cells
To Tailings
Chip Screen
40' Concentrate Thickener
Roaster Feed Agitator
3-Way Splitter
6' Disc Filter
Slurry Tank
Moyno Pump
Measuring Tank
1st Stage Roaster
2nd Stage Roaster
Air Blowers
Quench Tank
Cooling Air
Cottrell Precipitator
Baghouse
Fuller Kenyon Pump
To Underground Storage
150' Stack
30' Thickener
Tails
Carbon Plant Agitator
Stripping Tank
Vibrating Screen
30' Wash Thickener
5x8 Ball Mill
40' Wash Thickener
4x8 Ball Mill
Agitator
40' Calcine Thickener
Drum Filter
Pregnant Solution
Preg Tanks
Clarifiers
Crowe Tanks
ZN Dust
Perrin Presses
Precipitate To Refinery
Aeration Tank
Barren Solution Tank
To Recyle or Bleed


ROASTER BLDG
COTTRELL BLDG
BAGHOUSE BLDG
9'
70" ø
12'
10'
25'
CARBON PLANT
120'
AC ROASTER BLDG
75'
42" ø
STACK
STACK FAN
N
STACK AREA ARSENIC FLUE LAYOUT.
NOT TO SCALE

Appendix B

Summary of Material

Giant Mill and Roaster - Arsenic survey

Area sampled	Sample ID	Analysis As %	Wt tons
Refinery			
Old refinery floor	ORF		
Refinery furnace lining	FL		3.00
Refinery slag (in refinery bldg)	REFS		5.00
Drum of carbon in refinery bldg	RB		0.25
Refinery furnace enclosure scale	FE		0.01
Refinery floor concrete	refinery floor		
Refinery slag near #6 ball mill	MRS		2.00
Pipes and Scale			
Scale on electrowinning cell	EWCAC		0.01
Scale in electrowinning cell	EWCIS		0.01
Press scale	PS		0.00
Old press scale	OPS		
Zinc feeder	ZF		
Spare zinc hopper scale	SZH		
Lifter bar scale	LB5BM		
Barren pipe scale	BS		
Clarifier vacuum pipe	CVP		
Flot conc pump pipe	FCP		
#6 ball mill cyclone feed pump pipe	6BMPP		
Roaster calcine cyclone feed pipe	Sample 3		
North clarifier pipe	NCP		
North clarifier tank scale	NCT		
Preg pipe scale	PPS		
Preg pipe scale	PPS2		
South clarifier tank scale	SCT		
Calcine Ball Mills			
#6 ball mill ball charge	BC6BM		10.00
#6 ball mill feed end spillage	6BMFS		0.10
#6 ball mill cyclone u'flow box	6BMCUF	2.10	1.00
#6 ball mill discharge box	6BMD		0.01
#5 ball mill floor area	5BMFA		0.15
#5 ball mill pumpbox and area	5BM		0.01
Calcine cyclone overflow box	CCOF		0.04

Giant Mill and Roaster - Arsenic Survey

Area sampled	Sample ID	Analysis As %	Wt tons
Leach tanks and Thickeners			
#3 thickener lower tray	3TLT		45.20
#5 thickener top tray	5TT		13.50
#5 thickener lower tray	5TLT	<1.0	
#5 thickener lower tray - resample	5TLT2		52.00
#6 thickener top tray	6TT	1.80	151.00
#6 thickener lower tray	6TLT		201.00
#7 thickener top tray	7TT		
#7 thickener top tray - resample	7TTT2		151.00
#7 thickener lower tray	7TLT		
#7 thickener lower tray - resample	7TLT2	2.40	352.00
#8 thickener top tray - calcine	8TTC		51.00
#8 thickener top tray - tails bed	8TTT		51.00
#8 thickener lower tray	8TLT		
#8 thickener lower tray - resample	8TLT2		201.00
Drum of scale near #7 thickener	7TD	2.00	0.50
Drums of scale near #8 thickener	8TD		0.50
#5 thickener floor area	5TF		2.00
#6 thickener floor area	6TF		1.00
Spare leach tank	SLT	6.80	43.00
Spare leach tank floor area	SLF		2.00
#1 leach tank	1LT		85.00
#2 leach tank	2LT		127.00
#3 leach tank	3LT		212.00
#1 leach tank floor area	1LF		3.00
#2 leach tank floor area	2LF		2.00
#3 leach tank floor area	3LF		0.50
#1 leach tank floor trench	1LTFT		3.00
#5 thickener wood staves	5TW		16.00
#6 thickener wood staves	6TW		16.00
#7 thickener wood staves	7TW		16.00
#8 thickener wood staves	8TW		16.00
Spare leach tank wood staves	SLTW		16.00
#2 leach tank wood staves	2LTW		16.00
#3 leach tank wood staves	3LTW		16.00

Giant Mill and Roaster - Arsenic Survey

Area sampled	Sample ID	Analysis As %	Wt tons
Carbon Plant and AC Roaster			
#1 CIP tank	1CPLT	3.40	20.00
#2 CIP tank	2CIP	6.20	45.00
#1CIP tank wood staves	1CIPW		6.00
#2 CIP tank wood staves	2CIPW		6.00
North CP leach tank wood staves	NCPLTW		10.00
South CP leach tank wood staves	SCPLTW		10.00
Floor area in carbon plant	CPTF		6.00
Carbon strip floor sump	CSFS		0.10
Floor trench in carbon leach area	FTCL		0.50
Broken floor in carbon plant	BFCP		10.00
Carbon plant measuring tank	MT	10.60	6.00
Accumulation under #2 CIP	U2CPL		2.00
South carbon plant leach tank	SCPLT	3.20	32.00
North carbon plant leach tank	NCPLT	7.90	128.00
carbon plant flue	CPF	6.00	30.00
South floor trench, AC Roaster	SFTAC		0.25
Cottrell dust	CD	21.10	5.00
Calcine under AC roaster floor	ACF		50.00
Calcine under AC floor - North end	ACFN	10.40	50.00
Calcine under AC floor - South end	ACFL		50.00
Waste pile outside AC roaster	WPAC	16.10	8.00
Grinding and Sump Area			
#1 ball mill scoop	1BMS		5.00
#2 ball mill scoop	2BMS		5.00
#1 fine ore bin	1FOB		250.00
#2 fine ore bin	2FOB		75.00
#3 fine ore bin	3FOB		75.00
#4 fine ore bin	4FOB		75.00
#1 slot feeder - crushed refinery slag	1SF		25.00
#2 slot feeder	2SF		
#3 slot feeder	3SF		
#4 slot feeder	4SF		
Ore spillage in mill	OS		20.00
Mill emergency sump	ES		20.00
Mill main sump	no sample		

Giant Mill and Roaster - Arsenic Survey

Area sampled	Sample ID	Analysis As %	Wt tons
Precipitation Area			
South preg tank wood staves	SPTW		6.00
North preg tank wood staves	NPTW		6.00
North preg tank	NPT		31.00
Utility tank in mill	UTM	<1.00	15.00
South barren tank	SBT		31.00
Backfill plant floor	BFPF		1.00
Roaster Area			
#3 agitator floor	3AG		1.00
#1 roaster brick	1RB	2.60	
#2 roaster brick	2RB		5.00
#1 roaster wall	!RW		3.00
#2 roaster wall	2RW	4.10	3.00
Calcine quench vessel	CQV		0.01
Under roaster staircase	WRSC		0.01
#1 roaster floor brick	1RF		1
#2 roaster floor brick	2RF		1
Kiln Calcines			
Baker Creek calcine north	BCCN		
Baker Creek calcine south	BCCS		
Mill yard calcine	CY	1.00	
Kiln thickener	KT	<1.00	69.00
Kiln thickener o'flow tank	KOT		
Second kiln thickener o'flow tank	KTOF		
Kiln sump calcine	CK		
Miscellaneous calcines in kiln bldg	MCKP		
Rotary kiln brick	KB	<1.00	

Appendix C

Resume

Resume

Kent Morton

Profile Summary

A process consultant having more than 30 years of experience in plant operation, process design, project management and operations management of a variety of metallurgical plants.

Relevant Experience

Present, Northwest Consulting Limited, Yellowknife, NT
Process Consultant
Specializing in mineral processing and arsenic trioxide handling and processing

1999-2002, Miramar Con Mine, Yellowknife, NT
Mill Superintendent
Management of plant operations, including arsenic reclaim plant and tailings water treatment plant

1996-1999, 1986–1990, 1977-1985, Giant Mine, Yellowknife, NT
Mill Superintendent, Project Superintendent
Management of plant operations and of various projects relating to minewater treatment, recovery and treatment of arsenic trioxide in underground storage, tailings recovery and processing, wastewater treatment, arsenic trioxide purification and marketing, etc. Was industry representative on the technical Advisory Committee to the NWT Water Board.

1991-1996, North American Metals Corp, Golden Bear Mine, BC
Mill Manager, Site Manager
Management of plant and minesite operations. Projects included design and installation of a unique sulfur injector to enhance roasting operation, and installation of a dual alkali scrubber for treatment of roaster exhaust gases

1986, Denison Potacan Mining Corp, Sussex, NB
General Mill Foreman
Duties included commissioning, startup, and operation of a large new potash plant.

1962-1985, Various Mines and Construction Projects Throughout Western Canada
Held positions of increasing responsibility and authority.

Education and Career Upgrading

University of Saskatchewan, College of Arts and Science
Level II NWT Supervisor Certificate
Kepner Tregoe Decision Making Analysis
Loss Control Institute – Total Loss Control
American Management Association – Project Management
Ansul Fire Training School
Various management training and career development programs

Appendix D

Photos

Photo #1: Transition section between roaster and Cottrell. Note change of diameter where the more recent flue replaced a section of much larger diameter old flue.

Photo #2: This view shows the base of the brick stack, the 40' high column, and the flue connecting the (no longer existing) AC roaster and the base of the stack.

Photo #3: Tuyeres in #2 roaster vessel

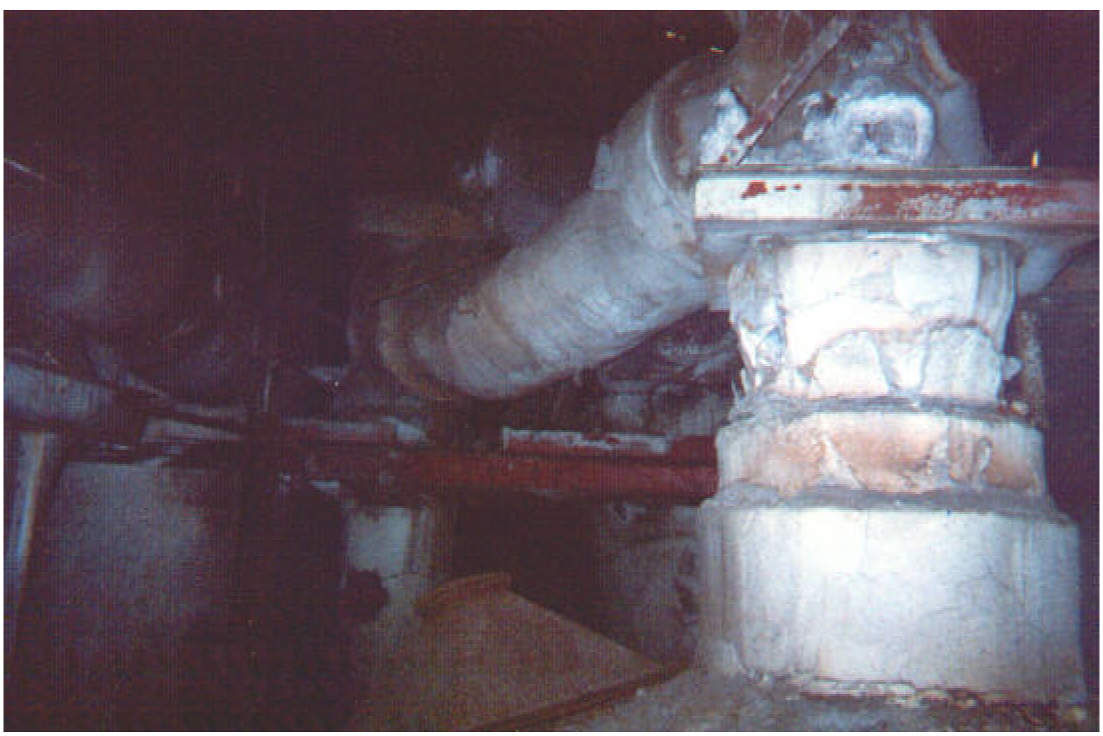


Photo #4: Exhaust flue from #2 roaster vessel to the dust collection cyclones. Note the white crystalline arsenic formation.

Photo #5: The black flue is direct from the AC roaster building to the base of the stack. The aluminum clad flue is quite recent, from the baghouse to the stack fan inlet.

Photo #6: An old flue section that once connected the Cottrells to the stack (pre arsenic baghouse).

Photo # 7: Flue section in roaster building. Note nipple for air lancing blockages.

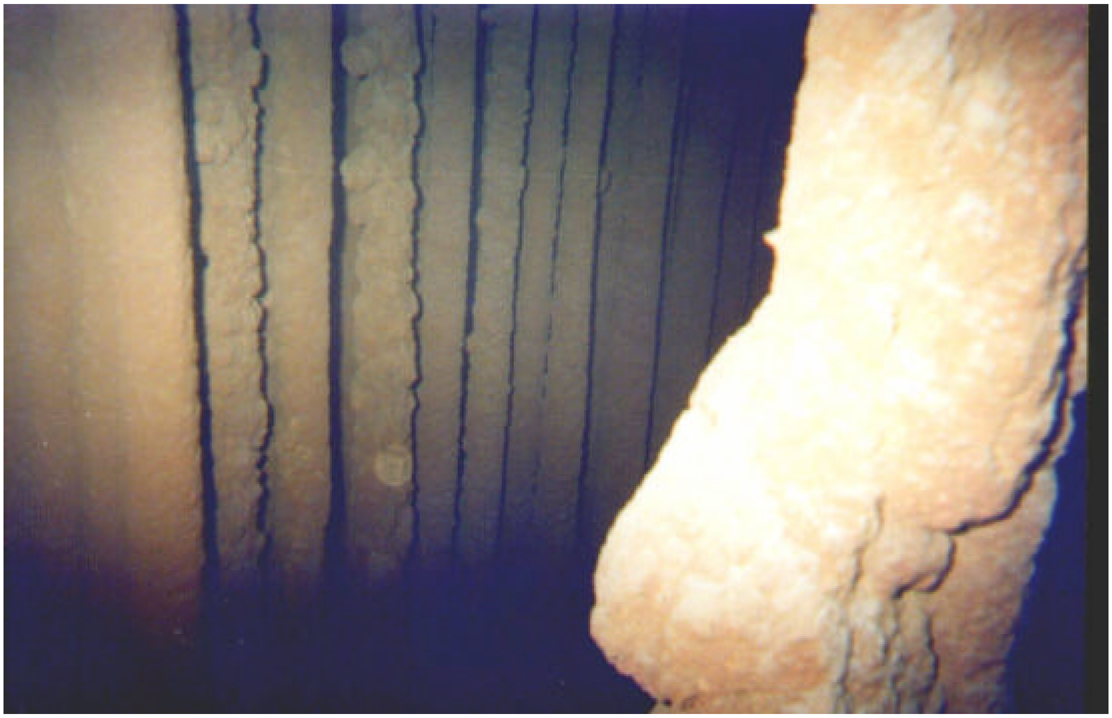


Photo #8: Inside #4 compartment of the Cottrell electrostatic precipitator. Note the heavy buildup (up to 2 ½" dia) on both the discharge and collecting electrodes.

Photo #9: Inside #4 compartment of Cottrell. Note heavy dust buildup on frames between Rod curtains

Photo #10: #6 baghouse compartment. Bags are in good condition and the compartment relatively clean. Dust collects on the inside of the bag in this type of collector.