NORTHWEST TERRITORIES WATER BOARD
PUBLIC HEARING
On An Application By
Royal Oak Mines Inc., Yellowknife Division
For The Renewal Of Water Licence N1L3-0043
For Water Use and Waste Disposal
For Industrial Purposes For Mining and Milling
Yellowknife, N.W.T.
14 January 1993

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The Northwest Territories Water Board Public Hearing on an application by Royal Oak Mines Inc., Yellowknife Division; for the renewal of Water Licence N1L3-0043 for water use and waste disposal for industrial purposes at the Giant Mine was called to order at 10:00 a.m., Thursday, January 14, 1993 in Annex "A" of the Yellowknife Inn, Yellowknife, N.W.T. by Chairman Dave Nickerson.

MR. NICKERSON: The time being shortly after ten o'clock we will call this Public Hearing to order. My name is Dave Nickerson and I am the Chairman of the Northwest Territories Water Board. If you will bear with me, I have some introductory remarks.

Some 20 years ago, Canadians began to take a new and real interest in the environment in which we all live and work. In response to this heightened awareness, Parliament enacted several new environmental laws. One of these was the Northern Inland Waters Act, designed to help protect the environment North of 60.

The Act created the Northwest Territories Water Board and directed it to hold Public Hearings like this one to make sure that northern waters were

protected and used wisely.

The Board has substantial powers, but can use them only in connection with the conservation, development and utilization of the water resources of the Northwest Territories. Political, social, economic or other concerns which arise from water use proposals, are beyond the Board's mandate and must be dealt with in other forums.

Water is the only real business of the Board. The best use of water resources for the benefit of all Canadians, and for the people of the Northwest Territories in particular.

The Northern Inland Waters Act gives the Board power to approve, reject, or approve with suitable conditions and limitations, applications for water use or waste disposal projects, such as the one we have before us today.

This application made by Royal Oak Mines, Inc. - Yellowknife Division is for the renewal of Water Licence N1L3-0043 for water use and waste disposal for industrial purposes for mining and milling.

This hearing lets the Board and the public hear from the Applicant, Government Agencies which have studied the proposal, and concerned citizens who have opinions about the effects these proposals could have on the waters of the Northwest Territories.

After the hearing is over, transcripts are made of everything which has been said. Then, the Board's Technical Advisory Committee studies those transcripts and the written submissions made here, before making recommendations to the Board. If an application is approved, the Board sends copies of a Draft Licence to the Applicant and all interested intervenors for their comments before it makes a final decision.

After all comments are considered, the Board prepares a Licence and then sends it to the Minister of Indian Affairs and Northern Development. The Minister can accept or reject the Licence, but he cannot change the conditions in it. No major water use proposal can lawfully be put into operation until the Minister gives his approval.

This Public Hearing today, is a vital part of the licensing process, because the Board is particularly concerned to hear from the people who use water resources in support of their way of life. The Board realizes that knowledge of the water is not confined to consultants, government officials, or academics, and the Board believes that to get the entire picture, it must have the help of those who have intimate personal knowledge of our rivers, lakes and streams in the Territories.

I would now like to introduce to you, the Members of the Board here today.

To my immediate left is Mr. D'Arcy Edward Arden, Vice-Chairman, who was born at Great Bear Lake and educated in the Northwest Territories. He started his career by joining the Royal Canadian Mounted Police at Great Bear Lake and assisted the Police there for several years. Since that time he has taken an active part in mining exploration and development. He lives at Prelude Lake just outside of Yellowknife, and is a lifetime resident of the Northwest Territories.

Next to Mr. Arden is Laura Johnston. She studied geology and chemistry at Queen's University and she worked in the field of limnology prior to joining the Groundwater Division of Environment Canada in 1977. Since 1989 she has been the Manager of Environmental Protection, with Environment Canada in their Yellowknife office.

To my immediate right is Mr. Frank Ipakohak who was born and raised in Coppermine. He was educated partly in Coppermine and Yellowknife. He was the speaker of the Kitikmeot Regional Council from 1982-89. He has also served as Chairman for the Coppermine Settlement Council prior to their becoming a Hamlet. Mr. Ipakohak has also served two terms as a Member of the NWT Eskimo Loan Board and is currently a Councillor of the Coppermine Hamlet Council. He is on staff with Echo Bay Mines in their Personnel Department and has been involved in the mineral industry for numerous years. Mr. Ipakohak is a lifetime resident of the north and a very respected and well known person on the Arctic Coast.

Next to Mr. Ipakohak is Dr. Ian Gilchrist who is a Doctor of Medicine with Degrees in Public Health and the Socio-medical Sciences. He worked for several years in New Brunswick, Northern Ontario and in Africa. He has been a consultant to the Canadian International Development Agency, the United States Agency for International Development, and numerous organizations on Public Health matters. He currently holds the position of Medical Director for the Department of Health and is the Territorial Chief Medical Health Officer.

My name is Dave Nickerson. I hold in degree in Engineering and was formerly involved in the mining industry. From 1975 until 1979 I was the M.L.A. for Yellowknife North, serving for part of the time as the Minister of Health and Social Services. From 1979 until 1988 I represented the Western Arctic Constituency in the House Of Commons.

Also with us today, at the table to my left is Mr. John Witteman who is the Controller of Water Rights for the Northwest Territories. Next to him is Pam LeMouel, the Board's Executive Assistant and next to her is Alan Denroche from the legal firm of Boyd

Denroche who is serving as legal counsel to the Board. At the reception table are the Board's secretary Laurel Gladu and Karen Huss.

The procedure we will follow at this Public Hearing is as follows: First of all I will ask the Applicant, Mr. Larry Connell and his colleagues of Royal Oak Mines Inc. to make their presentation. Then I will open the meeting to questions to be directed to the Applicant. Next, individuals who have submitted a formal brief will be given an opportunity to present that brief.

We have knowledge of the following formal briefs: The Department of Indian Affairs and Northern Development; a joint intervention from the Department of Fisheries and Oceans and the Department of the Environment; and the City of Yellowknife. In addition, we have been advised that a Mr. Peter Atamanenko of Yellowknife will make a verbal presentation and the Dene Nation has given notice that they also wish to intervene at this Hearing. Thirdly, Mr. Darrell Beaulieu has indicated that he wishes to make a presentation.

Then, I will open the meeting to anyone who wishes to ask a question or present a point of view and finally, the Applicant will be given an opportunity to respond to the points raised.

To keep the discussions orderly, people in attendance who wish to ask questions are asked to raise their hand and obtain permission from the Chairman before speaking. Each speaker is required to identify himself or herself and indicate the organization he or she represents, if applicable. I would ask that you come up and speak into the microphone if you have questions, in order to ensure we have the questions on tape for the transcript of the proceedings which will be prepared after the hearing.

That concludes the preface, and I would now invite Mr. Larry Connell of Royal Oak Mines, Inc. to make his presentation.

MR. CONNELL: Thank you Mr. Chairman. I am the Manager of Environmental and Metallurgical Services for Royal Oak Mines Inc. I will start off by introducing the other members from Royal Oak that are with me

today.

To my left is Mr. Terry Byberg who is General Manager of the Yellowknife Division. Next to him is Gary Halverson who is Mill Superintendent at the Yellowknife Division and also acts as the Environmental Officer. At the end of the table is Mr. Fred Matich, a well known geotechnical consultant with a world known reputation who has been involved in the design, maintenance and ongoing inspections of our Tailings Disposal Facilities for a number of years, very close to the life of the Mine.

I am going to start off with a slide presentation. As Mr. Nickerson has already said, we are gathered here today to go through a Public Hearing with regard to our formal application for the renewal of the water use licence that grants us the right for use of certain quantities of water and for the right to dispose of that water after treatment, within limits, for the industrial use at the Giant Mine.

I am going to start by going through an introduction to give you some background first of all to the Licence. I will start with a description of the current mine facilities with particular emphasis on the milling flow sheet. This is the principle use of water and the principle area where contamination is added to the water. I am going to concentrate in some detail on that for a general understanding of where the contamination comes from. Then, I am going to go through the Tailings Disposal System, generically how they operate, where they are located; and then the Effluent Treatment Facilities, what steps and action are taken to try to remove as much as possible of the contamination that is put into the water.

We will then look at the current mine ore reserve picture, to give you a sense of what we are applying for in the term of the Licence. Then, a review of our water usage pattern at the mine site; what quantity of water we are using and what attempts we are making to recycle water.

Then, we will look at a review of the quality that we have been discharging over the life of the current licence to demonstrate the type of performance we are achieving on decontaminating the water that we do use.

I am going to go through a discussion of the unauthorized spills and discharges, the things that we have done wrong over the past five to six years. That will lead me into a discussion of our Spill Contingency Plans.

I am going to discuss at some length our Abandonment and Restoration Planning and also look at future tailings disposal options; where we see our future tailings disposal coming from or where it is going to be placed and what plans we do have in place for that.

In the conclusion, the terms and conditions that we are asking the Board to grant us in the renewed Licence.

First of all, just a quick look at the water use history for the Giant Mine. The Giant Mine first

began the milling operation in 1948. The first water use licence was issued to the Giant Mine by the Northwest Territories Water Board in 1982. The first Licence was for a five year term. The Licence was renewed again in 1987 for a term of six years and the current Licence expires on April 30, 1993.

Again, I am going to go through a description of the Mine facilities with particular emphasis on the mill.

Just a quick history of the discovery of gold in the Yellowknife area. The first gold was actually discovered in Yellowknife by Arthur Blakeney who was passing through on his way to the Yukon. He discovered a gold outcrop north of Yellowknife, felt it was uneconomic to him at the time, and off he went to the Yukon. I don't think anybody has heard of him since or knows what became of him.

In 1934 the first real activity in the Yellowknife Camp began. C.J. Baker and Hugh Muir discovered the Burwash Property on the Yellowknife Bay. Later the following year they staked the 21 original

claims that make up the current Giant Mine.

In 1937 they incorporated the Company as Yellowknife Giant Mines and it sat dormant for a period of almost ten years. This was because the initial findings that they had did not show enough promise to try to get into a full scale operation. With some assistance by other consulting geologists in that intervening period, the actual ore body that we are now mining was discovered. In 1945 the first production shaft was sunk. "A" shaft was actually commissioned in September 1945 and the "B" and "C" shafts were sunk over the next two years.

The mill started up in May of 1948. In 1993 we will be entering the 45th year of operation within this camp.

I am sure that you are all familiar with the mine site and I will not dwell on a physical description of the Mine facility itself. I will concentrate the majority of my talk on the Mill Processing Flow Sheet, how we extract the gold from the ore, as this is the principle use of water.

We start off by taking ore from the underground mine. It is crushed to a 3/8 inch size in a dry crushing process. After crushing, it is combined with water from a set of storage bins and ground in tumbling mills in a wet slurry process. From that grinding process the product is a wet slurry. No significant reagent addition takes place until we get into the sulphide flotation circuit.

Gold, at Yellowknife or in the case of the Giant ore body, is associated with a sulphide mineral called arsenopyrite. It is intrinsically locked inside the matrix of this mineral arsenopyrite. Arsenopyrite is an iron sulphur arsenic mineral. We have other sulphide minerals contained in the ore, principally pyrite which is an iron sulphide, but the gold is principally in the iron oxide sulphide mineral called arsenopyrite.

The first step in the process is to concentrate as much of the gold as possible contained in the arsenopyrite by concentrating selectively or extracting selectively the arsenopyrite mineral and rejecting the other host rock that it is in. We do this by treating the particles of sulphide to

selectively allow them to float in air. So we bubble air through the slurry, it picks up the treated particles and draws them to the surface.

We are milling in the order of 1250 tons per day, coming in to the front end of the floatation circuit. We are able to concentrate 95% of the contained gold in a stream of 220 ton per day. The remaining 1100 tons is rejected to the tailings pond with no further processing. We lose approximately 5% of the gold in that stream which we are unable to economically recover.

We are currently putting together a process that will help us gain a small percentage of that 5% gold lost in the float tail by combining it with the cyanide waste streams from downstream where we treat the sulphide concentrate. I will get into that in more detail later. But currently the float tails with no further processing are rejected to the tailings pond and that represents about 1100 tons of the total tonnage that we are milling on a daily basis.

The remaining 220 tons which is the sulphide concentrate has to be roasted in order for us to extract the gold. If we were to take that material and try to extract the gold using cyanide leach technology, our recoveries would only be in the order of 20 - 25%. The gold is intrinsically locked in the middle matrix of the arsenopyrite. We are not able to economically extract that gold without somehow destroying this mineral matrix. We do that by sulphide roasting in a sulphide roaster.

[This slide covers the roasting process.] In the roasting process we feed a wet slurry concentrate into the roaster stream. We use the sulphur contained in the ore as the fuel supply. By actually burning off that sulphur, we generate the heat that allows us to drive the roasting process. The intent of roasting at Giant is a two-stage operation. In the first stage roaster, we roast under a slightly oxygen deficient atmosphere. We do this to drive off the arsenic as an arsenic trioxide gas. We are very careful to keep a minimum of oxygen present because we do not want to over oxidize the arsenic trioxide.

In the second stage we transfer the dry solid after the gas has been extracted and again roast it with an oxygen richer environment to drive off the remaining sulphur. This leaves us with an iron product called calcine. It is a mixture of hematite and magnetite which is then ground and leached to recover the gold. The leaching agent we use is cyanide. It is a leaching agent for gold. Basically, we take this calcine which has dried due to the heat of the roaster, re-slurry it in water, re-grind it, and then take the re-ground calcine product and cyanide leach it for recovery of the gold.

We then take the slurry with the gold removed, filter it to remove the water, and that slurry product is then sent to the tailings pond. Again, it is slurried back in some of the waste streams of water and sent back to the tailings pond in a thicker slurry, something in the order of 30% solids.

The solution that is separated from the filtering process is gold rich. It basically has gold in the form of a gold cyanide complex. That gold cyanide

complex is then treated with gold dust in a vacuum process in order to recover the gold as a gold zinc complex which we then filter from the water stream, collect the sludge or precipitate as it is called, and that is then fed to the final process of smelting. Then we melt down this zinc rich precipitate which contains significant values of gold and by using the difference in weight between gold and zinc, we are able to separate out the gold as a bullion product. Those bullion bars then leave the town. They grade something in the order of 80 - 85% gold, the remainder being mostly silver with some zinc contamination. The large portion beyond the gold is silver. We make no attempt to separate the gold and the silver.

From the roasting operation we also have this gas stream to treat. The gas stream that comes off the top of the roaster is first of all cooled with a small intake of air to protect the downstream cleaning equipment from the high temperature. We then remove the dust in an electrostatic precipitator. We charge the dust particles in this gas stream so that we can magnetically collect them on collecting rods to remove the particles of dust

from the air stream. We do not want to let those dust particles out into the atmosphere. So it is a very high efficiency, in excess of 90% recovery of dust particles from the gas stream. That electrostatic precipitator dust is gold rich and it is separately treated in a cyanide process to recover the gold.

The gas that passes through the electrostatic precipitator is cooled with very large volumes of outside air. The point of cooling it, is to bring the temperature down below the point at which the arsenic trioxide will recondense from the gas solid. We basically cool the entire gas stream down to remove the arsenic trioxide from the gas or vapour phase back into a solid phase. That solid arsenic trioxide is then removed in a filter bag house.

The arsenic trioxide dust is then pneumatically conveyed through a pipeline into a prepared stope underground. These underground storage stopes are not part of the regular mining stopes. These are stopes that are chosen and excavated in waste rock, and the location in the waste rock is chosen so

that we are within beds of permafrost. As you know, Yellowknife is a zone of discontinuous permafrost so we have to selectively choose where we build these stopes to be within the zones of permafrost. We then discharge the dry solid arsenic trioxide into these stopes.

During the period we are transferring it down we are bringing warm air in so there is some retreat of the permafrost while we are filling a stope. Once we are finished filling a stope which takes place over a number of years we then bring cold winter air back into that stope to re-introduce the permafrost and freeze the material that we have put in that stope. Permafrost will not easily re-establish itself so we use the cold winter air to freeze the product that we have placed into the stope and at that point in time allow the permafrost to take it's own control again by re-freezing the material.

To give you some sense of quantities, the quantity we are placing into the underground is something in the order of 15 -20 tons per day, so a stope takes a fair number of years to fill. The tail gas from

the bag house removal system after we have filtered out the arsenic trioxide dust is then released up the stack. This is the stack emission that you are all familiar with as you drive by the Mine.

This slide covers the cyanide recovery of gold from the electrostatic precipitated dust. This is the dust that we removed from the gas stream in the roaster. We again slurry that dust, treat it with cyanide, colloidal acetate which is a fatty acetate that is used for wetting the discharged solids.

The charged solids are very tough to re-wet because of the electrostatic charge on them so we use this material to help as a wetting agent. Our sodium hydroxide to control the pH regime. That is then leached and the gold is absorbed onto activated carbon. Activated carbon is mainly coconut shell that has been ground sized and roasted. It has the property of being able to selectively absorb all metal cyanide complexes from solution. This is very similar to what you see in a home air cleaner where they have a carbon bed for removal of contaminants from the air. We use carbon in water slurry to remove the cyanide and the gold cyanide

complexes and other metal cyanide complexes from the slurry stream into the carbon. We then filter out that carbon, strip the gold off of it and electrowin that gold onto wire wool cathodes which we take to the smelter and again refine into bullion bars.

The slurry, with the carbon removed, is combined with the remainder of the tailings stream and goes out to the tailings impoundment area.

This leads us into the Tailings Disposal System and the Effluent Treatment Facilities. I will start first of all with a description of the Tailings Impoundment System. First, what is going out to the tailings pond? The largest stream by far is the Flotation Tailings Solids. It is a stream at around 35% solids, 1100 dry tons per day going out to the tailings pond.

The next is the roaster Calcine Leach Residue. This is a cyanide bearing stream where we have leached the roaster calcine. To put it into perspective it is about 190 tons of dry solids per day.

Then the Electrostatic Precipitator Dust, again which has been leached with cyanide to recover gold; to put it into perspective is about 10 dry tons per day.

On the right hand part of the slide are the water streams; all of the groundwater that comes out of the underground mine. This is the water that is running into the Mine through fissures in the rock and water that we have used in the Mine, is collected and pumped out of the Mine. We use some of it in the milling process. The excess water that we can't use in the milling process is mixed with the tailings and goes out to the tailings ponds.

The roaster calcine; we first re-slurry it as it comes out of the roaster - we give it a wash and then thicken the product so that we can cyanide leach it. So we have this excess water stream that comes off the thickener; and that too is sent to the tailings pond as a water stream.

The Barren Solution Bleed is the cyanide solution that we use to leach the roaster calcine. We

recycle the majority of it in a closed loop but because of contamination build-up we do have to bleed off a stream from that, so there is a bleed from this cyanide solution on a regular basis. That too goes to the tailings pond.

Also, all the domestic sewage from the Giant Mine Townsite and also from the sewage at the Mine itself is combined with this product and goes out to the tailings ponds.

So that makes up the flows going to the tailings ponds. In total it means we have a product going out to the ponds that is something in the order of 15% solids, the remainder being water so there is a very large quantity of water going to the ponds.

[Referring To Slide] This is Yellowknife Bay, this is the Yellowknife River and the bridge going out to Prelude Lake is across the Yellowknife River up in this area. The Mine and Mill complex are located here. This blue line is Baker Creek, this is the C-1 Pit and this is Trapper Lake. The first tailings pond is this one here and it is

referred to as the South Pond. It is now filled and is only used for an emergency spillage point if there is a failure in the line to the other ponds. The Central Pond is also full. The North Pond was very close to being full but has since been re-mined and reprocessed through the Tailing Re-Treatment Plant. So a large percentage of the materials stored in here has been removed and reprocessed for extraction of gold.

The pink square is the location of the Effluent Treatment Plant. This is the sludge settling pond from the Effluent Treatment Plant and I will get into that in a little more detail in a few minutes.

This is the downstream Polishing Pond. Below the Polishing Pond is a dam and through a decant structure the water is released out into Baker Creek and flows down past the Mine and out into Yellowknife Bay.

To the northwest here is what we call the Northwest Tailings Pond. This is the current active tailings disposal site. The highway going up to Prelude Lake actually runs between the Northwest Pond and

this settling pond here. That is what you see when you drive by on the highway.

It is worthwhile having a look at the history of effluent treatment at Giant and how we got to the position we are at right now. In 1974 Environment Canada established criteria or limits for all metal mines in Canada for the level of contaminants that were perceived to be achievable by technology. These are goals that were established in law for metal mines to achieve. At the time, Gold Mines were exempt from that regulation because the technology for treating cyanide waste was not well demonstrated and had a lot of complexities to it. As a result it wasn't seen as technology that was available for use. Hence, in 1974 when the regulation was put in place, Gold Mines were exempted from the regulation.

In 1976, Giant financially cooperated with Environment Canada in a joint project which piloted one of the processes that was seen as being the future of effluents from gold mines called Alkaline Chlorination. This used chlorine to oxidize the cyanide from a toxic material into a non-toxic form

called cyanate. Basically the chlorine oxidized the cyanide into a compound CNO Cyanate. We then added to that a ferrous sulphate addition or processing section of the plant that dealt with the arsenic loading. The heavy metals as a consequence of these two were removed as well.

In 1976 we also did an awful lot of work trying to determine what stream this system worked on best. It was piloted in a number of different spots, it wasn't on one single stream. It was piloted on five or six different locations within the plant, trying to determine where best to apply the technology.

In 1981 Giant built a full scale Alkaline Chlorination Plant at a cost of around two million dollars and the Ferric Sulphate Precipitation Process was added to it. At that time it was the first and the largest effluent treatment plant every put on to a gold mill.

However, it was new technology and as a result problems arose. One of the first problems that came out was the effect of the chlorine. In

reality, we ended up with a situation where the solution became worse than what we were trying to cure in the first place. We had small amounts of residual chlorine left in the effluent which were harmful to the downstream aquatic environment. Also, chlorine reacts with ammonia concentrations to form a compound called chloramines which are harmful to fish life. As a result, this technology has had its grief even though it was subsequently picked up and used by a number of gold mines. Slowly but surely that technology has now changed.

In 1988, with technical assistance from the Dupont Company, we looked at using hydrogen peroxide as replacement for the chlorine. Hydrogen peroxide is the same sort of thing that you use for bleaching hair and has the ability to oxidize the cyanide to cyanate. In 1989 the plant was converted to replace the chlorine addition using hydrogen peroxide. That is the way the plant operates today. It now operates with the hydrogen peroxide addition. This effectively eliminated residual chlorine from the discharge effluent and thus resolved the problem of the downstream contamination of water from chlorine and

chloramines.

The addition of a Program Logic Controller which is a simplified computer that stages operations of the plant, enabled us to make the plant operate with less human input. When the PLC was added to the system, it allowed the plant to react faster to variations.

In 1990 the plant capacity was doubled in order to give us two factors. One is additional retention time for better treatment. Also, we were faced with a situation where with the start-up of the tailings reprocessing plant in 1988, there was no discharge so we had to treat a higher quantity of water in the subsequent years. So it had two functions; to treat this larger inventory of water but also to give us better retention time which in effect gave us improved effluent quality results.

In 1991 we added a small change to it, but a change that has had great benefit. We have changed the chemical process conditions through the ferric sulphate addition point. In the past we used to lower the pH to 8.5 with ferric sulphate. Ferric

sulphate is an acid so it lowered the pH to 8.5. That put us in a position where we were optimizing maybe the elimination of arsenic but we were not optimizing the elimination of nickel and we needed a fine balance. We needed to get both of these things removed so the pH controls were modified in 1991 to improve the balance for the removal of both elements both arsenic and nickel. I am going to go through the quality performance of the plant a little later on.

This shows you the flow from the tailings pond. Basically all of the water pumped from the Mine comes up to surface. Some of it is used in the tailings process and the excess goes to the tailings pond. All of the mill streams that have already gone through are combined and sent to the tailings pond. The current active tailings pond is the Northwest Tailings Pond.

The tailings are deposited over the full twelve months of the year. The Effluent Treatment Plant, because of the freezing conditions, can only be operated between the months of June and the end of September. So these ponds store the entire volume

of water that we put out between October and the end of May of the following year. At the end of May we start up the Effluent Treatment Plant and process at fairly high rates to remove this backlog of water and be in a position where the ponds are totally dry again by the time the following winter season starts.

The ponded water is pumped from the Northwest Tailings Pond through a pipeline to the Effluent Treatment Plant. The reagent mixing facilities, the control facilities, are all located inside a building. The actual tankage is located outdoors. The first two tanks deal with the cyanide and heavy metals. The third tank is basically there for the removal of arsenic for this reaction of arsenic with ferric sulphate. To remove the ferric sulphate, we remove it as a very fine colloidal precipitate called ferric arsenate. So in order to remove that ferric arsenate we have a settling pond where the treated water coming out of the Effluent Treatment Plant is allowed to sit in this pond. This allows for the colloidal ferric arsenate to settle out and fresh clean water is decanted off the top of the pond.

The water goes from the first ferric arsenate settling pond into a second polishing pond to give us additional capacity to ensure that we have removed all of this fine suspended solid matter. Then, it is run through two series of carbon columns. The carbon columns remove any gold that has leached out in the tailings pond during the winter months, gold that was in the float tails that has now reacted with the cyanide streams. There is a small amount of gold that does re-leach in the tailings pond.

At the same time it is not just gold. We also do some re-leaching of other metals. So we use activated carbon in columns. The water flows up through the columns and we pick up both gold cyanide and other metal cyanides on this carbon. Then the water is released from the discharge of the carbon columns into Baker Creek.

The discharge of those carbon columns is the point at which the Water Licence sets the limits for us to achieve. We have regulated limits that have to be achieved at the discharge from those carbon columns which is the discharge point going out into

Baker Creek.

This is a plan view of the Effluent Treatment Plant. When the plant was doubled we had two incoming parallel lines. They run out to the treatment tanks. The building itself has a small control room and reagent mixing and handling facilities for preparing the chemicals that are added to the plant into the treatment process.

This is a flow schematic. The input comes from the Northwest Pond and is split into two streams. In the first tank we raise the pH to 9.2 using lime. That is the optimum pH for the addition of hydrogen peroxide for the oxidation of the cyanide bearing complexes to cyanate. Our cyanide is not necessarily present, it is free cyanide. It is present as metal cyanide so we have to break the bond with the other metal cyanides, complex them as cyanate and at the same time precipitate these heavy metals. The heavy metals I am talking about are copper, nickel, lead and zinc.

In the third tank, we lower the pH to 7 with ferric sulphate and then precipitate the arsenic as a

ferric arsenate product. Ferric arsenate is fairly stable for further dissolution so we actually end up with a sludge that is fairly stable. It doesn't readily release the arsenic content in the water. Then at the very end of the plant we again raise the pH to 8.5 by the addition of lime. This is to help us balance the optimum removal of nickel and arsenic.

This is a schematic of the flow through the tanks. You have your incoming flow of untreated water. Any process water for this circuit is drawn off at this point for mixing reagents. We add some copper sulphate as it is a catalyst that is required for the conversion from cyanide to cyanate. It is not used in the process but it has to be there for the reaction to take place successfully.

Lime is added in the first tank to raise the pH to 9.2 and hydrogen peroxide is added to the tank to allow this conversion to take place. The conversion requires time so it goes through two tanks which give it the retention time required. At the third tank we add the ferric sulphate for the removal of arsenic and we then add a flocculant

to the tail stream which helps us enhance the settling rate of this fine colloidal ferric arsenate. We want to make sure that, that is removed in the settling pond so we add a chemical flocculant that actually helps enhance the rate at which these particles collide, join together, form a flock and settle out of the water. Then lime is added to the tail end of the circuit to raise the pH back to 8.5 to help optimize the removal of both arsenic and nickel and the water is removed out to the polishing pond.

Now a look at some of the treatment performance. This is the volume of water that is treated on an annual basis. The plant started in 1981 so it is a very low flow year. In 1988 there was no flow at all from the plant as there was no discharge that year. That was the year that Tailings Reprocessing Plant was started and all the water went into this reprocessing plant. Subsequent to that the water did not just disappear. It had to be treated in the subsequent year. So that is why the spike following 1988. It took longer and longer to draw the pond totally dry because we had this accumulation of water. In general, we are currently

treating 450 - 460 million imperial gallons per year.

On this slide there is a typographical error. The arsenic at 40 ton should be transposed with the cyanide. That 40 should 18 and the 18 should be 40. The rest of the slide is correct. This basically over the last five years gives you the amount of the contaminant that has been removed from the tailings water. In the form of arsenic we have removed 18 tons on average per year at an efficiency of 94%. In other words, 94% of the arsenic that was contained in the water has been removed through this process.

We have converted 40 tons per year of cyanide to cyanate. Physically the cyanide is not removed, we convert it into a non-toxic form of cyanate. That conversion efficiency is 98%.

We have removed 21 tons of copper per year at an efficiency of 95%; 0.6 tons per year of lead at an efficiency of 80%; 2 tons per year of nickel at an efficiency of 70%; and 2 tons per year of zinc at an efficiency of 95%.

You may ask yourself why the wide difference between percentage efficiencies? The bonding strength between cyanide and metals varies between the compounds. Zinc is one of the weaker bound metals so it readily disassociates from cyanide and is very easy to treat. Copper is next and nickel is one of the tougher ones. It is extraordinarily difficult to break the bond between cyanide and nickel and hence the conversion efficiency of the treatment process is lower for nickel and lead is in between. It has to do with this bond strength between the metals and cyanide. These are not free metals in solution, they are complexed as complexes with cyanide solution.

This is the concentration of arsenic in the feed going into the Effluent Treatment Plant and it varies year to year. The reason the plant had to be located at the end of the tailings pond is because there was a great period of time where no treatment took place. If we had treated back at the mill, its source, we would still have this problem of having older material that was out in the tailings pond being released. So the choice was made to treat at the end of the tailings pond

and thus we catch some of the material that is being leached out of the former old tailings that are sitting out in the tailings pond.

I have chosen arsenic for all of these and haven't gone through everything because arsenic is the most difficult of the elements that we have to remove. So I have done all of these slides based on arsenic. Arsenic removal efficiency is fairly uniform and you can see it is in the medium 90% range. I should correct that, you can see in 1985 it is missing data and the reason it is missing is that for whatever reason we don't have that data. There was treatment in 1985 but I don't have that data so I left that blank rather than fill anything in.

In this slide the yellow bars are the arsenic in the feed to the Effluent Treatment Plant. The red bars are the arsenic in the feed from the Effluent Treatment Plant. So you can a see a graphical interpretation of the removal rate.

This is the tons of arsenic that is removed per year. You can see that it varies year to year

depending on the concentration because the efficiency remains fairly constant.

This is the iron to arsenic ratio. We use ferric sulphate which is an iron product. It is the iron that forms a hydroxide and also converts to form this ferric arsenate precipitate. This is the ratio of the pounds of iron that you have to add to remove one pound of arsenic. You can see that the ratio varies and it is really a matter of the efficiency of our process as to how that varies. To be cost effective we try to make that iron to arsenic ratio as effectively low as possible. However, we still have to achieve our reduction and we can't do it at the expense of losing our reduction in efficiency.

This is the ferric sulphate consumption. Even though you may see the iron to arsenic ratio go down, it doesn't mean that we are saving any money on ferric sulphate. It just means that the usage of the ferric sulphate is more efficient. As you can see in the last three years, our ferric sulphate consumption has been higher because of the higher concentration of arsenic going into the

plant.

This is the cost of the treatment process. It averages around $800,000 per year. These have all been converted into 1992 dollars so there is no impact of inflation on that graph, but that is the cost of treating effluent. It works out to about $2.28 per thousand gallons treated or about $8.00 for every ounce of gold the Mine produces is going into just this last process of treating the effluent. That is not building tailings dams or running the tailings facilities, it is just the running of the Effluent Treatment Plant that represents about $8.00 per ounce.

Going into the Licence itself, we have asked the Board to give us a ten year renewal on this Licence. Now we have to give some justification as to how we came up with that ten year period and why we are asking for a ten year period. We have to look at the ore reserve picture at the Mine. These are the ore reserves that were quoted in the Annual Report of December 31, 1991. I don't have the ones for 1992 available for this presentation. They are currently being done. So, I am dealing with

results that are now a year old.

The Mine currently has an output capacity of approximately 100,000 ounces per year of recovered ounces of gold. This is gold that is actually sold from the Mine. The mineable ore, ore that has been developed and thus it is in a position that we can mine it, is different from what is mineralized material. Mineable ore is ore that you can count on being there to mine it. As you can see we have approximately 7.27 years of ore in that category. Ore that we know can be mined under current economic conditions. Obviously the price of gold has an effect on all of this, but we have to talk at current conditions.

Mineralized material is material that the geologist tells us is there but without actually developing further we are not able to call it mineable ore. However, it is there and is good potential ore to increase the life of the Mine. So again we are looking at about 7.73 years.

You can never take ore reserves as gospel because it is not a static thing. It is on ongoing

process. You have an ore body that you are developing and you are doing exploration on an ongoing basis. So, your intent is hopefully, if you have been successful each year, is for your geological department to find just enough ore to replace what you have been taking out of the ground. I believe when Giant first went into operation they were talking about two or three years of reserve. That is what they knew when they first went underground. So as you can see, this isn't a static picture. This is just the best picture we have to give anybody at this point in time.

Our targets for exploration are getting diminished and diminished over 45 years of operation. Obviously the targets you have for doing exploration get smaller and smaller as you do that exploration. However, there is known reserves of 7.27 years and very high potential that we have 7.3 years behind it. So even if you cut that 7.3 years in half, this is where we come up with our ten year term.

Why ask for a ten year term? Basically the Water Licence gives us tenure of stability at the Mine. It tells us that we are going to be able to operate that facility for ten years. The importance of that is that it allows us to plan our use of capital for ten years. A five year licence drops that planning period down to a five year period that you can only count on. You don't know what will come in the future five years.

The Board has protection within the Inland Waters Act that if a change in environmental criteria comes along, the Board can make changes to our licence conditions without having to go through the renewal period. They have the power within their Act to change as legislation is changed on a Federal basis. We are being told that ultimately the Metal Mines Liquid Effluent Guidelines are due for a renewal and we will see new criteria based on those guidelines. We know that will come and no matter what limits are set in the Licence, that will still apply to us. I don't believe that gold mines will no be exempt because technology is catching up. We will probably have separate regulations for gold mines, but we will be

included. This is where we came up with our ten year request.

Where we use water at the Mine is a subject we will go through now. Over the last five years we have drawn 1.5 million cubic metres of water per year from Great Slave Lake through our freshwater pump house. In addition, groundwater pumped out of the Mine is an average of 710,000 cubic metres per year giving a combined total of 1.91 million cubic metres per year. The Licence that we currently have has an allowable usage of the addition of those two items of 1.95. So on average, we have been within our licensed usage. We are not planning to change anything in our milling capacity so we asking for no change in that licence limit. We feel comfortable that we will stay within it.

These are averages, so in the next slide I have put together what it actually looks like on a year by year basis. Averages don't tell you that there were two years in 1988 and 1989 where we actually exceeded the 1.95 million cubic metres and had to come back to the Board for permission to do that. This was during the period where the Tailing Re-

Treatment Plant was in operation. Also, you will see there is a spike in the groundwater. I believe there was one extremely wet spring where a large inflow of water went into the Mine in the spring which spiked the groundwater piped out for that year. But on average, we have been able to maintain the 1.95 million.

The other side of water usage is efficiency of usage. We have been granted the right to use 1.95 which also means we are contaminating some of that water. Are we using it efficiently? Are we recycling as much as possible of the water is the question we should address? We pump 1.205 million cubic metres per year out of the pump house. Some of that water goes into the underground mine for use in drilling and use in running equipment. That water ends up being combined with the groundwater that comes into the Mine and is pumped to surface to a mill mine water storage tank. We draw off of that storage tank for some usage of that water in the mill. We have water that goes into our steam boilers. We do recycle condensate which allows us to reduce some of the usage of freshwater. So there is a recycling of condensate. We also use it

in the compressor cooler water. The wastewater from the compressor and the boilers is all sent to the mill and is used as the freshwater supply mill process water. In addition, we do draw off some freshwater directly from the pumphouse for use in the mill.

In the mill itself, the mill is broken into a series of processes. First usage of water is in the grinding circuit where we grind the material and then float it. The float concentrate is taken over to the roaster and thickened prior to being put into the roaster where it is taken from something in the order of 20 - 25% solids up to something in the order of 75% solids. That water that is removed is recycled back to the head of the circuit and is reused.

In addition, the leaching solution, the barren solution, the cyanide solution that we use to leach the roaster calcine; a large percentage of that is continually recycled but there is a bleed off of it. So the freshwater circuit in the mill is to make up the usages that are bled from it. We do practise some recycling of water within the plant,

but I don't have a percentage for you. The remainder of the water from the mill ends up going out to the tailings pond. It is decanted through the Effluent Treatment Plant, goes through the sludge settling pond and then out into the environment. There is some loss of water in the tailings pond through evaporation. The Northwest Territories is a net evaporation area where your rate of evaporation is slightly larger than your rate of precipitation coming in.

There is also some water seepage. When these tailings sit out in the tailings pond, they hold water. So, there is some percentage of water that always stays within the tailings and tailings facility. There is some seepage, although the Licence deals with seepage. Seepage over a certain amount has to be returned to the tailings impoundment area.

In addition to the other water we have talked about, we also draw some water from the City of Yellowknife Water supply. This is used mainly for the townsite drinking water for drinking water throughout the surface buildings at the Mine. That

water ends up as sewage which ends up going through the tailings impoundment system. That is another source of water that is used.

Now I would like to deal with water quality, how we have performed over the last five years in regards to water quality management.

These are the current Licence requirements that we were asked to meet. Basically there are two criteria. The first column is an average concentration. The average concentration is defined as the average of the last four samples taken. We are required to take a sample once a week for the purposes of this compliance record. So it is a running four-week average. As the next week comes along you take the fifth week off so it is constantly the last four weeks of discharge. We have to meet the first columns criteria for that discharge.

In addition, to protect a single bad week, there is also a second set of limits that no single sample can exceed and that is what that second column is. No single sample should exceed that column. So you

can't use averaging to deal with one extremely bad week, it is protection for the environment.

Starting off with cyanide, this is the maximum grab for the single one grab sample. The horizontal line is the right hand column, the single sample. As you can see with cyanide, we had two excursions late in 1987 where we had very poor performance by pushing the Effluent Treatment Plant to late into the winter season and the temperature resulted in us doing very poorly in the performance for removal of cyanide and the associated metals. You will see these two points repeat in all the metals.

In 1988 there was no treatment. In 1989 and 1990 you can see are scattering. You can see the effects of converting from the alkaline chlorination to the Dupont hydrogen peroxide process. In 1991 you can definitely see the improvement. We actually made the change in 1990, but you are seeing start-up grief as we learn to operate the process and how to optimize our process. In 1991 we did better and in 1992 you can see we are even getting tighter in our performance for removal of cyanide. Again, these are for any

single grab.

This is the average of the four weeks. Again, because those two were so high, they also pulled the averages above the line. So for the same reason we had those two bad weeks in 1987 where we did not meet levels on cyanide. The scatter gets larger in the average in 1989 but you can see how it is tightened in 1991 and 1992.

The other point to be made here is that while the Board gives us an average allowable of 0.8, our intent in any operation is not to just operate at that point. Our intent is to operate at the very maximum we can, to try and remove as much of the contamination as possible as technology will allow us to do. So as you can see we are not aiming to be just below the line. We are aiming to be as best as we can in the removal of the contaminants from the water stream.

This is the picture for arsenic. Arsenic is our most difficult element to deal with. You will hear quite a bit later on in requests from Water Resources and Environment Canada for the level of

arsenic be reduced. The current level is 0.8 for an average, 1.6 for a grab. We are being asked to reduce that to 0.5 for an average and probably 1.0 for a maximum grab. We would have difficulty with that, and I'll get into that a little later on.

This is the grab. Basically grabs were all within the 1.6 over the life of the Licence. On the average, that is not the case. You can see that in 1990, mid-year, we had some levels that were pushing the limit. Not that one single grab was exceeding it, but we were slightly over the limit. We had a bad period in 1990 and you can see that we are always fighting to stay below the 0.8 limit. Technically we do not know how we would achieve a 0.5 level if we were to receive a level of 0.5.

I don't know what we would do at this point in time to achieve that level given the technology that we know that exists today. You will hear that the reason for wanting to lower it is that the Con Mine is asked to read a 0.5 and do meet it. Argue backwards, and we will do this later on, that we aren't the same ore body as the Con Mine. If we were to take our ore and mill it through the Con

Mine, the recoveries would be much lower. We would not be able to achieve our recovery.

We have a roasting operation, they don't. In doing that roasting, we liberate the arsenic and hence we have to deal with much higher levels of arsenic in the water contamination. So probably our single largest difficulty is in the treatment and removal of arsenic.

This is the maximum grab curve for copper. Again you see the two same points that I talked about for cyanide. Again the same logic, same reason for why those points are over. It was late winter operation of the Effluent Treatment Plant and we did very poorly in not achieving them. You can see the improvement that has come with the hydrogen peroxide process. We have significantly lowered the levels in 1991 and 1992.

This is what it looks like on an average basis. You can see that 1990 was a bad year. This was the year that the conversion was taking place and represents the difficulty that we encountered in getting copper under control. It is a double edged

sword. We were adding copper as a catalyst and at the same time trying to remove copper that was contained in the ore. Subsequent to that you can see that we have now managed to resolve the situation and are now dealing effectively with copper.

Lead is relatively easy. I won't say easy, but it is easier than copper and nickel to remove. In lead we are consistently within the grab sample and the same on the average. One of things we have asked the Board for in our new Licence is not the removal of lead from the Licence, but to lower the frequency for which we have to monitor the lead. We have consistently been able to achieve compliance on the lead. Maybe, instead of being asked to do it once per week, if we were asked to do it once per month to make sure that this maintains. We have to make sure that we always maintain that we are removing the lead. I think we have a very good consistent record. We now have over five years and even over ten years of information.

Nickel is much tougher to remove than lead. Again we see the same problem in late 1987 and the same

reason applies. This is the grab samples and I will go straight to the averages. You can see that the same problem followed in 1990 as we saw for copper and subsequently with the changes made to the process in 1990 we can see the effects in 1991 and 1992. We now believe we have nickel well under control and are meeting the limits.

Zinc is similar to lead. It is one of the weakly bound elements. So again we have consistently made licence limits. This is for the grab and this is the average. You can see that consistently in zinc we have achieved the licence limits. We will ask the Board the same thing in our new licence, not to remove zinc because we recognize that it is a contaminant and must be checked on an ongoing basis, but to at least reduce the frequency with which we check it so that we just monitor on a longer term basis given the performance of the last five and this goes back even over ten years.

Total Suspended Solids are the fines colloidal suspended solid matter in the water that would make water cloudy. Our grab sample allowance is 3 and as you can see we are consistently within that

limit. The average is 15 and again consistently we fall within the limits for suspended solids. Suspended solids removal at Giant is a little easier than it is at some of the other operations because of the presence of this polishing pond. Those two-stage polishing ponds help us to polish off this fine colloidal material a little easier than in some of the other operations. We are within the limits for suspended solids.

The pH is the measure of the acidity or alkalinity of the effluent being discharged. The Licence requires that it be held between two levels, a level of 9 on the higher side and a level of 6 on the lower side. As you can see, the points consistently have fallen between the two lines.

While it is not regulated, ammonia is a major concern to the environment in that ammonia has a tremendous impact on aquatic life. You can see that some of the changes that have been made in going from alkaline chlorination to hydrogen peroxide has a side effect. It had a tremendous lowering of the ammonia concentrations that are now being released to the environment and substantially

we are well into the low levels.

There is no such thing as an authorized spill. No spill is acceptable. But given that, we are a Company run by individual people. We make mistakes and we have had our share of releases to the environment. There is also a changing world in spill reporting. Things that ten years ago we would never think to have reported to a Government Agency, is today reported. We take it foregranted that it is reported. There is a benefit to all parties in reporting things. When you report things an investigation begins and an investigation ultimately works towards reducing the frequency of these events. So very similar to accident investigations, by reporting things that we would not have reported in the past, we are slowly getting a better handle on controlling the significance of each individual spill event.

While the spill events are significant, this does not mean material was actually released into the water stream. This means that something fell onto the ground. In a large percentage of these cases, the material was picked up, but that is still a

spill. If you contain it completely and pick it all up, it is still a spill that has occurred so they make up this function. It does not mean that this material actually entered a water stream.

The tailings line has been a source of some very significant spills. We have put aside capital money in the 1993 season for a program of replacement in our tailings line. In replacing the pipeline we are basically going to reroute it so that the pipeline runs through the tailings impoundment areas so that when we do have a break in the future the tailings are more likely to stay within the confinement of the tailings impoundment area. When the lines were first laid many years ago, this was not taken into consideration. The shortest distance was usually the consideration. Times have changed. We now have to be much more environmentally conscious of what we do. So in replacing the sections of worn line we won't take the shortest distance. We will run it through the tailings impoundment system to ensure that future breaks have a chance of being within the tailings impoundment system. We can't run it 100% in the impoundment system, but we can increase the

percentage that is within the system.

The first thing we do with an unauthorized spill is conduct an internal investigation of each spill. They are reported to Water Resources, and they also conduct and investigation of the spill events. Where appropriate, we find out what we can do to prevent a reoccurrence so that we can take some action to prevent them from re-occurring. We are all human, and some of these spills are due to our negligence ad employees, as people. There is a job for us to be trained or to have educated that in today's environment we are responsible as each individual employee to protect the environment whether at home or at work. So, where appropriate, employee discipline takes place. I think it has only been used once or twice at the Mine, but it is an educational process that we all have to go through to make sure that we are all doing our part whether on the job or at home, to protect these spills.

On this second slide, that is an error. That is not an HDPE line, that is a clay line. That was my mistake and Gary corrected me. That is actually a

clay lined containment pond in order to prevent material that would escape the mill. Normally that would have run down the hill towards the Creek. Over the last few years we have now built two containment lines that give us a second line of defence so that if anything does escape from the Plant we have a second containment system along side the Plant to intersect that material. From that containment system we are able to pump it back to the plant once it has thawed so that we can intercept the material again and prevent it reaching the Creek and the watersheds.

This leads us to the subject of Spill Contingency Plans. As a condition of the Licence, and I am sure that it is a condition of nearly all the licenses that the Board issues, we are required to put into written form a Contingency Plan that deals with how we would deal with spills of a small nature and of a large nature. We have such a plan and we have actually gone through a re-write of this plan in 1992. It is on ongoing thing as you improve and you learn on past actions, but basically that plan gives us a formal system of response. So that when the panic occurs on the

floor and something has gone wrong, we have a plan to refer to that gives us a hierarchy to refer to; who's going to be in charge, who's going to call the shots, where the material is going to go. There is a formal system in place to deal with the spill at the point and time. This plan does exist and the Board is aware of it.

The plan is also intended to promote the safe handling of hazardous material to minimize health hazards, environmental damage and clean-up costs. This plan doesn't strictly relate to things that would reach the environment. It is also spills that would impact on employee health within the plant.

Abandonment and Restoration.

This does not mean that we are planning for immediate closure of the Mine. If I were to be operating or even contemplating opening a new mine today, regulators would ask me to give them a plan of how I am going to close out that mine before I even start. I think that it is appropriate that this be done because it forces us as engineers to think of how we build a facility, not for

necessarily the easiest way, but to build it so that we can also close it out and stop the long history of abandoned minesite's being left in terrible conditions. It just doesn't apply to minesite's, but industrial sites in total.

We do have an Abandonment and Restoration Plan. It has gone through two successive generations of writing. In 1992 we just completed the second generation re-write on it and the Board is aware of it.

The kind of things that we deal with in an Abandonment and Restoration Plan are:

1) That abandoned mine facilities do not endanger public health or safety; that when we are finished that we are not leaving something behind that will endanger public health or safety.

2) To prevent the progressive degradation and to enhance the natural recovery of the areas that have been affected by mining activities.

3) To ensure that mine facilities, waste and tailings are abandoned in such a manner that the requirement for long term maintenance and monitoring is limited. Obviously the Mine employee group is going to disappear and it should not be up to some other group to have to take responsibility for monitoring or controlling those facilities. They should be closed out in a manner that will ensure the public the contamination is controlled or will stop once the facility is left.

4) To mitigate and if possible prevent the continued loading of contaminants from waste to the environment.

5) To mitigate and if possible prevent the formation of acid rock drainage. Acid rock drainage is possibly the largest problem facing the mining industry today. This is the generation of acidic water that runs away from exposed rock. It doesn't necessarily have to be mine rock, but rock that contains sulphide that has been exposed to the air, allowed to oxidize and now generates an acid material

that leaches metals from the surrounding material and loads into aquatic systems and does kill aquatic systems. So it is incumbent upon us to first of all try to prevent that sort of formation and if we can't to at least mitigate the formation.

Some of the largest problems with acid rock drainage actually relate to airports. Some of the airports in Eastern Canada have significant problems in dealing with acid rock drainage.

6) To return the affected areas to a state compatible with the original undisturbed condition giving due consideration to the practical factors including economics, aesthetics, future land productivity and potential future use of the land. We can't restore the land to what it looked like. That is not possible. We have put an open pit in place and we can't put the material back in. The material that we have taken out has been changed in form. However, we can try to return the land to a situation where it is

compatible with its former usage.

The second generation re-write has gone through some review by Government Agencies. They have identified a number of issues that they feel are appropriate and we agree with them for ongoing study for the third generation. Again, these plans are not a static thing. They are something that as technology changes and as knowledge changes, they should be improved upon. They are basically meant to be a dialogue that allows the Company and the regulators to be talking back and forth to make sure that the plans we are putting in place are adequate for that ultimate closure.

One of the things that has been brought up from our first go around with the plan, is acid rock drainage. What information is available to show that the tailings and waste rock left at Giant Mines won't be a source of acid rock drainage at some point in the future. There is need for additional study to answer that question.

We do have a little bit of a database on this. Granted, it is not a large database, so we will

have to sit with Water Resources in this next year and work out studies that can help enlarge this database to give everybody some satisfaction that we have dealt successfully with this issue. This database tells us that basically it is done on float tails and combined mill tailings. The first column is the sulphur content which basically is the material that is ultimately there to produce acid if it oxidizes. We are talking about something that may take up to 10,000 years or it may take a year to take place. We can't, as engineers, very effectively today predict that time scale.

What we do is done in the laboratory. We run two sets of tests. First of all we find out what the potential is for the material to produce acid. That is done by calculating right off the percent sulphur. So in the case of the combined mill tailings, this was determined to have a potential of acid production of 11.64 kilograms per ton of tailings. 11.64 kilograms of acid would be produced per ton of tailings if all of that sulphur were generated into sulphuric acid.

The next column is where we take the material and treat it with acid and find out what the other minerals contained in it will absorb some of the acid, and to what extent. So we actually treat it with acid in the laboratory to determine what absorbtion capacity the other minerals in the ore have to absorb acid that is produced. In this case we are looking at about 138.7 kilograms of sulphuric acid per ton of tailings. So the ore has a potential of making 11.64 kilograms of acid, has a potential of neutralizing 138. Subtract one from the other and you have a net neutralizing potential of 127 kilograms per ton of tailings.

So in our case, this little database indicates that these three tests indicate that this product should be a net acid consumer, not an acid producer. So it is very, very unlikely that this material will produce acid. The acid it does produce will be neutralized by the other minerals in the material. We understand that this is a very small database and it needs to be enlarged so we have agreed with Water Resources that further study in required to enlarge that database to give us comfort.

Precipitation Runoff.

We have looked at the major contamination which is a contamination that we know where it is going. What affect does major rainfall have coming across the minesite? Does it pick up contamination from the soils around the Mine and carry them off to water streams? We don't know of any problems to that regard but study at other locations has indicated that this is sometimes very significant. It is something that should be studied. So again, with Water Resources, we have agreed that we have to do some study to at least answer these questions because we don't have the answer at this point in time. We don't know of a problem, but we need to answer it.

In the Abandonment and Restoration Plan, we have proposed that after the tailings ponds were complete that we would continue treating the water that flows off of them for a number of years as we go through the decommissioning and removal of all the Mine buildings. At some point in time, we are relying on the frozen condition of the tailings to eventually drop the contaminants down or prevent the continued loading of this contaminants to the

environment, two or three years after you have stopped putting anything in.

What information is available to us to actually know that the tailings can be kept frozen? This is a discontinuous zone of permafrost not a continuous zone. What comfort can Water Resources have that we can in fact technically achieve this? We haven't provided any information to Water Resources on this to date. It is incumbent on us, over the next few years, to study this and to provide them some data. When the North Tailings Pond was looked at as a source of ore for the tailings re-treatment plant a number of drill holes were punched down into that tailings deposit. We do know that the North Pond has layers of frozen tailings, unfrozen tailings, and then frozen tailings which represents the seasonal deposition of tailings.

We've got this eight months where tailings were laid in a frozen place during the winter months and that material is frozen evenly through great depth and has remained frozen. There are also smaller layers which represent the summer months where it is not frozen. Being that the summer months of

deposition are much smaller time periods than the winter months you have these smaller layers of unfrozen material sandwiched between layers of frozen material.

That was not intended when they started placing tailings in 1948, 1950's. It happened more as an accident and as a result of that accident a lot has been learned from it and a lot can be learned in the future. However, we need to identify and address this issue and quantify it for Water Resources so that they can have some comfort that what we are proposing for an abandonment scheme is in fact reliable from an engineering standpoint.

The last one is the storage of underground arsenic. Giant has always practised storage of the arsenic in underground storage faults. There is concern that you will hear from the City of Yellowknife and Water Resources that these faults can be kept frozen and that they are frozen in fact right now. Again, data has to be collected and presented that can give the public and the regulators some satisfaction that this is being achieved.

Just to give you a view of this underground storage of arsenic. These are some slides that were taken at some of the abandoned or older sites where arsenic has been stored underground. This is the drift leading to the bulkhead that leads into the storage stope. The end of the drift behind the gentleman is a steel bulkhead and what you are seeing is frost on the bulkhead. In his hand is a large chunk of ice that he has taken off the side walls. These stopes are not in the active mining areas. They are selectively chosen to be within the permafrost. They are bulkheaded with bulkheads that were designed to withstand the hydraulic loading on them so that eventually when the mine floods the water can be held out of these stoping areas.

This is behind the bulkhead on the other side of the drift. That is just frost you are seeing on the Mine back. You are not seeing any arsenic stored there, just the frost within the drift that leads to the storage stope.

This is the actual storage stope itself. The powder you see at the bottom of the slide is the

arsenic trioxide in place. As you can see it is dry and it is very difficult to make out in the slide. At the very back end of the stope you can see the ice crystals hanging off the wall. The permafrost is definitely in place within these areas.

What Water Resources is asking us to do and I think it is valid, is to come back and to monitor these stopes and monitor the temperatures on an ongoing basis over twelve months. This will verify that this is not an isolated case, that this is what is taking place in all of these storage faults. That this isn't just something we are saying, but is quantified with data.

This is the active storage area. This is the concrete bulkhead that leads into the storage area that we are currently using. There is a small steel panel right behind where the man is standing that is the access to it. That is sealed at all times because otherwise the dust would be coming out into the drifts. You can see the pipes going through it that take the arsenic trioxide from the surface down into the stope. This stope wouldn't

be frozen yet because we are transporting the material down in a warm air stream from the plant so it is warmed air. The intent would be when the stope is fully filled you would then run cold winter air through the stope for one winter season. This would bring the frost back into the ground, freeze the material that we have put in there and then allow the permafrost to reintroduce itself. We are not relying on the permafrost to do it by itself, we have to help that along.

Future Tailings Disposal Options.

Where do we go on future tailings? When we last appeared before the Board we were presenting a plan where we were going to build what is now called the Northwest Tailings Disposal Pond. That was intended to last for five years at a rate of 13,000 tons per day of tailings from the tailings re-treatment plant. That tailings re-treatment plant did not function for two seasons before it was abandoned for economic and other reasons. Consequently, this impoundment area has not seen the type of input that was forecast in the last submission. It is now being operated at a completely differently fashion than was stated at

the last submission because of this closure of the tailings re-treatment plant.

You may ask the question - what does the future hold for tailings re-treatment? It is dim. We don't see any economic potential of us being able to successfully re-treat tailings with the known economic conditions that we have today. So we don't see that plant restarting in our future. You can always hope that the gold price will take a tremendous blip up, but that is pie in the sky as well. I think gold is now a commodity and not something we will see tremendous changes of value in any more.

So that leaves us with where our plan goes. We have two phases. We have the Northwest Tailings Pond that is currently being used to hold our tailings capacity, but our tailings capacity is not driven by our solids capacity. It is driven by water. We are having to hold through the longer winter months tremendous volumes of water. Our capacity of tailings is driven by this volume of water that we are holding. So we have a scenario or strategy that will allow us to use both the

Northwest Tailings Pond and the North Pond in order to get us through this winter season to the treatment season for the effluent treatment plant starting in June, 1993. We have developed a strategy where we are confident we can hold all of the water through this coming year.

The second phase is where we look at longer term storage. We are looking at a series of options that we will be coming back to the Board with over the coming year once we have chosen which of the options is the one we would like to proceed with. Where we are driving ourselves with these options is to not necessarily look at building up tailings damns to ever greater heights, but to somehow reduce the volume of water that we are putting into the tailings ponds. At a treatment cost of $2.28 per thousand gallons there is a lot of economic incentive for us to somehow look at reducing the water that we are storing through the winter.

Some of the options that we are looking at and working on to that effect:

1) is to take our float tails and thicken them. The float tails leave the plant right now at something in the order of 35% solids. We can thicken them realistically up to 50% solids, and remove - that was 1,100 tons per day so it was a significant volume of water that we can remove from the tailings stream, recycle that water back to the head of the floatation circuit and use that water again. So that is one of the active programs and projects we are working on.

2) To somehow come up with a technique of treating the minewater 365 days a year or even through the winter months so that we can discharge it. Treat it to the licence limits and then discharge it directly to the environment rather than hold that water throughout the winter months. Some of the concepts that we have in mind are to winterize the current effluent treatment plant and see if we can't utilize that effluent treatment plant while it sits dormant in the winter months to treat minewater using the arsenic treatment system to decontaminate the

minewater and allow us to release that during the season.

Logically we also have to consider raising the dams, but if we are successful in reducing the water quantity that we have to hold, the rate at which we have to raise the dams would be dramatically reduced. We do have capacity within the Northwest Pond to carry us through the life of this Licence. We also have the area within the North Pond to hold our solid storage. Our problem is water retention. So we are working on these options and hopefully have them to our management by the end of the first quarter. Once we have gone through the economics we will be coming back to the Board with what we propose to do for ongoing tailings storage. Our prime focus is not going to be trying to build new tailings storage areas but to reducing the volume of water so that the current storage areas can carry us. I think the economics are there to justify us pursuing those targets.

We have other options that we have looked at for tailings storage. These are for the longer range to avoid having to open up new territory or

contaminate new ground with tailings storage. In the next few years the "A" shaft area of the Mine will be totally mined out so we have potential then of using the "A" Pit as a tailings storage area. That is well into the future. It is not something we will be considering in the next five to six years but there is engineering knowledge of how this is being done elsewhere. You can isolate mine workings so that you can use open pits for successful tailings storage and we propose to look at these options before coming back to the Board and asking for some new piece of ground to store tailings on. We think the economics will drive us in that direction.

Currently we will be continuing to use the Northwest Pond and the North Pond. In order to use the North Pond it requires that we do some geotechnical investigation of No. 2 Tailings Dam. In No. 2 Tailings Dam, the tailings were removed from the upstream side of that dam as we mined the tailings for the tailings re-treatment plant. In doing that we left an unstable structure as we now had a structure that had material that was no longer buttressed by the tailings. So that

facility has been taken down or reduced in size to give us a stable structure. We errored in not telling the Board that we dismantled part of that dam and we will take our knocks this afternoon from Water Resources for not having done that. It was done to make sure that we did not leave an unstable structure standing there and as we now want to go forward in reusing that facility we would have to build it up as we use storage capacity. That would be the subject of a separate submission to the Board.

In closing, I am not trying to go into an economic lesson in any way whatsoever. We recognize that as good corporate citizens that it is our responsibility to minimize the impact of our operation on the environment. That is our responsibility. The price of gold is down and times are tough for us but it is up to us to find more cost effective means to continue to operate. It doesn't mean that we can relinquish or ask you to relinquish the standards which we are being asked to make. It just means that we have to be that much more inventive to try and find techniques, for us to be vigilant and continue to

have the diligence to protect the environment and still be a cost effective operation.

This is a base slide I took from Statistics Canada. It shows you the Consumer Price Index. We are all very familiar with it and we all feel the suffering from it in our take home pay. No need to say anything more, it just marches ahead on us.

I have done the same thing for the price of gold in US dollars. We all remember back in 1981 when gold hit some fantastic highs. It actually did go higher on an individual basis, but these are average prices for the year. Historically you can see that gold has been fairly flat through this period of time and over the last four years has actually been declining. When you compare the two, you can see that the price for things that we have to do is following the price of the Consumer Price Index. Two examples are the price of labour and the price of the commodities we buy. However, the money that we get for the product we sell follows the red line. So it really means that we have to be much more innovative from here forward to come up with more cost effective solutions to hold the

line and make sure we continue to be diligent in protecting the environment. So again we are not asking any sympathy and relinquishment of standards but just to recognize that we have to be cost effective and look for any assistance in being cost effective in meeting those.

What are we asking the Board? We are asking the Board to renew our Water Licence to allow us to continue to draw water for industrial purposes; and to allow us to continue to treat and dispose of that water to allow us to operate. We ask the Board to give us a ten year term for this next renewal. We have asked the Board for no change in the quantity of water that we are using, and no change in the effluent quality limits that we are being asked to achieve. We have asked the Board for some changes in our Surveillance Network Program. We realize that you can't delete items because we still have to monitor zinc and lead. We can't just assume that we are going to continue to do well, but rather to change the frequency with which we monitor them to reflect the fact that these are two elements that we have well in hand.

That concludes my presentation. Mr. Chairman I will turn it back to you.

MR. NICKERSON: Thank you very much Mr. Connell for a very professional, very helpful presentation. Now I will open the Hearing for questions to be addressed to the Applicant. After that we will break for lunch. So I would now invite anyone who wants to ask questions of the Applicant if they would like to come forward to the microphone. Are there are any Board Members with questions?

MR. LEVERT: Mr. Chairman, Members of the Water Board. My name is Dan Levert with the City of Yellowknife. I have a very simple question. Will the Applicant have an opportunity to respond to any of the submissions that are made this afternoon?

MR. NICKERSON: Yes they will. They will have the opportunity to speak when you speak or shortly thereafter and they will also have the opportunity in their final wrap up to reply again.

MR. LEVERT: Very good. If they will have a chance to respond to the issues we will be raising then, there is no

need to ask questions at this stage.

MR. NICKERSON: That is correct.

MR. MCDONNELL: My name is Kevin McDonnell and I am with Water Resources. In looking at your charts I noted that in 1992 your ferric arsenic ratio was the lowest that it had ever been and yet your arsenic removal was not a efficient as it had been in previous years. Would not an increase in the ferric arsenic ratio further improve your effluent quality more than just below licence limits?

MR. CONNELL: Not necessarily. Looking at the tons of ferric sulphate that was added that year was the highest ever. It was actually higher and what we were dealing with was larger incoming concentrations of arsenic so not necessarily would the high ratio of ferric arsenic done it. We have stored geometrically well above the level that is required to precipitate the arsenic. We don't need to hold these five and six pounds per pound of arsenic. So our driving force to do that is there. We have sufficient driving force to make sure that we are eliminating the arsenic.

A number of other factors always come in to play and I don't pretend to even understand myself why one year is slightly different than another year. We are dealing in averages here and so other factors come in to play. It was not a matter of just trying to save ferric sulphate because actually our ferric sulphate consumption that year was higher than in previous years. So no, it will not necessarily follow that by just raising the ratio we would have done better.

MR. MCDONNELL: Thank you. Thank you Mr. Chairman.

MR. NICKERSON: Are there any more questions of the Applicant?

MR. WITTEMAN: I have one question that deals with the water that gets into the Mine itself. You are talking about something in the order of 700,000 cubic metres per year getting in the Mine. Is that actually the amount that is leaking in or is that the amount including something that you pumped down for drilling purposes or mining purposes?

MR. CONNELL: I believe that is the amount of groundwater that is being done by difference. It is deducting off the

amount of water that we are pumping into the Mine for usage ourselves and by difference it is the calculation of what inflow has come out of the rock as groundwater movement into the Mine. So it does not include the water we have pumped down into the Mine. That is already included in the freshwater drawn off of Great Slave Lake. That is metered back at the pumphouse.

MR. WITTEMAN: So the water that is leaking in, that comes from on the property itself? There is some question of whether it is coming from Great Slave Lake or do you have any idea of where this water is coming in to the Mine?

MR. CONNELL: I am sure it is coming from Great Slave Lake. It is coming from the groundwater table that surrounds the Mine. We are so close in proximity to the lake that I am sure our groundwater regime around the Mine is tied someway to Great Slave Lake itself. But it is basically the water that is coming in through every fracture and opening you make in the rock. There is some degree of water that will run from the groundwater table as you make an opening below the groundwater. I am sure our groundwater

table is tied to the Lake.

MS. JOHNSTON: What is the chemistry of the groundwater relative to the licence limits or relative to the water that is going into the tailings pond? You were speaking of treating it separately perhaps.

MR. CONNELL: It is contaminated. We have contaminated it by - a lot of our contamination in dealing with our groundwater right now is due to in-leakage from our Northwest Tailings Pond. We have a significant volume of water that is in-leaking back into the Mine on top of us from the Northwest Tailings Pond which is going to make treatment of this water almost identical to treating effluent. We shouldn't otherwise see cyanide anywhere in the minewater and we do see concentrations of cyanide in our minewater. We do know it comes from the Northwest Tailings Pond as we were able to track it back to that spot. We do have some plans in place to try and seal up that area because we would like to mine under the Northwest Tailings Pond in the future and obviously we cannot send people to work in an environment where this is coming down on their head. So we do have a contaminated water

source that we have to deal with that is coming from our own industry.

MS. JOHNSTON: Thank you.

MR. NICKERSON: Mr. Witteman.

MR. WITTEMAN: These arsenic stopes. These are dry, these are frozen, there is no water leaking into them?

MR. CONNELL: The ones that we have seen, I haven't personally seen them completely, but the ones that we go down into, they are dry. The one that we are actively in has some water seeping in. Now when we are actively filling it, we are taking compressed air from surface and pneumatically conveying this arsenic into the stope. So we have pushed the permafrost back in that stope that we are now actively filling. The heat we are inputting into that stope will cause the permafrost to move back into the walls away from us so we do have some seepage and we do pick up the water that comes from that stope and bring it back into our minewater system, back up to the tailings pond and treat it.

When we are finished filling that stope we take the outside air for a full winter season and run it down into that stope to again try to freeze the part we put back into it to compensate for that heat input we have made into the ground and allow the permafrost to reestablish itself. Permafrost will reestablish itself over very long periods of time so we are helping it to reestablish by using cold winter air. In the active stope yes, we do have some arsenic water. The water the comes from that stope is higher in arsenic and has to be collected and treated.

MR. WITTEMAN: Do you feel that one year of cooling this stope is enough to reestablish the permafrost on a continuous basis?

MR. CONNELL: I haven't studied that issue so I really can't speak to it with any degree of certainty. I would have to ask others from their experience and these are some of the things we should be addressing in the studies with Water Resources.

MR. WITTEMAN: Now do you have access to all these stopes?

MR. CONNELL: Yes we do.

MR. WITTEMAN: What is your inspection of these stopes?

MR. CONNELL: I don't know the frequency of inspections, but there is a periodic inspection of the stope. They all have a concrete bulkhead designed to withstand pressure in both directions from a hydraulic head, but they all have an access plate to the stope so we can access to the stopes. They are inspected more than once per year. I can't tell you the actually frequency.

MR. WITTEMAN: Okay. I have one more question on the length of the Licence. You say you want to do your capital planning ten years in advance. What is the difference in your capital planning between a five year versus a ten year.

MR. CONNELL: It is security of tenure. Take your own personal situation at home. You like to plan where you are going to be somewhere down in the future so that when you make an investment decision do you amortize it over a five year period or do you amortize it over a ten year period? By having

tenure of security at the site you can do that amortization over a longer period of time. As a result, your economic decisions can vary. That is the reason.

In answer to your other question, Terry informs me that he thinks the arsenic stopes are inspected monthly.

But it is basically to allow us to do this planning of capital and returns on your capital into the Mine.

MR. JESSIMAN: Good Morning, David Jessiman, DIAND. Since you are asking the Water Board to grant a ten year Water Licence, and tying into the number of spills that may have been caused from the mill which I believe from May, 1987 to 1992 you're estimating between 10 and 30% of these spills may have originated from the mill, I was just wondering if you may have any ideas and suggestions on sort of a proactive response to prevent any spills from escaping the mill and related facilities from actually entering Baker Creek or potentially getting into Great Slave Lake?

MR. CONNELL: I don't think there has been a change in the frequency of spills from the mill due to its age. These are things that traditionally have happened with time. Generally a spill in the mill is when a piece of equipment has failed. A pump fails, a pump box overflows or generally someone hasn't been there at the precise moment to catch it. We have sumps in the mill which deal with those. Those sumps have the same integrity, they haven't changed. What we have now put in place is a second line of defense so that if a spill goes on and on and a sump overflows, we now have these sumps located within the drainage pattern of the plant so that we can intercept them before they reach Baker Creek.

I don't want to leave you with the impression that these are due to the aging of the plant or anything. I don't think there's any change in the frequency of spills. As a matter of fact, if anything, I think with time and employee recognition of the importance of controlling them and this comes with the environmental consciousness of all employees, all public safety, that we will see that under control. Especially with the

investigation that you and we now do. That says to that employee that we take this importantly. We are not just accepting this any more, that we are going to investigate every single incident. So I think ultimately we will gain some education that will help us in reducing these as well.

MR. JESSIMAN: To clarify that, you are not envisioning any additional measures to prevent spills from escaping the mill that may enter Baker Creek. Maybe as a point of clarification, I believe that the two containment sumps you are referring to are in fact reactions to spills that did escape the mill. So do I understand that you will not be adding additional containment structures or is it more of a response to spills?

MR. CONNELL: We have nothing that we are planning to do in the next two months. You are right, those two containment areas are a response to spills and we were charged for them. Things got out of control on us and following the investigations that is what was put in place to give us that second line of defense. I would think that if another problem came along that escaped our precautionary system

that we put in place that we would, through investigation, may find another technique that is needed to do it. We would be very pro in putting together those techniques to solve it. But I can't specifically give you a list of things that we are planning to do today. But I am also not telling you that if something happens tomorrow and the investigation says that we should do this, that we won't do it.

MR. JESSIMAN: I am just wondering if you would be able to comment on the integrity of the mill foundation, walls and sumps and what sort of maintenance and internal investigation you would do to ensure that all of the mill effluents and solutions are retained within the mill and the waters being contained and going through the mill system as it is intended to do.

MR. CONNELL: The mill is a concrete foundation mill. The sumps are all concrete. The inspections that are done on those are all eyeball inspections of the concrete looking for obvious fractures and cracks. We don't have a program of drilling through the concrete to do groundwater studies or anything below the mill.

We haven't done that nor do we have any logical reason why we should go to that extreme. The walls around the mill are a concrete foundation and then a wooden structure built on top of that concrete. Again, those are visually inspected for breaks and fractures. We have had some of those concrete structures that have been found to crack and have been subsequently repaired by pouring additional concrete to buttress those. This is on ongoing maintenance program that is done by eyeball. It is not a formal inspection program. It is done by the mill operational staff.

MR. JESSIMAN: Thank you.

MR. NICKERSON: Is there anyone else who would like to ask questions of the Applicant?

I have one question. When a licence is up for renewal the Board usually looks at the amount of the security deposit. Currently I believe the Giant security deposit is $200,000. I wonder if you have any representations to make with respect to the security deposit?

MR. CONNELL: We understand the need for the security deposit. We would like to see the security deposit held where it is because it is a cost factor to us. It is us tying up money that we no longer have access to, but we understand why the Board has in place that security deposit. What I can say to you, is that in Royal Oak's planning for Abandonment and Restoration, we perceive that we will receive through the dismantling and selling of the assets, that we will generate several millions of dollars worth of salvage value. That money is fully allocated to the Abandonment and Restoration. That is where all that money will be going into. It is not going to be taken away by the Company. It is fully allocated to that and we will likely even have to supplement that. We would ask that the deposit stay where it is but we also recognize the situation the Board works within.

MR. NICKERSON: Thank you very much. If there are no further questions of the Applicant, we will adjourn for lunch and resume at 1:15 pm.

[LUNCH BREAK]

MR. NICKERSON: It is now 1:15 and we will reconvene this Public Hearing. The next stage of the proceedings is a presentation on behalf of the Department of Indian Affairs and Northern Development and I would accordingly invite Mr. Kevin McDonnell and Mr. David Jessiman to come forward to make their presentation.

MR. MCDONNELL: Thank you Mr. Chairman. My name is Kevin McDonnell. I am the Head of the Regulatory Approvals for the Water Resources Division. Sitting beside me is Mr. Dave Jessiman, the District Water Resources Officer for the Yellowknife District of the Northern Affairs Program.

To start I would like to read into the record the Introduction and the Environmental Screening and then Mr. Jessiman will read in the Compliance Report. After that, I will finish our intervention with a discussion.

1.0 INTRODUCTION:

This submission on the renewal of a water licence for Royal Oak Mines Inc. - Yellowknife Division,

Giant Mine is presented on behalf of the Northern Affairs Program, Indian and Northern Affairs Canada. It contains a report on Royal Oak Mines Inc. compliance with the terms and conditions of it's Water Licence NIL3-0043 since the last renewal of April 1, 1987, and a discussion of aspects of the mining development which may be regulated under the Northern Inland Waters Act.

2.0 ENVIRONMENTAL SCREENING:

Pursuant to Section 10(1) of the Environmental Assessment and Review Process Guidelines Order (1984), Indian and Northern Affairs Canada has conducted an environmental assessment and screening of Royal Oak Mines Inc. - Yellowknife Division, Giant Mine Water Licence renewal application submitted to the Northwest Territories Water Board.

It is the Department's decision that the potentially adverse effects and/or public concerns are mitigable with known technology and the application may proceed through the licensing process. Additional government and public concerns may also be raised at the Water Board's Public Hearing and it is anticipated that these concerns

will be addressed during licence preparation.

MR. JESSIMAN: **3.0 COMPLIANCE REPORT:**

This compliance review covers the period from April 1, 1987 to December, 1992. During this period, certain changes occurred with the ownership of the Mine, hence the holder of the Water Licence who was responsible for compliance changed. In 1986, Giant Resources of Australia acquired the controlling interest in Giant Yellowknife Mines Limited from Falconbridge Nickel Mines Limited. Subsequently in November of 1990 this controlling interest was sold to Royal Oak Resources Ltd. In July of 1991 Royal Oak Resources Ltd., Giant Yellowknife Mines Limited, Pamour Inc., Pamorex Minerals Inc., and Akaitcho Yellowknife Gold Mines Limited were amalgamated into a new corporate entity called Royal Oak Mines Inc. This compliance review does not differentiate between the different owners but simply refers to the holder of the Licence as the Licensee.

The following is a summary of the detailed compliance report attached as Appendix 1 to the departmental submission.

Except for a few problems with the late payment of water use fees and security deposit, the Licensee has been in compliance with the General Conditions, and with the Conditions Applying to Water Use.

With respect to Conditions Applying to Waste Disposal, all mill tailings and sanitary waste waters were discharged to the tailings ponds. Tailings were initially discharged to the Northwest Pond in November of 1987. In 1992, the Licensee began discharging tailings to the North Pond. Treated effluent from the tailings ponds was discharged to Baker Creek.

In 1987, total residual chlorine levels in the effluent became elevated, however no determination could be made as to the cause of these elevated levels. Also in November of 1987, the Licensee occasionally violated licence limits for total cyanide, copper and nickel. These violations were attributed to the operation of the effluent treatment plant late in the season when cold temperatures reduced the effectiveness of the treatment system.

The Licensee changed the effluent treatment process from alkaline chlorination to hydrogen peroxide in 1988. This conversion was done because it was considered to be cost effective and was a more widely used technology for the treatment of cyanide bearing wastewaters at gold milling operations. It was also thought that the conversion to a hydrogen peroxide system would address the problem of elevated total residual chloride levels in the effluent, which turned out to be the case. No effluent was discharged in 1988. During this period the Tailings Retreatment Plant was constructed, which was built to recover gold from tailings. It operated for two years before it was permanently shut down.

During 1989 the effluent quality was within licence limits for all parameters except total copper, when the maximum average concentration was marginally exceeded once.

In March of 1990 the Licensee doubled the Effluent Treatment Plant throughput. This was done to treat the waste generated from the Tailings Retreatment Plant and the tailings solution not treated in the

summer of 1988.

Subsequent to the doubling of the Treatment Plant throughput, the Licensee had a number of violations of their licence limits. The violations were attributed to start-up problems where the Licensee was learning how to operate the treatment system and how to effectively treat twice the volume handled previously. The Licensee reviewed the process system and implemented certain measures to improve its control of the effluent quality.

The Licensee was successful in improving their compliance with effluent quality limits for 1991 and 1992, as only one violation was noted in 1992. This occurred when the maximum average concentration for total arsenic was marginally exceeded due to a high value reported on the last day of operation of the Effluent Treatment Plant.

Only one problem was noted with Conditions Applying to Modifications. In 1992 the Licensee failed to notify the Board of their plans to remove material from the downstream face of Dam 2.

The Licensee has had 59 spills since 1987. Approximately 70% of the spills resulted from tailings line breaks and from incidents within the Mill. The Licensee was charged by the Department of Indian and Northern Affairs Canada under the Northern Inland Waters Act for five unauthorized discharges of waste that occurred in 1987, 1988 and 1991. The Licensee plead guilty.

Some problems had been noted with the Licensee's fuel handling and clean-up techniques and these have been identified to the Licensee.

Compliance with the surveillance Network Program attached to the Licence has generally been satisfactory, except for problems with the quality of analysis from the in-house laboratory at Giant Mine. The Licensee has reviewed and adjusted their analytical practices which has appeared to solve this problem.

Although the Licensee has had some problems complying with the terms and conditions of their Water Licence, overall compliance has been satisfactory. It appears that the compliance

problems noted above relate to poor monitoring of their processes and the need for a more proactive approach to the operation of the waste treatment facilities, and when dealing with Regulatory Agencies. It should be noted that when the Licensee experiences compliance problems, they generally respond in a prompt and cooperative manner.

MR. MCDONNELL: **4.0 CONDITIONS APPLYING TO WATER USE:**

In December of 1988 the Licensee applied for and received an emergency amendment to their water licence to increase their authorized water use from 1,950,000 cubic metres to 2,352,914 per year. This amendment was required as a result of the high water consumption by the Tailings Retreatment Plant, and to account for increased minewater generated due to seepage from the Northwest Pond to underground. No concerns were noted with this amendment and since the Tailings Retreatment Plant had been shut down and the seepage from the Northwest Pond had been reduced, no further amendments were necessary.

Royal Oak Mines Inc. has requested that the maximum allowable consumption of water be maintained at

1,950,000 cubic metres per year. **The Water Resources Division feels that the use of this volume of water will not result in any significant environmental impacts, but recommends that Royal Oak consider the recycling of water to encourage water conservation.**

5.0 CONDITIONS APPLYING TO WASTE DISPOSAL:

Since their last licence renewal, the Licensee has completed several modifications to their effluent treatment plant. In 1988, the Licensee converted the effluent treatment plant from Alkaline Chlorination Treatment to Hydrogen Peroxide Treatment. In 1990, the plant capacity was doubled to approximately 18 m^3/min, using two parallel circuits.

As noted in the compliance review, these modifications have had an impact on the quality of the effluent discharged. However, when reviewing effluent quality data from the past two years, it appears that the Licensee has been able to work out the start up problems, and has better control over the effluent quality. The Water Resources Division believes that the licence limits may have been

appropriate considering the upset conditions the past modifications had caused, however these limits and the current treatment process should now be re-evaluated.

Royal Oak has requested that the current effluent quality requirements be maintained. **The Water Resources Division recommends that the Board require Royal Oak to assess their effluent treatment process with the intention of improving the effluent quality. The objective would be for the maximum average concentration of total arsenic and total copper in the effluent to be at or below 0.5 mg/l and 0.3 mg/l respectively.**

The Water Resources Division recommends that the effluent quality be improved for the following reasons:

The closure of the Tailings Retreatment Plant means that fewer contaminants have to be treated by the Effluent Treatment Plant. Since less contaminated water has to be treated, processing of the effluent should now be easier and less costly in terms of reagent requirements.

When assessing effluent quality and the need for improved treatment, the Water Resources Division considers where the effluent is being discharged to and the extent to which low levels of contaminants are diluted to background levels.

The Licensee discharges their treated effluent into Baker Creek usually from May to September. Baker Creek then drains into Back Bay near the Giant Marina. The Water Resources Division has reviewed the flow rates of Baker Creek and the effluent quality data to determine how much dilution occurs in Baker Creek and where background levels of metal contaminants are reached.

The Division found that the effluent is partially diluted in Baker Creek during the spring snowmelt, but there is little dilution in the late summer. This means that higher than background levels of metals are entering Back Bay, with increasing concentrations towards late summer. Due to the complicated mixing dynamics of Back Bay, it is unknown how the mixing occurs in Back Bay and where background levels are reached.

The Water Resources Division is concerned that the area where Baker Creek discharges is used as a recreational area, and the surrounding area is heavily populated.

Since there is little known about the mixing of Back Bay, the Water Resources Division can only assume that if the Licensee was able to improve the effluent quality being discharged to Baker Creek, the contaminant loading to Back Bay would be reduced. It is important to reduce the contaminant loading to Back Bay as much as possible considering this is a recreational and residential area.

Giant Mine's effluent treatment system is very similar to Nerco Con's system, with the main difference being the settling of suspended solids in the effluent. Giant uses two settling ponds while Nerco uses a clarifier. A review of Nerco Con's Surveillance Network Program water quality data shows that Nerco can consistently meet their licence limits of 0.5 mg/l for total arsenic and 0.3 mg/l for total copper. Royal Oak Mines Inc. should assess their treatment system to identify how they may also improve effluent quality.

There should be consistency in licence limits especially when two mines are in such close proximity to each other and are both discharging into the same waterbody.

The Water Resources Division also believes that it is technologically feasible and practical to improve the treatment process. Royal Oak will need to evaluate the current process and some suggestions to consider are:

- increasing retention time in the settling ponds;
- reducing the plant throughput;
- adding a clarifier, and/or increasing reagent usage.

Currently, Royal Oak is required to sample and analyze the effluent being discharged to Baker Creek weekly. **The Water Resources Division recommends that the Board require the collection and analysis of composite samples on a 24 hour basis and to use a four day average to determine the Maximum Average Concentration (MAC).**

The current once per week sampling and analysis provides data that poorly represents the effluent quality. More frequent sampling is required especially with the large flow of water being treated (approximately 160,000 m^3 per week).

A grab sample is appropriate when the water being sampled is known to be fairly constant in composition over a period of time. Effluent quality from a water treatment plant has the potential to be highly variable if not closely monitored. Composite sampling is most useful when assessing the efficiency of a wastewater treatment plant. It is also an alternative to the separate analysis of a large number of samples followed by the computation of average and total results. The 24 hour period is considered standard for most determinations, as referenced in the Standard Methods for the Examination of Water and Wastewater, 1989, 17th edition.

A four day average for the Maximum Average Concentration (MAC) would allow for a response to upset conditions in the plant. Less than four days might result in a record showing too numerous

violations when in fact compliance had generally been good, while more than four days would result in the "smoothing" of violations which ought to be subject to scrutiny.

These requirements would also be consistent with Nerco Con's Water Licence.

At this time, the Northern Affairs Program would like to take this opportunity to inform the public and the Board of a study currently being undertaken in Back Bay and Yellowknife Bay.

Early in 1992 the Yellowknives Dene Band wrote to the Board to state that they were concerned that as a result of the Mine's operation, the water, sediment and fish in Back Bay may be contaminated. The Board referred this request to the Department of Indian and Northern Affairs Canada, for further assessment as a study under the Arctic Environmental Strategy Program.

During the summer of 1992 the Department of Indian and Northern Affairs Canada, in conjunction with the Yellowknives Dene Band, the Dene Nation, the

Metis Nation, the Department of Health, GNWT, the City of Yellowknife, and the Department of Fisheries and Oceans initiated a joint study.

Samples of water, sediment and fish were collected in August and September of 1992 and are in the process of being analyzed. The results will be made public, once the analysis has been completed.

6.0 CONDITIONS APPLYING TO CONTINGENCY PLANS:

Royal Oak's Contingency Plan was approved by the Board on November 6, 1992. However the Northern Affairs Program has recently completed a review of the number of spills that have occurred since April 1, 1987, which resulted in mill and tailings solutions escaping from the mill. **As a result of this review, the Water Resources Division recommends that the structural integrity of the foundations, walls, and sumps within the mill, as well as outside containment sumps be assessed, and improvements implemented to prevent spills from entering Baker Creek.**

7.0 CONDITIONS APPLYING TO ABANDONMENT AND RESTORATION:

The Board approved Royal Oak's interim Abandonment and Restoration Plan on November 26, 1992 but identified a number of items that require further assessment and which may necessitate revisions to the A&R plan.

To ensure that Royal Oak considers some important factors when updating this plan and initiates these studies in the near future, **the Water Resources Division recommends that the following studies be identified when developing the Water Licence Terms and Conditions for Abandonment and Restoration:**

a) **Royal Oak should evaluate the acid rock potential of the tailings areas, open pits and waste rock areas. The results of the study, including a discussion of any changes to the Abandonment and Restoration Plan that may be necessary should be submitted to the Board for approval.**

Only a cursory evaluation of the acid rock drainage potential at Giant Mine had been done in the past. Since ore and waste rock composition may change as mining progresses, and milling and tailings disposal practices may also change, the acid rock drainage potential may be significantly different than what it was back in the 1980's when it was last assessed.

b) Royal Oak has indicated that at abandonment they will cover the tailings with three feet of waste rock to promote the formation of permafrost. It is expected that the permafrost will immobilize any contaminants in the tailings and prevent acid generation from occurring. Since the use of permafrost as a restoration technique is unproven, **the Water Resources Division recommends that further study should be done to verify that permafrost will form in the tailings and to assess the effectiveness of the proposed covering to encourage and maintain permafrost formation.** Royal Oak may consider establishing study plots of tailings, with different types and

thicknesses of cover material. The formation of permafrost in these plots can then be monitored by the use of thermistors or frost gauges.

c) **The Water Resources Division recommends that the underground arsenic storage vaults should be monitored to ensure that they remain frozen.**

Royal Oak Mines Inc. disposes of arsenic bearing material to underground storage vaults where the material freezes and is therefore prevented from being mobilized. To ensure the material freezes and remains frozen, some type of ongoing temperature monitoring such as by thermistors or frost gauges should be conducted, which provides data upon abandonment.

d) **A soil and surface water contamination study should be conducted by Royal Oak Mines Inc. to identify zones of contamination within and surrounding the property. The results of this study and proposed mitigation should be**

submitted to the Board for approval.

The Water Resources Division is concerned that areas where spills have occurred may remain contaminated even after the spilt material has been cleaned up. These contaminants may then be mobilized with surface water runoff and flow untreated into the surrounding waters.

e) In 1988, Trapper Creek was diverted around the perimeter of the Northwest Tailings Pond. It had been noted during that spring that high runoff was causing erosion problems at the middle third of the diversion. In 1991, high runoff again caused erosion problems in this area, therefore **the Water Resources Division recommends that the Board require Royal Oak to investigate this erosion problem and to implement mitigative measures.**

The Water Resources Division is unaware of any measures established by Royal Oak Mines Inc. to finance restoration upon abandonment. **The Water Resources Division recommends that the Board require Royal Oak to identify measures as to how**

they will finance restoration.

8.0 RECOMMENDED LICENCE TERM

Royal Oak has indicated in their submission that they do not anticipate having to construct any new tailings disposal facilities during the next five year period. This intervention has also recommended a number of studies that should be completed within five years. **The Water Resources Division recommends that the term of the Licence be five years to allow for a public review of the studies and plans of Royal Oak Mines Inc.**

9.0 SUMMARY

Throughout this intervention we have identified a number of concerns that Royal Oak Mines Inc. should address. We would like to note that Royal Oak Mines Inc. has recently been working cooperatively with Government Agencies and the Board. This became evident with Royal Oak's submissions of their Contingency and Abandonment Plans. While these plans may require some further work, they are generally well thought out and presented. They have addressed many concerns that had previously been noted and Royal Oak Mines Inc. should be commended

for this effort. The Northern Affairs Program hopes that this spirit of cooperativeness will continue. Thank you.

MR. NICKERSON: Thank you very much Mr.McDonnell. Are there any questions of the presenter? We will also entertain questions or comments from the Applicant at this time.

MR. CONNELL: I have some comments I would like to make in response, but will wait until after the questions.

MR. NICKERSON: We will see if there are any questions? Mr. Witteman.

MR. WITTEMAN: I have one question and it relates to page three of the submission where you state "only one problem was noted with Conditions Applying To Modifications". In there you mention Dam No. 2, where is this dam No. 2 located?

MR. CONNELL: Damn No. 2 is the dam on the North Pond, the one where the tailings have been removed for retreatment. So the structure basically had no tailings standing against the face of it and that

left an unstable structure.

MR. WITTEMAN: This is what you mentioned earlier.

MR. CONNELL: That is what I was talking about earlier. The borrow material was removed from it and it was used in construction elsewhere. We should have notified the Board of what we were doing at the time and we did not. That was an error on our part. It is the original structure that held tailings in the North Pond.

MR. NICKERSON: I have a question, something that I would like a little bit of an explanation from both from the Department of Indian Affairs and Northern Development and also from the Applicant. When we are talking about the various effluent criteria, there wouldn't seem to be any real technical problem with anything other than arsenic. In the Applicant's presentation it showed that they are up against the existing limit of .8 which of course is quite high in comparison with any other water licence issued by the Board. The recommendation from the Department of Indian Affairs and Northern Development is that, that be reduced to 0.5 m/L. I

would entertain comments respecting the technical feasibility of reducing that.

MR. MCDONNELL: One point to note is that it is, as Larry pointed out, a very complex treatment system. I think the whole system would have to be evaluated to see the feasibility of improving the effluent quality. We did note, in comparison with Nerco who are able to meet consistently lower limits, that they do have some differences. As I pointed out in the intervention, the clarifier was one of the main differences. There certainly may be avenues for other improvements such as a longer retention time to allow for further settling or other aspects like that. We don't suggest in here that the limits have to be dropped below right away. I think it would require some assessment from both Royal Oak's side and perhaps our side to see what the technical difficulties would be to have better effluent quality.

MR. CONNELL: I should probably cite some history on that. When we first did the work with Environment Canada and the colloidal Program back in 1976, that program showed that 0.5 was going to be an achievable

target. The very first Licence that was issued to Giant had 0.5 as the licence limit for arsenic. Subsequently through the years of operation of that plant, we had to come back to the Board when we realized that we could not achieve 0.5 and had to ask the Board to raise the level at that time. This is not an issue that is coming back for the first time. So that is some history. We have always had this problem. The two ore bodies are treated differently in that we have to roast our entire ore and thus are breaking up the mineral matrix of arsenopyrite. So we are liberating more arsenic and consequently we have more difficulty in removing the same concentrations, even though we use very similar processes for removal of that concentration.

The difference between the use of a clarifier and our settling ponds really will not address the problem of arsenic in solution. In actual fact the Con Operation uses a clarifier to remove it and as a result the Board has, in the Con Licence, they have higher suspended solid allowances because they don't have these downstream polishing ponds. We understand that, that is the nature of the

difference between the two operations. By us having the natural advantage of having the two settling ponds we are able to actually do a better job of removing the fine colloidal precipitate material. So our problem is not so much removing the fine colloidal material as it is in chemically transferring the arsenic from the water phase into something that is ready to precipitate. That is where our chemical history problem comes in. We have been unable to chemically induce that additional difference between 0.8 and 0.5 on a consistent basis.

As you saw on some of the graphs that we presented earlier with the iron to arsenic ratios, at times we have taken the iron to arsenic ratio to very high levels and still did not achieve 0.5 on a consistent basis. If you go back two or three years ago, we had some very high ratios of iron to arsenic where we really pushed that ratio trying to drive the arsenic down and still did not achieve it on a consistent basis.

Like I said earlier, we don't know technically what we would have to do at this point in time to

achieve consistently 0.5. We strive to get there but we do not make it. I do not know of any technology that I could use to put into play today that could achieve it on a consistent basis. That is the only criteria that we are basically arguing on is the arsenic level.

MR. NICKERSON: Are there any other questions of the Department of Indian Affairs and Northern Development? Did the Applicant wish to make further comments on the presentation?

MR. CONNELL: Yes please, if I could. I have covered the issue of the arsenic to this point in time but one of the issues that I would like to address is this water sampling issue. The difference between the two mines and the frequency of water sampling.

Again, there is a difference between the two mines because of our physical differences. In the Con Operation the Effluent Treatment Plant treats the effluent and it is discharged immediately to the environment. So if there is an hour by hour change in that effluent treatment performance it is immediately impacting the environment. In the

Giant situation, the water coming out of the Effluent Treatment Plant goes into two subsequent holding ponds which give us in the order of in excess of seven days worth of capacity storage. This is why the Board originally set the frequency of monitoring at seven days or once per week because there is this mixing zone downstream so that hour by hour changes are absorbed in this mixing zone. In our actual performance in operating the plant we actually take our readings further upstream for our control of the physical operation and do this as quick rapid checks in order to make sure that we are adding the appropriate amount of peroxide and adding the appropriate amount of ferric sulphate.

The compliance monitoring is done strictly for the purpose of compliance monitoring. We actually do our own monitoring further upstream strictly as a control to control our Effluent Treatment Plant. Thus by increasing that frequency to once every day rather than once a week that would increase the quantity of work that our analytical lab would see by approximately seven times. So it is a significant amount of volume of work increase which

then translates into a cost.

I really don't see the cost benefit in that we basically have the seven day pond that allows the blending of these hour by hour changes. So there is a very consistent record of effluent coming out of that treatment pond because of the fact that it is a large polishing pond. It isn't something that varies rapidly. So that is why we would ask that the Board maintain the present sampling regime rather than increasing it to one per day.

The review of the structural integrity of the mill we have covered earlier today. Yes we did have spills since the beginning of the Licence that were released from the mill and that is what drove the installation of these containment systems as a second line to make sure that current spills will not have a chance of reaching Baker Creek. I think we have addressed that as a result of the spills that we have had over the life of this licence.

We have talked about the acid rock potential and we agree with Water Resources that it is applicable and correct that we should do some additional study

to clarify what we have in the way of a database on potential rock drainage.

The studies on permafrost in the tailings, again we agree with Water Resources that study is necessary in this area however we would like to point out our technique for covering is not intended to induce permafrost to come back into the tailings. That is not the intent. We are relying on this thin layering of material when you place tailings above the water line, for it to freeze during the winter months. The cover material at the end of the life is to replace the active zone of thawing that takes place each summer season. We are trying to put a cover material on so that we protect the material below that has frozen during the winter from actively getting into the active zone of thaw that takes place each summer season. It is not to try to induce permafrost to change. It is to try to maintain what we hope will be a frozen condition already.

I think there is some room to look at studying this further to advance our Abandonment and Restoration Plan. We understand that this is on ongoing plan,

that it is intended to put the ideas on the table so all parties can address them and to close in and make sure that the proposals that are being made for Abandonment and Restoration are technically feasible and correct.

With the underground storage vaults, we agree with Water Resources that it is suitable to look at thermistors in place to monitor them and to verify that the permafrost has returned into those areas, that the rock surrounding those areas is being truly frozen. We agree that we can do that sort of study work.

The same with the soil and surface water contamination study. We know of no troubles but this is something that we definitely can study and address.

The last one is identifying measures as to how we would finance the Abandonment and Restoration. While we are not putting away money now for restoration, we are a Canadian based company. We aren't going anywhere at the end of the life of the Mine. We are relying on the salvage value of the

Mine paying a large chunk of restoration costs. We don't intend to allocate that money for any other purpose. That is what it will be used for but we will also finance restoration from our ongoing costs. We believe also in the principle of doing some of that rehabilitation prior to the final day of closure and are acting on that even now.

I think that is sufficient for me at this point in time. Thank you.

MR. NICKERSON: Thank you very much Mr. Connell. If there are no further questions of the Department of Indian Affairs and Northern Development we would invite representatives of the Department of Fisheries and Oceans and the Department of the Environment to make their joint intervention.

MR. HARBICHT: I am Steve Harbicht with the Department of Fisheries and Oceans. Thank you for having us here. On my left is Sigfried Heinze-Milne who is representing Environmental Protection.

I will begin dealing with our intervention. I will not be reading it verbatim and will leave some

parts out in as far as the Department's mandate goes. That is addressed in the intervention and can be read at leisure. I will start with our introduction and do the presentation in total and then both of us will address questions as they come forth from the floor or from the panel.

Royal Oak Mines Inc., Yellowknife Division, has applied to the Northwest Territories Water Board to renew its Water Licence (NIL3-0043) for water use and waste disposal at the Giant Mine Site.

This submission is being made jointly by the Department of Fisheries and Oceans (DFO) and Environment Canada (EC) to emphasize our concerns in the following areas:

1. the allowable effluent quality limits, sampling frequency and environmental effects program associated with the waste discharge;

2. issues within the Abandonment and Restoration Plan which require further assessment. These are the establishment of a monitoring program for the arsenic trioxide storage vaults;

assessment and follow up action for old tailings outside of the existing tailings containment area; the potential for acid rock drainage from waste rock piles; erosion control on Trapper Creek and restoration of Baker Creek; and finally, duration of the Licence.

The recommendations presented in this submission may be modified as additional information is brought forward by the proponent or identified during the Public Hearing. Should new information be obtained, any changes to DFO's and EC's recommendations will be brought to the attention of the NWT Water Board.

I will skip through the next section and proceed to Section 4, Technical Comments and Recommendations beginning with the Effluent Quality Limits, Sample Frequency, and Effects Monitoring.

Impacts on aquatic ecosystems result mainly from the disposal of liquid wastes, therefore efforts to reduce these impacts must focus on controlling waste disposal. Using the average levels of

contaminants that were discharged into Baker Creek by Giant Mine, the following, the following meaning the Table below, shows the actual chemical loading to Yellowknife/Back Bay water bodies.

The year that was selected was 1991 at their Station 43-1 which discharges directly into Baker Creek. I won't go through those numbers, but as you can see, the numbers reflect the actual loading of the contaminants to the receiving water bodies.

These data indicate that there is substantial chemical loading occurring to the water of Yellowknife/Back Bay. Studies by Environment Canada prior to the last licence renewal showed that benthic invertebrates in Back Bay were significantly reduced by enriched concentrations of arsenic, copper, and other metals related to contaminants in the sediments. I have identified where that information can be found.

Both Yellowknife and Back Bays are known to contain valuable fish habitat and fish from both areas are used extensively by subsistence and recreational

fishermen, maybe that should be fishing persons. Because of the importance of these areas it is essential that the amount of contaminants entering Yellowknife/Back Bay be minimized. One step which can be taken to reduce the metal loading in Yellowknife and Back Bay is to ensure that the existing waste treatment systems at the mines on Great Slave Lake are operating at their maximum efficiency. Regulators should ensure that effluent limits are set at a stringent enough level so that the operator will be required to make full use of the existing treatment technology and achieve maximum efficiency with that technology.

Currently Giant Mine is allowed to discharge higher levels of contaminants than other mines in the same area, using similar treatment technology. Table 1 lists the comparative levels associated with two mines, Giant and Nerco and also identified the CCME Water Quality For The Protection Of Aquatic Life.

There is a slight amendment to our submission that most people have not had and I will read it in as we have it now. It is recommended that the Northwest Territories Water Board should consider

adjusting Giant Mines Effluent Quality Discharge Limits to ensure that the Canadian Council for the Ministry of the Environment (CCME) "Guidelines For The Protection Of Aquatic Life" values are recognized in the surrounding environment.

Giant Mine's SNP sample frequency for heavy metal levels in waste discharged to Baker Creek is once per week at Station 43-1. This level of monitoring does not provide sufficient lead time to identify problems that may develop within the treatment plant. For example, from 07 August 1990 to 18 October 1990, copper values did not exceed the allowable maximum concentration for any grab sample for a period of eleven weeks, however the maximum average concentration, which requires four grab samples to develop its value, exceeded the allowable limits for seven of those weeks. The first indication that this value exceeded licence limits did not show up until after the analyses of samples obtained during the fifth week. Because of this sampling schedule, five weeks of discharge went into Baker Creek before the licence limits are exceeded and the problem is recognized. This frequency of sampling allows for a large volume of

water where contaminants are above licence limits to be discharged to the receiving environment.

Our recommendation's are: Department of Fisheries and Oceans and Environment Canada recommend that Giant Mine's effluent quality discharge limits be reduced to reflect the demonstrated levels of treatment that can be achieved with its existing treatment facilities. At the very least these levels should not exceed the levels which have been assigned to other mines that operate within the same area.

Two, there should be a program of environmental effects monitoring, both chemical and biological, to ensure detrimental impacts on fish and man's use of fish do not occur.

Three, the SNP sampling frequency during periods of discharge from the effluent treatment plant should be changed to a minimum of once per day. This will allow more effective monitoring of operational problems which may develop with the process and will allow the implementation of corrective measures before the effluent reaches Baker Creek.

Now on to Abandonment and Restoration. The most recent Abandonment and Restoration Plan received from Royal Oak Mines Inc. outlines several abandonment scenarios, however the DFO/EC Intervention relates only to the final abandonment of the Mine. Areas which require further attention by Royal Oak Manes Inc. are as follows:

Arsenic trioxide is stored in underground vaults at the Giant Mine, with the intent that the material will be permanently stored underground and eventually frozen in the permafrost. However, no monitoring studies have been conducted to determine whether this will occur. Royal Oak Mines Inc. should establish a monitoring program to ensure that the arsenic trioxide will freeze in situ.

Surface waste rock dumps and tailings containment areas exist throughout the mine site. The Acid Rock Drainage potential of waste rock piles was evaluated in 1981. Since then, Giant Mine has used this information to extrapolate the ARD potential for all additional waste rock piles. Because the geology of the ore deposit and host rock will change depending on which area is currently being

mined, ongoing evaluations should be conducted on each geological unit to determine the potential for ARD.

There are several tailings containment areas located on the Giant Mine Lease. The Abandonment and Restoration Plan indicates that upon abandonment the tailings containment areas will be covered and permafrost will be allowed to penetrate the areas, thereby permanently sealing the tailings. No evidence has been provided by Royal Oak Mines Inc. that freezing will occur throughout the tailings containment areas. Since Yellowknife falls within a region of discontinuous permafrost, Royal Oak Mines Inc. should undertake a monitoring program to determine the effectiveness of permafrost as a measure to permanently seal the tailings.

The Abandonment and Restoration Plan also does not address the clean up of two old tailings sites which lie outside of their existing control structures. The first is located along Baker Creek, just downstream from Trapper Creek confluence; the second site is located on the shoreline of

Yellowknife Bay. Information on the volume of tailings and contaminant levels in these two sites is limited. However, an abandonment plan for these sites should be developed to ensure no further contamination of the environment occurs.

With the development of the Northwest Tailings Containment Area, Trapper Creek's channel has been altered and this has subsequently caused downstream erosion. Gully erosion of clays and silts from the Trapper Creek diversion channel has resulted and sedimentation is ongoing into Baker Creek and into Yellowknife/Back Bay. The resulting infilling behind the causeway located in Yellowknife Bay provides evidence of the extent of this erosion. The Trapper Creek channel should be re-stabilized to prevent impacts on downstream fish habitat in Yellowknife/Back Bay.

Royal Oak Mines Inc. suggest that Baker Creek will be restored by removing culverts and leaving the rest as is. The historic channel of this creek has been modified to such an extent that any fish habitat that existed before has been lost and to leave it in this state will provide very little

fish habitat. Further evaluation should be considered to ensure that fish will be able to return to this watershed once mining has ceased. Further degradation of the stream channel should not be considered unless fish habitat rehabilitation is proposed.

RECOMMENDATIONS

1. A thermal monitoring program be established on all underground arsenic trioxide storage vaults to establish the normal mean temperature associated with each site.

2. An Acid Rock Drainage (ARD) program be established to evaluate all rock types that are being mined by Giant either as waste rock or tailings. Procedures developed by the British Columbia Acid Mine Drainage Task Force in the report entitled "Draft Acid Rock Drainage Technical Guide Vol. 1" should be considered.

3. A monitoring program should be established to address the potential for permafrost to move into the tailings mass and to establish the

required amount of overburden to ensure that the tailings remain intact.

4. A program should be established to evaluate the contaminant levels, acid production potential and leaching capabilities associated with the two old tailings disposal sites and an appropriate abandonment plan be developed.

5. An assessment of Trapper Creek be conducted and an erosion control design be developed to decrease the ongoing erosion to acceptable levels of Total Suspended Solids.

6. Further evaluation of Baker Creek should be considered to determine the extent to which this watershed could be rehabilitated to support fish life.

The final section within the intervention deals with Licence Duration. Royal Oak Mines Inc. has requested a licence renewal period of ten years. Within its submission it was identified that there will be no major changes to its operations, but Royal Oak Mines Inc. have also stated that it has

current storage capacity for tailings of another five (5) years. The other aspect which requires consideration is that if the proposed stage 2 of their Abandonment and Restoration Plan comes into effect which is custom milling of off site ore, it will introduce a new level of concerns that will require review and assessment.

Therefore, our recommendation is that the Licence duration be limited to five years.

That concludes our intervention Mr. Chairman.

MR. NICKERSON: Thank you very much Mr. Harbicht. Are there any questions of the Department of Fisheries and Oceans or the Department of the Environment? Mr. Witteman.

MR. WITTEMAN: On page three of your intervention you have a table and the total loading to Yellowknife/Back Bay for each of those parameters. Is that based on the limits set in the Water Licence or is that based on the actual data coming from the Mine itself?

MR. HARBICHT: Those numbers were based on the actual data provided by the Company within their submission, taken directly from their submission.

MR. WITTEMAN: I have another question related to your program for environmental effects monitoring. As you know there is a program presently underway to look at Yellowknife/Back Bay where fish, water, and sediment are being collected under the Arctic Environmental Strategy Program. Does this in part or in whole address this environmental effects monitoring or what are Environment Canada and the Department of Fisheries and Oceans looking for in this environmental effects monitoring?

MR. HARBICHT: To address the first part of your question - the study that is ongoing now will certainly provide some answers to what the state of the environment is at the moment. I think where we feel the mining company has to come into it as well, is the long term, dealing with the loading that goes on to the environment. Some assessment should be done on a continual basis to see if there is any fates and effects to the environment over the duration.

MR. WITTEMAN: How far would this extend then into Back Bay, Yellowknife Bay? Do you see it at where Baker Creek empties into Back Bay or do you expect it to go all the way out to Dettah or where?

MR. HARBICHT: Because of the water regime associated with Back and Yellowknife Bays I don't know if we can actually establish the extent of the monitoring program. I think with what the existing program may show, that might define the region that has to be looked at. Sediment quality analysis may indicate to what extent is the mixing zone going to and what limits are there. I can't give you an exact answer on that. I think that the program that is there now will provide some of the answers and ongoing programs will probably confirm or identify the need to expand.

MR. CONNELL: The discharge limits I think we have covered that to a great degree at this point in time and it is similar answers so I will not repeat myself on that matter.

The same with the SNP sampling program. Again, we make the argument that while you talk about the

fact that over a five week period this is not known, we actually are aware of this in a much quicker period of time because of our in-plant monitoring of the effluent treatment plant. Our problems at that time were even though we knew about it, getting it under control. Subsequent to that we have managed to get that problem under control so that I still argue that the polishing pond with its seven days provides a larger mixing zone and thus you don't get the tremendous rapid changes in effluent quality that come off of this polishing pond and thus we don't require 24-hour a day monitoring or even seven day monitoring because we do have this large mixing zone. For control of our facility, for tracking the trends, we are doing that back within the effluent treatment facility ourselves, for determining what we are adding in the way of reagent. We couldn't do it from what is coming out the end of the polishing pond.

Having had some experience with environmental effects monitoring, I really can't comment on this until we have had a long discussion on the types of species that would be applicable and the extent of the monitoring program. These things can turn into

extensive research programs worth literally hundreds of thousands of dollars. Royal Oak does do environmental effects monitoring at some of its other operations so I have some experience with DFO on trying to home in on the proper species to monitor. While I appreciate what you are saying and the need for it, I think we have a fair way to go to find what we should be doing before just jumping in and putting the onus on us. I would like to see a lot more before I could comment with any kind of rational discussion as to what we should be doing in the way of environmental effects monitoring. I am not arguing your principle.

With regards to Abandonment and Restoration, I think we have covered the underground arsenic trioxide storage vaults. We can appreciate that there is desire to collect additional information. Nobody is saying that this technique is not a correct technique to us, but it needs more scientific date to quantify what is going on and we can agree with that collection.

The same with the Acid Rock Drainage. We don't have large stockpiles of waste rock at the Giant

Mine. The majority of our waste rock is currently in the tailings dams. Still, we have to address what happening to that rock that is in the tailings dams. The little database that we have shows that we have a net acid consumer but I appreciate that we will work with Water Resources to come up with a study that will address and increase that knowledge base.

With the tailings pond and the moving of the permafrost. We are not counting on the permafrost coming into the tailings deposit. There is quite a large body of knowledge on permafrost throughout the Canadian North and specifically with its use in tailings. We are not trying to invent or propose something new that hasn't been done within the Northwest Territories and within Canada's North. What we are trying to utilize is our winter to freeze tailings, is to actually look at the way we place our tailings. Accidentally from 1950, from the way tailings were deposited at Giant, we have had created, these sandwiches of frozen materials with thin layers of non-frozen materials in between. What we are trying to do is just to hold that situation at closure so that we minimize water

being able to percolate down through the tailings rather than just trying to promote the permafrost coming back in.

Obviously, we did not do a very good job of explaining that in our Abandonment and Restoration Plan and we will have to adjust that. There is more information available that we should perhaps put on the table for that. In the drilling logs which were done for the Tailings Retreatment Plant which now have a number of holes that have been punched down through the tailings ponds that have been logged and give us an indication of the ice content. That is information that you would not have had and it is appropriate that it be put forward.

The two old tailings areas, are you aware of any contamination coming from those? I don't have any response for you, but is Environment Canada aware of problems right now with those areas.

MR. HEINZ-MILNE: There was some work that was done five or six years ago and they were rather ad hoc that identified those two tailings areas on your

property that were abandoned and for all practical purposes decommissioned. The concern that we have is to find out if there is contamination coming from them and if there is, that we get it cleaned up.

MR. CONNELL: So there is no known problem at this time, it is just a subject that has not been addressed?

MR. HEINZ-MILNE: Yes I am sorry, be it that there could be a problem associated with it.

MR. CONNELL: I could argue the other side of that but I think it would be appropriate when we are doing our Acid Rock Drainage tests, to incorporate that as part of them and to include that and then when we come to the next stage of redoing the Abandonment and Restoration Plan, to include those two areas.

MR. HEINZ-MILNE: I agree.

MR. CONNELL: Those two areas pre-date modern technologies for tailings disposal. It is not something that has been done. It was done as the tradition of the day and we have moved forward since then. I am not

aware of any problem with them but I can't tell you that there is not problem. We just don't have the data as well.

With Trapper Creek, all I can say on that matter is that we will look into that. I can't give you a response at this point in time on it.

With Baker Creek, I think it should be made clear that yes, there is a channel change in Baker Creek. We cannot go back to the old channel as basically the old channel is now an open pit. In our submission we put together our Abandonment and Restoration Plan and if we were to divert back to the old channel we would be putting the pit back into the stream bed. This would isolate the flow of water, and I don't know the length of time, but it would be in excess of one or two years which I think would have an environmental effect that none of us would want either. I just want to make it clear that we don't have the option of going back to just restore the creek to where it used to be.

MR. HARBICHT: I realize that. I think what we have to work with is as the Creek is now and to leave it in the best

state possible.

MR. CONNELL: Right. There is some fish habitat redeveloping in that Creek. I am not an expert in this area and I wouldn't want to go further than that but in our sampling routine we do see fish coming back into the Creek bed more and more over the last number of years.

MR. HARBICHT: I think what has happened with Baker Creek over the years, is that the water quality has certainly improved over what it used to be. This has allowed the fish to come to the front door of Baker Creek, but there were other problems associated with stream crossings that prevented them from moving further up. Those have been re-addressed with highways replacement of culverts within the system. So it is slowly returning but I can see there is certainly potential to do more. I think that what I am saying is that at the final abandonment level it needs to be looked at a little bit more than what your Plan has done.

MR. CONNELL: Perhaps you could provide us some information with a little more detail that we can incorporate in the

next revision of the Plan?

MR. HARBICHT: Sure.

MR. CONNELL: As to ideas and things as I don't profess to be an expert on fish habitat, just a small level of experience with it.

MR. HARBICHT: That is no problem, our Department would be glad to assist wherever we can.

MR. CONNELL: Regarding the licence duration, when we made our submission we said that we had five years of storage capacity. That five years is within the existing Northwest Tailings Pond. We have more storage capacity without having to build new ponds. The North Pond is empty although there is geotechnical work that would have to be re-done to reestablish Dam No. 2, rebuild it. We do have more than the five year storage capacity without having to address a new area for tailings. It is well in excess of the ten year period that we are looking at. Thank you.

MR. NICKERSON: Mr. Witteman.

MR. WITTEMAN: I am addressing this to Royal Oak if I could. You have made note of the polishing ponds, the two that you have there. You say that you have seven days of retention in those ponds based upon the amount of water you treat. Are these ponds homogeneous? Do you know if you get things like plug flow through them?

MR. CONNELL: No I don't know the exact quantity of storage volume. I believe there to be in excess of seven days but I don't know the exact volume of the pond. I have no information as to how the mixing would take place in those ponds. It would not be dissimilar from lake flow and you will not have a perfect homogenous mix and you won't have a perfect plug flow through them, by just experience on any kind of pond. I have nothing to quantify one way or the other.

MR. WITTEMAN: Thank you.

MR. NICKERSON: In that case I would like to thank Mr. Harbicht and Mr. Heinz-Milne for their presentation and invite the next presenter on our list which is Mr. Peter Atamanenko.

MR. ATAMANENKO: This will be quite a brief presentation. I have an outline of my oral submission, would you like me to hand it out to you?

MR. NICKERSON: The Board would appreciate having that, yes. Thank you very much.

MR. ATAMANENKO: I just have a few points about the Company's record and concerns about environmental concerns in the Licence and some of the procedures there. Like many of us here, and like many of the people in the community, I am very concerned about Abandonment and Restoration. Today we are hearing that people are talking about five years, two years, or the Company says ten years or so. However, when we are talking about the abandonment of the Mine and all the arsenic there, that is a 100 year concern or a 1000 year concern. It is quite a serious matter so I have a few things to say on that.

Just briefly, you have heard more comprehensive submissions from government departments and so on outlining some of the fairly frequent violations. There have been remedial measures, although flawed upon occasion and there is a need for some

correction there.

Another item is about the Company's performance of late payment of fees or security deposit, just a few things to take note of. I guess what I am really getting at is a system of accountability. The Water Board hopefully has community representatives on it and it can help decide what is best for us here. I am very concerned seeing a repeated theme in some of the analysis done by government departments. There is a lot of self monitoring. You could almost call it self enforcement by the Company. Just a general point, but I am very concerned about it. I would really like to see the Water Board initiate or strongly recommend to government departments with authority to do much more independent monitoring and terms of enforcement of the Licence. We have heard some concern about hopefully improving the environmental levels, the parameters of heavy metals and so on going out. We can have the standard in place but if it is not enforced then it is regulation on paper. I think the people know that, that does happen from time to time in the Government of the Northwest Territories up here. You have

regulations that just aren't enforced.

Just quickly moving on. Another very important thing that connects with the underground arsenic storage when the Mine is abandoned, is the life of the Mine operation. I don't want to get into it, but I have a couple of newspaper articles where, you can call it strike tactics, or the turmoil in Yellowknife, where the President of the Company threatens to shut down the Mine. You can call it a bluff or whatever, but one thing a lot of people noted with interest, is that they did mention is threatening to flood the Mine and shut it down as one option or to sell it.

Let say the Mine closes in two years. Now at this Hearing or next year we don't have a proper Abandonment and Restoration Plan in place, what is going to happen? Is the community going to pick up the tab? Is the government going to pay for cleaning it up? Is the community going to pick up the tab for hundreds of years? The problem is there.

I am getting ahead of myself but really I think

what we have to look at is dealing with this abandonment issue urgently. If I can extract a couple of good points on that I would say that for the term of the Water Licence now, while the Mine is operating, rather than just give out a five year term I would suggest giving a two year term and an automatic renewal conditional upon getting a proper abandonment plan up in operation to prove to everybody and with some sort of strong damage deposit to cover it. If the Company shut down in a year, a $200,000 damage deposit doesn't go very far in dealing with the long term consequences. That is a concern about the process there too. Ideally what I would like to see in the next few months is another hearing on the abandonment plan. I don't know how many people you have got out here today, but I think that out there in the community there would be a lot more concern down the road when the problem actually crops up if it is not done carefully and quickly now.

While I am on the topic of the arsenic vaults, we have had some discussion of permafrost and as stated by Government intervenors, this is not proven and in the case of Royal Oak Mines, you

should be aware of instances that occurred there in the mid 80's before present management. The Company proposed to recover gold from the underground arsenic waste dump through reprocessing. What they did is the bought a $10,000 vacuum device to suck the arsenic out and then drilled holes into every arsenic stope. Most of the arsenic was found to be wet like clay or mud, so they couldn't vacuum it out, rendering the $10,000 investment almost useless.

I think that if the Company has some records that weren't damaged by that flood in 1969, if there are proper records kept, then maybe this is something to look into. You could certainly interview the experienced miners. That is where I get my information on this, from talking to people who had been there for years. They were there.

So the arsenic was actually wet in most of the vaults. This raises extremely serious concerns about arsenic that is frozen or supposedly dry and so on. He can say well maybe it is taking a little bit longer to freeze now, but that still indicates that there were leaching channels and so on into

there. So that is very serious, very, very serious.

I don't think anyone could say in good faith that the long term arsenic disposal plan can be settled at this brief hearing. I know you have given notice and so on, but a month or more over the Christmas Holidays. It is damn serious stuff. It is going to last a hell of a long time. Decades or centuries after the Company has moved its investments elsewhere or even two years after, what are we going to do? Are we going to hold a hearing then? There aren't a lot of government funds around anyway.

So to finish that topic, what I was proposing was rather than one large licence period of five years or so, a two year renewal with the condition that it not be renewed until some proper plan has been developed and action is beginning to be taken. Included in that I would suggest there has got to be a security deposit put up by the Mine. Several million dollars is reasonable. It is a very large operation. It can be paid in instalments. All of you know big investments are made all the time in

big industry and they know how to amortize the payments and do all that traditional accounting. It does not take into account the environment or traditional concerns, but we've got to. We've got to put the money into it. It is not necessarily an investment to the future but it's preventative medicine for sure. I don't think anyone from Fisheries or whatever wants to be going around today or in twenty years monitoring to see where the arsenic is leaking out of there. We have to deal with it now.

Because I may not have made myself too clear, I think at this stage there has got to be another specific hearing process to look at the Abandonment Plan. You can attach whatever conditions you want to the Company for that but I think it has just got to happen there. I am not an expert. I haven't read over every document and know the whole story but it sounds like not everyone else does too about this very serious concern.

Just briefly then, there is obviously a relationship between air and water pollution. It is not within the jurisdiction of the Water Board

necessarily, but the arsenic pumping out of the stack goes into the watershed and so on, and directly onto the Bay in fact. Just from the famous study from the 70's by the Canadian Public Health Association it does show the gradience they marked out for arsenic snow deposits. According to the Yellowknifer it may not be so bad in downtown Yellowknife but the fact is that the same concentration in downtown Yellowknife is over in Dettah so you can see how it does spread out quite strongly in certain directions. In fact I suppose it is almost an east, west, southwest, southeast and if you look on the map it covers Yellowknife Bay quite densely up at the head too, and of course watersheds flowing into the Bay.

I am not an expert and don't have the time to become one, so as far as accepted pollution levels go, I would certainly like to see stricter guidelines put into existence. Those, along with ongoing tests of the Bay should be used to jointly set stiffer environmental limits. Someone or some group or organization has compared limits coming out of another mine in town but that is a pretty limited benchmark. I think for the environmental

concern it has got to be a real benchmark.

Most importantly, I stand to be corrected on this, I understand there are no regulations to control the emission of arsenic trioxide air emissions, either federally or territorially. That sort of discretionary system again spells trouble for everyone and it compounds the fact that there is not, in my opinion, an adequate inspection system. In that case not enough inspections and not the stiff regulations that you need.

I guess I will just tackle a couple of quick points and then wrap it up. On the Water Board file there is a Minister's Emergency Amendment to the Licence on May 14, 1991. That is of course spring runoff. I have to say, that is a perennial problem. People know about it, it wasn't a surprise. I know the Water Board may have recommended it and so on, but I mean that is an example where you don't have preventative action. It is just allowing the water flow to go out. Along with that we hear about flooding and open mine pits and drainage out of that. That is another big concern you should tack on to the file about the abandonment because those

open pits are another access for water of course. In the winter of 1990/91 it was the sixth highest snowfall ever and the Company and monitoring officials would have noticed this and should have taken this into account before spring flooding occurred. Ministerial exemptions undermine what the Board is about. Things happen of course, but, the point of having the Licence is to set the standards and work towards them in advance of the fact. Environment prevention is the key.

I guess my biggest request of the Board is could you please do further public involvement for the arsenic storage system and the long term close down of the Mine. That is really vital. I think we have the right to know. With all respect to the individual commitment of Board Members, in reading this Canadian Public Health Association Task Force on Arsenic, they come out with a recommendation for sort of a Territorial Board, set up by the Territorial Government, for monitoring environmental matters. They suggest bringing in more sectoral representation; one from industry, one member from labour, one member from native groups and so on. I think that is where it is at

these days. You have got to have direct community representation by organizations, more of that. I am sure you are all concerned, but you have lots of government representation and 50% of you come from business backgrounds. That's fine, but there are a lot of other people living up here who don't come from quite that perspective and obviously we are reviewing a major corporations initiative here.

With that I thank you.

MR. NICKERSON: Thank you very much. I wonder if you would let me make a few comments with respect to some of the points that you have raised. Then perhaps you would be kind enough to answer questions if there are any questions from anyone else.

Your last point first. Who should be charged with the duties currently enjoyed, at least in part, by the Water Board in monitoring what is going on and the recommendations made in the CPHA Study. That is a question that presumably should be asked of the Territorial Legislature who would have the authority to establish such a body. The current Water Board is appointed by the Minister of Indian

Affairs in accordance with the Northern Inland Waters Act. We can only exercise the authority that is given to us under that one Act.

We don't have a lot of jurisdiction in the area of air pollution which is related to water. I know there have been complaints about arsenic emissions from the stack. I understand that a lot of improvements have been made there. There have also been complaints made from time to time about excessive sulphur dioxide releases from the stack and maybe Mr. Connell would like to add a few words on those sulphur dioxide emissions if he feels that might be helpful.

Similarly with the spring run off in 1991 following the very unusual snowfall that winter. You could argue that we should have anticipated that and maybe some provision should have been written into previous licenses. You don't really know what is going to happen in the future and things are designed for fifty year floods or hundred year floods and that type of thing. Then you get a two hundred year flood and all of your calculations go out of the window. We understand that the Licensee

has made some improvements since that time so there should not be a reoccurrence of that. Perhaps again, Mr. Connell would like to touch on that.

On the question of the security deposit. The amount of security deposit that can be assessed by the Board is limited by certain sections of the Northern Inland Waters Act. We can only assess that money to be used for certain purposes, really the compensation of downstream users or downstream licensees, downstream owners with rights. Under the existing legislation, the Board can't assess multi-million dollar security deposits with the idea that all phases of Abandonment and Restoration be implemented before that money is recovered. Parliament made amendments or in fact passed a new Act, the Northwest Territories Water Act that would increase the scope for which security deposits could be levied. That has not yet been proclaimed. The Act has been passed by Parliament but has not yet been proclaimed and we are still operating under the old Act which kind of restricts the purpose for which we can levy security deposits.

Also, within Government, both Federal and

Territorial Governments, there is a lot of attention being given to the financing of eventual Abandonment and Restoration of mines and other industrial undertakings. The various arguments that you can get into, can the monies all be put up front, is that a deterrent to economic activity? Can those monies be paid into a fund periodically over a number of years and if so what is the tax treatment of those monies? Are they going to be taxable or non-taxable? There is a lot of thought being given to it, but nothing really definitive has come out of it yet. The very comments that you made have been looked at by political and administrative arms of Government.

The suggestion was made that a Public Hearing be made into an Abandonment and Restoration Plan. Under the Act the Board would have authority to hold a Pubic Hearing into that matter. We have never, to my knowledge, done so in the past. If we chose to do so, we would have that authority. I would point out that currently the Licensee has an approved Abandonment and Restoration Plan and as was stated earlier these things are not carved in stone and your just set them aside and come back to

them ten years later. There is a continuous correspondence between the Board and the Licensee to keep these things up to date as more information becomes available and techniques improve. They are living documents and although the Applicant has a current approved Abandonment and Restoration Plan, there will undoubtedly be changes and improvements made to that as time goes by.

The point you made about a two year licence and then automatically renewing that if things are going well in two years hence. That would give us some legal problems. Under the Act, and even under the new Act that has not yet been proclaimed, the Board just can't give automatic renewals subject to certain conditions. We have to receive an Application for Renewal. We have to go through the advertising in the Canada Gazette. We have to call a formal Public Hearing and that is very expensive because transcripts have to be made and the process costs the taxpayers thousands of dollars. So there is kind of a legal constraint in going with that suggestion in its entirety.

The final point that you raised that I would like to address is the self-monitoring versus monitoring by Government Agencies. It is true that we rely a great deal on self-monitoring. We do that with all licensees whether they be industries or municipalities. I wonder if someone from the Department of Indian Affairs and Northern Development, perhaps Mr. Jessiman, who's job it is on a daily basis to look after this type of thing, if he would like to explain the extent to which we rely on self-monitoring and the extent to which Governments become involved and take their own samples and do their own analysis.

MR. JESSIMAN: To answer that question in a general sense to start off with would be that within our office we generally have four inspectors that would monitor various industrial and municipal operations. Depending on the size of the operation we will judge on the number of formal inspections that we will do over the course of a year or so. In the case of Royal Oak I believe we have done two formal inspections - one in the middle of June and the other in October. If we have any other spill responses to do we will go to the site to do

investigations that relate to spills or any other incident that our Department may be concerned about. For instance, if we are doing spill investigation and we do see something on site that we believe could be corrected we will obviously notify the Licensee or the representatives that will be involved in that case.

Other monitoring that we do, do, is periodical checks of effluent quality by taking routine water and effluent samples. We compare them with what the Company gets and verify that through our own lab, running periodical inter-lab studies comparing the analytical capabilities of both the industrial lab and comparing it with other water labs. Another aspect of that would be water licence conditions to submit quality assurance plans to ensure that the samples are collected in an acceptable manner and there is no opportunity for contamination so that we know these samples are being collected, handled and analyzed in a correct manner.

MR. NICKERSON: Thank you very much Mr. Jessiman.

MR. ATAMANENKO: I guess I would just ask you, if in your opinion, the monitoring you do is frequent enough? What about your periodic checks? I will put it more positively, could it be more frequent?

MR. JESSIMAN: I think the Royal Oak representatives, Mr. Halverson in particular, could probably account that our office and our inspectors have been to the site quite frequently this year as well as last year. Yes we have been there quite frequently. It is not the normal due to the improvements through water licence administration and effluent quality. Our inspections and compliance may be somewhat reduced because we are definitely relying on industry to self-regulate themselves as well as on the opposite side. If we do notice a number of difficulties or problems or things that need to be corrected obviously we will increase our inspection frequency. So it is a give and take.

MR. NICKERSON: Thank you very much Mr. Jessiman. Mr. Atamanenko has indicated that he would be willing to answer any questions that people wish to pose to him. Are there any questions? Would the Applicant like to make a response to this presentation?

MR. CONNELL: First of all I think we should thank Mr. Atamanenko for his presentation. I think he is to be commended for taking his own personal time to show an interest and to work on your own time to collect information and make a submission. I congratulate you on that and thank you for that.

I don't want to leave any public impression that our or any other industry is self policing. I think Water Resources is being very generous in the way they are saying that. We definitely are a regulated industry. They periodically do check our samples on a random basis. Our laboratory analysis are subject to meeting the approval of their laboratories to ensure that the quality of the work we do is meeting their standards. It would be very misleading to say that we are self policing. They do enough checks to make sure that it would be very foolish for us to be nothing but fully open and honest with them.

I think the Chairman has already indicated that we do have an Abandonment and Restoration Plan. The current one that was done in 1992 is actually generation number two. The first one was taken and

it was weak in its areas. As time and our standing of things changed a second generation plan was done. A number of reviews have been made of the second generation plan, and have identified things that they would like addressed in the next plan. So, on this will go, ever getting a better and better plan. These things are not kept private, they are in the public domain. They are not something we are hiding.

The same applies to our arsenic storage stopes. They are not something that Giant has kept hidden. We have been very open with the method and technology used to store arsenic. It has been the subject of many studies. You have the major study right in front of you there. It is still perceived as being the best of the options. Ideally, no storage would be the best option. Ideally we would be able to sell it some place. For a while there was a period where it could be sold. However, the market is not there any more for the wood preserving agents that it was being used in. So we are forced with what is the best alternative we have of safely disposing of this material.

The underground storage has been chosen as a safe method. I agree that, that should be subject to ongoing study to ensure that the public concerns are addressed. That in fact we know what will happen to these stopes once the Mine is closed. So we agree that we should be working with Water Resources to identify the types of things we should be studying and then go and study them and provide the data again through a public form.

I won't go into a lot of detail about the emergency amendment that took place in 1991. Yes people should know from a high snowfall that you are going to have a high spring runoff. That wasn't the cause of the problem. The cause of the problems with spring runoff are the method at which the runoff takes place, the speed at which the melt takes place, and the problem of ice jamming in the Creek. So just knowing the snowfall doesn't automatically mean that we should have known there was going to be a problem with runoff in that subsequent year. In actual fact this is the first time that I know of in the life of the Mine, over 45 years, that this problem has occurred where you have had such high levels within the Creek.

As Mr. Nickerson has pointed out, there has been changes made that were learnt from that incident to try and prevent a recurrence of the same level. Not only could that have had an environmental problem, it also had significant problems in bringing the Mine to a complete halt in the way of operating. It was a very expensive period of time for the Mine as well. Terry has just pointed out to me that they have revised and installed additional dyking. I won't go into the details but will let you know that work has been done as a result of that occurrence for the next time we deal with a similar type of occurrence in the future. It wasn't strictly knowing the snowfall hence we would know we would have the runoff. It greatly has to do with the rate the spring runoff takes place and the kind of ice jamming that can take place.

I am not prepared to go into stack emissions, but we don't just release anything we want up the stack. Stack emissions are monitored. There has been significant work done to reduce stack emissions of arsenic and sulphur dioxide over time. There is no recovering the sulphur dioxide whatsoever. The sulphur that is present in the

arseno pyrite is liberated and it is released to the environment. The levels of sulphur in the off gas do not change dramatically day by day. The levels of SO_2 gas that people perceive or that you every once in a while see that the level is higher, is not really a higher concentration going up the stack. Much of it has to do with the atmospheric conversions that take place that put the SO_2 in a spot where people are going to come into contact with and be nuisanced by it. We actually don't vary the quantity of SO_2 gas going up the stack on a day by day basis. Again, I can't elaborate in a lot more detail on that.

Thank you for your participation.

MR. ATAMANENKO: Just briefly, certainly snowfall is not the only factor but I don't think it is a coincidence. There are some measures that can be taken with better culverts and so on. I don't think anyone here knows all the answers about what happened there.

Just as far as the arsenic storage goes, I believe others have said that it is an unproven method so

again it is a serious matter and I don't think a lot of people feel comfortable with it being decided through correspondence through the Board and the Company without something being done publicly and equally important, quickly.

Earlier into your comments Mr. Chairman, I was just wondering if the Water Board would be willing to or interested in requesting that the Minister assist you in whatever way possible in having this new legislation which would allow you to put in some sort of bond with the Company for the Abandonment and Restoration Plan just because of its importance to the community. You don't have to answer me now.

MR. NICKERSON: The Board is on record as having been in favour of the new Northwest Territories Act. The draft regulations that have been developed have not yet become part and parcel of the law. In fact, for ten years or so we were regularly going to Ottawa and to the Minister asking him just to do that. The Act has been passed. The regulations have been worked on. There is some differences of opinion between various levels of Government. I understand they have some problems in the Yukon too. We are

looking forward to the day that the new Act comes into being.

I would like to thank you very much for the presentation that you have made. You have been very helpful to the Board. The next item of business is the City of Yellowknife.

MR. NICKERSON: Mr. Ipakohak has just pointed out that it is 3:00. We will take a ten minute coffee break and when we return, we will hear from the City of Yellowknife, from the Dene Nation and then from Mr. O'Brien.

[Coffee Break]

MR. NICKERSON: I have been asked to point out that not only does the Department of Indian Affairs and Northern Development do inspections of the Mine in question but also a number of other Government Departments come around from time to time and make their own inspections. One of those is the Department of the Environment. With respect for example of the arsenic storage stopes, the Mining Inspection Services with the Territorial Government does inspections. So I am sure that in the opinion of

the Applicant there is no shortage of inspectors out at the minesite.

We now have a presentation by the City of Yellowknife to be given by Mr. Dan Levert.

MR. LEVERT: Thank you Mr. Chairman, Members of the Water Board, Ladies and Gentlemen. I would like to begin by thanking the Water Board for the opportunity to comment on the application by Royal Oak for renewal of its water licence. I can tell you that it is much more comfortable sitting on this side of the room than sitting where they are. I know the type of pressure that they are under. Let me also apologise for being late. I had an engagement that I could not postpone.

When I read the Abandonment and Restoration Plan put forth by Royal Oak in February, 1992, I did it much as a layman might. I came away with a lot of questions and very few comments to make. I thought I might get some assistance in reviewing what they were intending to do by looking at the reports referred to in that plan so I did some digging around and was able to come up with the CPHA Task

Force On Arsenic For Yellowknife, Northwest Territories, which was issued in 1977. As I said, the Applicant had referred to this Report in particular with respect to the issue of arsenic storage underground. The Report was very interesting reading.

It seems that at the time on January 15, 1977; there was a press conference in Toronto by the National Indian Brotherhood and the United Steel Workers of America. At that time the NIB and the USW declared that there was a most serious arsenic problem in the Yellowknife area. If I may read from the report, they stated that "certain specific groups in the area, especially miners and certain Indian people, had come into contact with high levels of arsenic".

In an effort to resolve the issues raised the Department of National Health and Welfare decided to establish and independent impartial task force to study the question of possible arsenic poisoning in Yellowknife. The study and the selection of the Task Force members was to be the responsibility of the Canadian Public Health Association. Three days

later on January 18th, the Minister of National Health and Welfare, the Hon. Mr. Marc Lalonde requested the CPHA to select three distinguished scientists and to conduct an independent study of the issue. He also issued terms of reference for the Task Force.

Under the terms of reference, the members of the Force were to approach the study in two phases. The first phase was to conduct a review of all available relevant data, the submission and hearing of briefs as required by the Task Force from interested individuals and groups and the submission of the initial report within three months of beginning the study. In the phase two section the Force was given the task of continuing their scientific research as well as assessing the effectiveness of current monitoring programs in Yellowknife. As well, consultation continued with individuals and groups concerned with the Yellowknife issue. That Task Force requested that additional samples of water, soil and fish be collected in specified areas in the Yellowknife vicinity.

Obviously at the time, the subject of arsenic in Yellowknife was very topical and it was felt that some work should be done by fairly qualified people in a fairly short time frame. The Task Force made a number of recommendations at the conclusion of their report. There are a total of 46 recommendations, and many have to do with health.

Their study included atmospheric monitoring, ground monitoring, snow, you name it they covered it. I will deal with the issues that I have raised in my submission. Recommendation Number Twelve, "that close attention be directed to the prevention of seepage from tailings ponds in future. The use of backup catch basins is a useful safety mechanism. That the underground bulk method of arsenic storage continue to be used during the operation of the Giant smelter. That the Department of the Environment be kept informed of all new plans for underground storage of arsenic not withstanding the Task Force recognizes that development of future underground storage areas is subject to assessment and approval by the Mining Inspection Branch." I should add that the Mining Inspection Branch referred to at that time was under the auspices of

the Department of Indian Affairs and Northern Development. "That at such time as the Giant Yellowknife Operation is discontinued, the Company take all necessary steps to seal off all points of entry of surface water or runoff into the Mine."

Number Seventeen, "That provision be made for monitoring water levels within the Mine following closure and that DIAND be responsible for routinely monitoring variation in groundwater levels in the Mine. That Giant Yellowknife Mines take appropriate steps to ensure that drainage from open pit workings cannot enter into the arsenic storage area and that through the Department of Indian Affairs and Northern Development, the Department of the Environment be kept advised of these activities." So there were some very definite recommendations made as a result of this Report, as to the future operations of the Mine.

There was also a short section dealing specifically dealing with arsenic storage at Giant Yellowknife and I refer to pages 63 and 64 which I have attached to my submission. If I may read from these pages, "Arsenic removed during the smelter

operation has been stored in underground vaults since 1951. The requirements for underground storage, as specified by the Mining Inspections Branch of the Department of Indian and Northern Affairs include: all openings to be securely sealed to prevent escape of arsenic-bearing dust. All drifts, cross-cuts and raises to be bulkheaded in specified locations. All changes or modifications to be subject to the prior approval of the Department of Indian and Northern Affairs and the Department of National Health and Welfare." I would ask whether or not this has been complied with between the Mine and DIAND? "Stopes to be dry prior to storage and to be kept dry." I understand that some evidence may indicate that, that may not be the case. "Permafrost to be evident in the arsenic storage areas before arsenic storage commences, and these areas to be kept frozen. All air discharged from the storage areas to be filtered through the existing bag filter system prior to discharge to the atmosphere; and regular inspections of bulkheads and storage operation by the Department of Indian and Northern Affairs."

There were also some very specific recommendations in so far as the continuing monitoring of the water levels etc. at the Mine. In taking the requirements and recommendations together, it seems that at that time the Mining Branch at DIAND had a very heavy onus on assuring that the various requirements were met. So I contacted several government departments to determine whether or not these requirements had been complied with over the years.

The first individual that I contacted was Sylvester Wong who is with the Northwest Territories Environmental Engineering and Mining Inspections Branch. I filled him in to what I was doing and he said he was not aware of the Hearing, and had no intentions of making any submissions at the Hearing. He advised that these requirements and recommendations were not applied or enforced in any way by his Department and that since 1981 the obligation that DIAND had at that time to inspect the mines had gone over to the Territorial Government. Mr. Wong was not aware of this Task Force Report and the requirements therein.

He advised me when we discussed the storage vaults themselves, that they were all at the 200 - 250 foot level and that some of them were in abandoned stopes and others had been constructed specifically for the purpose of storing arsenic. In so far as the competency of the rock is concerned, he could not comment very much on that. He indicated that no request had ever been made to them or by them to Royal Oak to test the adequacy of the rock and he assured me that the permafrost that had been in the area as stated by Mr. Connell had been disturbed by the mining operation. He did not know the extent of that disturbance. He indicated that before arsenic is put into the vaults they do a visual inspection of the area and if they can't see any fissures or cracks, then they give approval for the storage.

In his view, once permafrost had gone back into the area then there would be no seepage out of the storage vaults. He did indicate that there was very little water in these storage vaults areas and that water sampling was being done by DIAND and that there was no indications of elevated levels of arsenic in the water. In his experience he

indicated that they were of the view that the permafrost would return to the area and it would stay frozen and would cause no problems. But, he did advise that he was not an expert in these areas and this were just his opinions.

I also spoke to Mr. Howard Madill, who is with the DIAND Water Branch who advised me, and advised me again this morning, that his Department really has nothing to do with land use. They are strictly responsible for Water Inspections Services. He indicated that there was really no understanding between the GNWT and DIAND as to who was to perform the various inspections that may have been recommended by this Report and that perhaps it might be a good idea if the various Government branches got together to decide how they would each take on some responsibility or someone take on the responsibility for doing so.

Finally, I spoke to Mr. Buddy Williams, of the GNWT's Land Use Department who again was not aware of the Report, had not been asked or had not done any inspections and certainly did not consider himself qualified to do so. So after I did all of

that I was left in a state of confusion which is not foreign to me, so it is no problem.

I noticed that in the Task Force Report they state that there was a concern expressed on the flooding of mine workings following closure of Giant at some time in the future. They recommended that at such time as the Giant Operation is discontinued, the Company take all necessary steps to seal off all points of entry of surface water and runoff into the Mine. They also recommended that provision be made for monitoring water levels within the Mine following closure.

I have difficulty resolving or tying that in to the Applicant's submission with respect to the flooding of the Mine after abandonment. They indicate that after they stop pumping the water out there will be about a half a cubic metre per minute of water that will go into the Mine and in 145 years the area will be flooded. How have they made the leap from the recommendation of the Report that suggests that no flooding should be done or should be allowed to take place, to almost including flooding as part of their close out scheme. I would ask the Applicant

to comment on that.

I would make a comment also Mr. Chairman, regarding the security. I understand that the security at the present time is being held as minimal. I refer to Mr. Connell's comments that at the time of close out it is the intention of Royal Oak to sell off the assets of the Mine and to use those funds for the Abandonment and Restoration Plans. Perhaps something can be put into place that would insure that.

As I indicated in my written submission Mr. Chairman, speaking on behalf of the City I think we would have more comfort in knowing that an independent study of the arsenic storage vaults has been performed and that the requirements and recommendations of the 1977 Report at least have been complied with. I was pleased to see that the Applicant has retained the services of a highly qualified Geotechnical Consultant and I would invite their expert to comment on some of the things that I have brought up.

Finally, I would just like to compliment Mr.

Connell on an excellent presentation. It certainly gives us some comfort to see the thought and preparation that has gone into their Application and we trust that the same commitment is made to the environment in Yellowknife. Thank you.

MR. NICKERSON: Thank you very much Mr. Levert for a very interesting presentation. It brings back memories of the CPHA Arsenic Study. I remember at that time having samples of my hair cut off for analysis and electrodes stuck in my arm to see how the nerve response had been affected by any possible arsenic. At that time I had been an employee of Giant Mines some years before that.

MR. LEVERT: I see it has had not effect of your hair Mr. Chairman.

MR. NICKERSON: I will tell you just a story there. There was one gentlemen, I think he was an electrician there. He had almost believably high concentrations of arsenic in the hair samples that had been taken from his head and nobody could understand why. When it was all eventually figured out, it was some kind of hair oil he was putting on.

I don't know if there are any questions with respect to your submission Mr. Levert but the Board would certainly be very interested in any responses that Royal Oak might have.

MR. CONNELL: The study, as I understand it, wanted us to prevent the runoff water from surface entering the Mine which is a fact of life for control of the water going into the Mine. However, the only way you could keep the Mine dry for perpetuity would be to pump it for perpetuity. The groundwater system will equalize in the Mine once the Mine is abandoned. So in our design and preparation we have always considered that the Mine will flood once we are finished with the mining activity. This is why the bulkheads were constructed to withstand that hydraulic force, to keep the hydraulic force from entering into those stope areas. The rate of infill will be slow. I am not an expert to tell you if it will freeze when it inflows into those areas or not. I can't tell you that but we have always understood that the Mine would flood once pumping was stopped. There is no way to prevent that, that I know of, without pumping in perpetuity. That has never been part of

the engineering plans from day one on arsenic storage.

MR. LEVERT: I think the question that is now raised, is why did the Task Force make the recommendation that water should be kept out of the Mine? What was the basis for that recommendation? Do you have any idea?

MR. CONNELL: No I don't. I don't understand that. Basically you would not want water freely flowing into these stopes and liberating the arsenic, putting it into solution and then contaminating the groundwater moving on. That is the purpose of maintaining the hydraulic forces from entering those stopes and maintaining the ground in a frozen condition. That is part of the engineering plan that we have proposed on abandonment.

MR. LEVERT: Mr. Chairman I am not too familiar with engineering in terms of permafrost, but I assume that it is intended that at the 200 - 250 level where the vaults are, that the permafrost will be reintroduced and that area will be frozen. Once you have done that are you still going to get migration of groundwater in and out of that area?

MR. CONNELL: No. That is why those levels were chosen. That is the area where the permafrost has established itself prior to any mining activity. So that is why the 250 foot level was chosen. That is the area the discontinuous permafrost is in right now. So as you withdraw human activity from these stoping areas, the permafrost reestablishes itself. The only thing that thaws that out is the heat input into the rock itself from other mining activity.

MR. LEVERT: Without getting into a debate, you say you have designed your vaults to withstand a hydraulic head, presumably of whatever elevation the water would be at, say 200 feet. So it is anticipated that water could be forced into the vaults?

MR. CONNELL: Not forced into the vaults, but forced against the bulkheads.

MR. LEVERT: Forced against the bulkheads?

MR. CONNELL: Yes.

MR. LEVERT: So going on the assumption that in so far as building your bulkheads is concerned, that you may

not get the area frozen, it may not be frozen?

MR. CONNELL: No, we're also hoping that the area would freeze but we are not relying certain on it. In engineering as you well know, just because you believe you have done something that doesn't stop you from going to the next position, re-engineering to make sure you have doubly protected yourself. That is the case here. We are still counting on the reintroduction of permafrost and in actual fact we have seen this reintroduction of permafrost in the abandoned stope areas. It is not true in the current active stope, but the hydraulic force is also there so that as water does come to these levels we have this added protection of keeping the water away from these vaults.

MR. LEVERT: Okay, so my next point and I hope my final point would be, that if you are anticipating a large hydraulic head in the area of the storage vaults and you have designed your bulkheads to withstand that head, then you have to ensure that the rock surrounding those vaults is competent.

MR. CONNELL: Yes.

MR. LEVERT: So there should have been some testing done or something done to ensure that the rock was not shattered or fissured or anything. If you have any evidence that, that isn't the case, that the rock is fractured or fissured then you would have to do a drill and grout program to ensure that the rock is competent in that area. I would ask your geotechnical expert to comment on how you have ensured that the rock surround the vaults is competent?

MR. CONNELL: I will let Fred comment in a second. The degree of grouting that has been done will vary with the life of the Mine. Obviously the vaults that were done in the 1950's don't have the same degree of preparation and engineering as the ones that we have last constructed. That is a factor of our engineering knowledge and science as we progress from the 50's.

MR. LEVERT: Mr. Chairman again if I may. I understand that the grouting you are referring to is a shotcrete surface grout that is put on the walls of the vault. Is that correct?

MR. CONNELL: I am not sure of the preparation that is done on those vaults. Perhaps Terry can help me with that but I don't believe they are even shotcrete.

MR. BYBERG: To my knowledge they aren't.

MR. CONNELL: No.

MR. LEVERT: Okay. The drilling and grouting that I am referring to is, and this comes from experience on a hydro-electric project where we prepared the rock for the foundation of the dam, is where you drill holes into the rock and inject a groat slurry under high pressure to ensure that all the fissures are sealed.

MR. CONNELL: You are basing all these assumptions on the fact that the permafrost within this zone will not be there. That is what we are not counting on. We're counting on the permafrost retaining itself there despite the flooding. That this zone will remain frozen and thus the fractures and the micro fractures in the rock will remain frozen.

MR. LEVERT: You say you are counting on that and yet you have

designed your bulkheads to withstand a hydraulic pressure of how many ever feet in case it doesn't freeze.

MR. CONNELL: That will come from the drift network that accesses these vaults. That is to keep the water away from the proximity of the vaults.

MR. LEVERT: Mr. Chairman obviously if any of the vaults are fissured, if the rock is not competent, and if the area does not freeze as expected, then you are going to get migration of the arsenic into the groundwater table. That will happen. Would you agree with that Mr. Connell?

MR. CONNELL: If the rock structures totally thaw out around them and water contacts the arsenic there will be some dissolution of arsenic, some transfer of arsenic, yes.

MR. LEVERT: So I would put it to the Board that some assurance should be given that the storage vaults are competent enough to hold that arsenic without the benefit of permafrost.

MR. NICKERSON: It would appear to the Board that there would be something of a consensus between the Licensee and for example Government Departments that have presented evidence today, that more work needs to be done and more studies should be done with respect to the arsenic containment system. I am sure the Board will be very interested in receiving the recommendations of its Technical Advisory Committee on this.

MR. CONNELL: Yes, we have agreed with Water Resources to that, with respect to additional information to give you comfort on that is required and it can be obtained through ongoing studies. Would you like to say anything Fred with regard to permafrost?

MR. MATICH: Fred Matich, Consultant to Royal Oak Mines. My terms of reference to date have been primarily with respect to the design of the tailings retention works and the influence of permafrost on the design and performance of those works. In that connection I think we have developed quite a good understanding of how permafrost interacts with the disposal of tailings. We have just begun to be involved with Royal Oak Mines in the ongoing

studies related to Abandonment and Restoration and abandonment of the works. In that connection I would like to add one comment to Mr. Connell's earlier comments with regard to the evidence for permafrost in the original tailings area. Not only was this established through drilling at the time of the examination of those tailings as a potential ore body in the fashion he described, a layered effect of frozen layers and thawed layers, but also in a very vivid way at the time that the tailings were excavated for reprocessing. They were then found, at least in the area that was excavated, to be frozen almost entirely for their full depth. This lead to quite considerable difficulties in excavating the tailings at all. I am involved in another project in the North where the placement of tailings in such a way will become permafrost and be abandoned as permafrost is involved. This is currently under consideration in the eastern part of the country.

It is only recently that I have begun to be involved in the arsenic storage and the influence of permafrost on a long term basis. I have only been into one of these stopes personally. I have

had only very brief exposure to the whole question and that is only recently.

But, I would like to say though that your points are well taken. The whole question of how the permafrost and the arsenic in storage will interact in the future and how flooding of the Mine or access of water to these areas through the existing drift system and so forth, how all of this will develop should come out of the further studies are planned and that Royal Oak Mines have undertaken to do and discuss with the Board and the public in the future. The points that you bring up are points that would normally be taken into account in such ongoing studies. I can't comment on them at this stage because it is too early in my involvement to do so but I would say from my work with permafrost elsewhere that they would normally be considered. I don't know whether that answers your question.

MR. LEVERT: It certainly speaks to the issue of the tailings pond Mr. Chairman and somewhat to the issue of permafrost at the elevation of the storage vaults.

One of the facts that came to light as a result of my looking into this issue is that there really has been no government department or individual properly qualified to comment on any of these things or even to conduct the necessary inspections. It seems that they are bringing the appropriate professional people to address their minds of this issue but perhaps we aren't. Because it is very much a water issue and we are looking at possible contamination of our groundwater. As you know we pump our potable water from the Yellowknife River and our line runs right by the Giant Property. If anything should happen and we had plans say in ten years to pump water from Yellowknife Bay instead of Yellowknife River, if anything should happen then those plans would not be proceeded with.

So I should say that, to the extent the Water Board is able to bring to bear some pressure on various government departments to assign the appropriate individuals to the task of perhaps working with the Applicant to resolve some of these issues then I would urge you do to that. Thank you.

MR. NICKERSON: Thank you very much Mr. Levert. We appreciate your presentation. Is there anyone who would like to ask questions of Mr. Levert. No, then thank you very much Sir. The next presentation is to be given by the Dene Nation, Mr. Darrell Beaulieu.

MR. BEAULIEU: Chief Darrell Beaulieu, Yellowknives Dene Band. First I will be representing the Dene Nation. As you are aware Mr. Bill Erasmus is away on other business. I will also be making a verbal presentation of the Yellowknives Dene Band.

Just before I start, from the community point of view I have been noticing the interpreters sitting back there. It looks like they are having fun. For the Elders back in the community this should have been interpreted for the Dene Nation to bring back to the community so the Elders can hear what is happening. Right now it is being done in English and we have written submissions that they cannot understand should it be brought back to them in that form. I am not sure if it has been done to date, but that is a recommendation for these Water Board Hearings.

On the other hand, I would like to thank the Water Board for giving us the opportunity to make a presentation.

I will start with the Dene Nation presentation and Mr. Trevor Teed who is also an employee of the Dene Nation will elaborate on what I have done here. What I am going to read to you is a letter from the Dene Nation. It is addressed to Dave Nickerson, Chairman of the NWT Water Board regarding the Royal Oak Mines Inc. Renewal Application For Licence N1L3-0043. This letter is from Bill saying:

"Please accept my apologies for not being available to present the Dene Nation position but I was called to Ottawa for an AFN meeting. The Yellowknives Dene Band will submit an oral intervention and they will further elaborate on the position that I discuss.

The Dene are not satisfied with the condition of the environment at Pine Point following the closure of the Pine Point Mine. We would like assurances that nothing similar occurs at Yellowknife. It is our belief that a detailed abandonment and

restoration plan is paramount at this time. Royal Oak has recently threatened to close the Mine if the strike at the Mine continues. What happens to the tailings if the Mine is closed? If the Mine continues to operate using replacement workers are the Dene residents of Yellowknife area at a health risk? Is the Mine safe with replacement workers?

The Dene have for years, observed unnatural events at the Giant Mine. We see unusual water conditions in Baker Creek. We see spring flooding and winter flooding. In summer we observe cloudy water conditions in Great Slave Lake where Baker Creek drains into the Back Bay. These conditions historically did not exist. We would like to know where the excess water comes from.

We would like to see the Mine, in conjunction with the local aboriginal people, initiate ongoing fish studies. The Mine and aboriginal people could regularly discuss local environmental conditions.

The Mine and aboriginal people should also begin an ongoing bottom sampling program in Back Bay. There have been high levels of arsenic in the Bay in the

past.

The Dene Nation understands there are poor arsenic storage facilities on the Mine site, the facilities leak. The Dene Nation also understands that water from the Great Slave Lake leaks into the Mine. These are intimidating thoughts. The Licence for the Mine should be limited to five years.

Could the Water Board provide the public with Royal Oak's compliance rate of the past licence? Did Royal Oak meet the criteria of the conditions?

There were at one time signs posted around the Mine warning the public not to drink, or swim in the water? Why were those signs removed?

The Water Board has the responsibility to ensure that the quality and quantity of water at Yellowknife is above acceptable Canadian standards. There have been several studies regarding the water quality. The Water Board should make those studies public.

The Dene of the Yellowknife area have experienced unpleasant events as the result of mine developments at Back Bay. We would like to be assured that history does not repeat itself and that science has improved, therefore public safety from tailings has improved.

I thank the NWT Water Board for providing the Dene Nation an opportunity for this submission."

As you notice, I have signed it on behalf of Bill Erasmus of the Dene Nation.

I also wanted to make a presentation on behalf of the Yellowknives Dene Band and I will also be representing Chief Jonas Sangris from Dettah as he is not able to make it today because of other commitments.

I sat here this morning for a little bit and this afternoon and listened to some of the submissions from the various groups. I have heard some impressive numbers and some technical terms that are probably beyond a number of us sitting here. But, from the community's point of view, the

question is the water. An example I am going to use here is four years ago, back in 1987/88, there was some study done around the Bay. The biologist came and placed two glasses of water on the Band Office table and said that the water is good here. It is really good. It is drinkable. So we said if it is good, you drink it. He never drank it and he left. So that is an example of the studies that have happened. Maybe later on I will invite you to taste or we will probably serve fish from Back Bay.

But getting to the submission. The people from Ndilo have been exposed to the different heavy metal effluents such as arsenic. Here is a little history. We did have fatalities which directly involved the Giant Mine Site back in the earlier years, 30 or 40 years ago. I don't know if the Dr. is aware of them and the health baseline study that could be done to minimize these sort of effects on the people not only in Ndilo, but there is a lot of people that live right at the minesite and in the City of Yellowknife. Maybe that potable water should be taken from the Back Bay and we will get a little more information from the residents of the City to show what the original people have been

subjected to here.

I took some notes on hydrogen peroxide and all those other technical terms but I am not going to talk about them. What I want a little more clarification on is the amount of water that is being used from the Great Slave Lake. You mentioned 1.95 million cubic metres and you treat 500 million gallons. I haven't figured out the difference between 1.95 million cubic metres and 500 million gallons yet, but I will. If there is a difference, where is that other water going? Why is it not being treated if it is being used? The cost for that treatment of $600,000. I don't know if it is the difference, what that weight is against the amount of pollution that is happening?

It was brought up earlier about the air quality. I am aware of some air quality studies done. One of the latest ones was done last year. The number I remember of the top of my head is 13 parts per million and it is probably one of the highest in Canada. I think Toronto was second at 3 parts per million.

I want to bring up the wildlife that has an effect on our population. The fish from our Band Members that still fish in the Back Bay, the fish is very soft. It is not edible. It is being fed to the dogs but some people don't have a choice. Some people have to live off the land. We are not totally all on welfare yet.

Another issue that was brought up to Renewable Resources regarding the mines, not only Royal Oak, was the Caribou. As you know the caribou have been coming down over the last few years and usually it does not matter what lake they go on, they do eat snow. The only place they do not go is where it is fenced in. One of the things we have seen in the last couple of years at another mine close by, is the caribou have been going into the tailings pond. Our people do live on caribou and we are affected through the animals. Not only through the caribou, the muskrat people still go out for muskrat and beaver.

I am aware of the discharges and some of the spills that have happened and I am aware of the old sites just south of the Yellowknife River Bridge. I have

travelled through the Giant Mine Site many times when I was younger with a dog team going to visit traps and I am aware of where the arsenic plant is. I know that area very well. I know it is full. I know it is being used when there is an emergency. So if it is full and it is being used when there is an emergency and it won't have the capacity to hold anything, wouldn't that over spill? If there is a chance, I am not saying if there is a chance, to look somewhere else that is safe for an emergency that won't do any harm to the surrounding area and to the water and the people.

There have been motions passed by the Dogrib Tribal Council in relation to putting fences around tailings ponds so the animals don't get in there, primarily because of what I have said earlier.

To elaborate on the Abandonment and Restoration Plan. Many of you in this room probably won't be here after you retire but the Dene people aren't going anywhere to retire but here. The future generations will have to live with what is left after the Mine closes similar to Pine Point. Rayrock Mine is a good example as is Northland Mine

and many other mines that have operated in the Northwest Territories.

When I go back to looking at $600,000 for water treatment I realize the amount of money that has to be expended to run a business. But at the same time, I look at the figures of Giant Mine over the years. It has operated in the billions. That is quite a ratio.

So on behalf of the Members of the Yellowknives Dene Band I would like to thank the Water Board for our submission. One thing I did want to add to the submission is that we have done some studies on our own. The Yellowknives Dene Band has taken photos and low costing studies on the whole Giant and Con properties. One question for the Water Board is about those signs that have been issued by the City of Yellowknife and signs put up by Royal Oak or the previous owners. By removing those signs is that an indication that the water is okay to drink and bathe in now? Or is it potable water?

We have some Elders' statements that I do not have with me regarding some of the interactions between

the aboriginal community and the mines and the Water Board. I think Mr. Nickerson is aware of some of the interactions that a previous Band Councillor, Michel Sike had been trying to discuss with the mining community in 1965 and earlier.

With that I would like to thank the Water Board for the submission and Mr. Trevor Teed will elaborate on the Dene Nation submission.

MR. NICKERSON: Thank you very much Mr. Beaulieu.

MR. TEED: My name is Trevor Teed. I work for the Dene Nation. All I am going to touch on is a few areas that were mentioned in the letter that Darrell read into the microphone.

One comment I have aside from that letter is that I noticed in this morning's presentation by Royal Oak that spills for 1992 have gone up somewhat and it looked like about 600% over the past year. Some of that was attributed to persons unknown. That is part of our concern, the safety of the Mine. Is it because of replacement workers or why are there more spills this year than there have been in past

years?

Touching on underground arsenic storage areas. We mentioned in our letter that we are aware of some that have leaked. The one I am referring to is in the bottom of the pit at B-1. About four or five years ago it is our understanding that a heavy equipment operator broke through the vault and opened up the pit and reached arsenic. The operators at the time all suffered skin problems. I understand that Royal Oak did not own the Mine at that time, but the remedy, the method used to deal with the breaking in to the vault was that they covered it with mine muck. They did not seal it with cement. To this day when the pit floods the water is pumped out of it. When there is spring thaw it is our understanding that water is pumped out. We are concerned about where that water goes and what happens with it.

Another concern aside from arsenic is also a storage area, but it is the PCB storage area that is just above Baker Creek stored in what was formerly known as Powder Magazine No. 2. We understand that when it was stored in there the

life span of the storage facility was 20 - 30 years. We are concerned somewhat, that recently with the strike there has been talk of the Mine closing down and being flooded, what it going to happen with the PCB's? Are they going to be left there? What happens if they get into Baker Creek? They are just right above Baker Creek. It is the same with the arsenic. We have concerns about B-1 Pit as well.

To move on, we are also concerned about access runoff and airborne pollutants. A couple of years ago I was involved somewhat in bringing to the attention of the press and others the condition of the leaves on the trees at Giant when certain emissions were made from the smoke stack at Giant known as bag housing or whatever. I could stand corrected on that. It killed the leaves on the trees. We are concerned also that some of that fallout would end up in Baker Creek of when the wind is different, in Back Bay itself. We are wondering if the water has ever been measured for whatever comes out of the smoke stacks exactly?

We are also concerned that in the spring other pollutants are picked up off the ground and flushed into Baker Creek and then eventually deposited into Back Bay. We are concerned whether or not there are any studies to determine what is deposited in Back Bay. It is quite obvious to us that there was a spring runoff problem a couple of years ago. We have heard that discussed here today. We don't dispute that there was a problem as the road was affected by it so it was very obvious.

One of the other concerns we had was water seepage in the Mine. We understand that in a few incidences from some of the underground places there has been four inch diamond drill holes that have punches up through the bottom of the Lake and allowed lake water to flood in to the Mine. It is our understanding that in 1989 the Mine had to purchase a number of pumps above and beyond what they normally would and are constantly pumping water because these holes are under such pressure that they can't be sealed. This is just our understanding, we are not saying that it is fact. What we are concerned about is if it is the case how much water is coming in? Are the arsenic

storage areas safe from this water? Is the water accounted for in the Water Licence and whatever questions could be developed from that by the general public?

Overall our concern is the safety of the people of Yellowknife. What is going to happen? We have heard threats by Mine Management that the Mine is going to be shut down, sealed and flooded. If they have holes into the bottom of the Lake, what is going to happen there? We don't understand. If the water is going to come into the Mine and flood it, where is it going to go once it fills up? It is going to keep coming up or is it going to turn around and go back through these holes into the bottom of Great Slave Lake? We don't know any of this and it concerns us.

Further to that and in closing, the Dene Nation recommends strongly that only a five year licence be given. There are a number of significant reasons for that. It is understandable that the Mine would request a ten year licence. It is the normal procedure on any business part to try to extend the capacity they can, the length of the

Licence. One of our concerns, aside from what we have listed here, is that in the next five years there could be significant discoveries in science that could better mining operations. We would like to see those implemented if it should come up. If we have to wait ten years to implement some of them, I don't think it is fair to the public at Yellowknife. So we strongly urge that the Water Board only issue a five year licence.

That is all I have to say.

MR. NICKERSON: Thank you very much Mr. Teed and Mr. Beaulieu. There are a few things that you raised in your presentation that I would like to respond to right now. I will also ask Dr. Gilchrist to respond to the one on the safety of drinking water in Back Bay.

In the letter it requests information relating to the compliance of the Licensee. That information was given to us this afternoon by Mr. Connell. Copies of his presentation are available or you will receive it in the transcript. So that should satisfy that requirement.

There have indeed been studies done in Back Bay and various other areas in and around Yellowknife over the years. To the best of my knowledge all of this is public information. Maybe the problem is that it is not easily available in a shelf on the Yellowknife Library. I understand that Mr. Heinz-Milne has copies of all of this information some place. I am sure that he would be pleased to go over that material with you and provide you with copies of anything you wish to have.

Nobody can find out what happened to those signs, why they were put up in the first place and who took them down. All kinds have people have tried and it is one of the fascinating aspects of Yellowknife history. What happened to those signs? You asked about the safety of drinking and bathing in that water. If it is at all possible and we can get answers to your questions right now we will. Although it is not really the responsibility of Board Members to answer questions, we like to do that. I don't know if Dr. Gilchrist is prepared to comment on that.

DR. GILCHRIST: I think what I would like to say as Chief Beaulieu knows Mr. Teed, is that Mr. Witteman and several Federal and Territorial Departments are working with the Dene Nation to do a water quality study in Back Bay. The Water Quality Study will hopefully answer a lot of those questions that are not clear at this point. I don't know if you want to say anything John on that?

MR. WITTEMAN: I can bring forward a few points. I think Francis Jackson from our office just yesterday sent you the water quality results that we have to date. We are in the process of working with you and in the next little while are going out to do another sampling trip to actually do some under ice sampling of these various stations. In the data that we have collected to date there are a few high points. One of them is in the Meg Peg Keg System which is used by Nerco where the arsenic is fairly high and exceeds the drinking water standard. Another one was high faecal strep at a sampling point in Baker Creek which exceeds the drinking water standard again. Now I think from our view point is that when you are living in a town where there are dogs, where there is runoff, whatever, you are going to

get something going into the water. You just can't avoid it. For safety's sake, I think that many of us end up using the water that the City supplies because of the City's responsibility to treat that water to human consumption levels and that is what we use.

Now we are also looking at the fish and into the sediments. We are hoping to get those results to you once they become available and the Department of Fisheries and Oceans, Steve Harbicht is working with us on that. He is part of this study.

There is a lot of things in the questions you have asked that need to be addressed through this study and we hope to be able to do it. But it is only going to be done if you keep asking those questions and if we all work together to answer them.

MR. BEAULIEU: [Background Comment]

MR. NICKERSON: By all means. We would be interested to know whether you are satisfied with your level of involvement and participation in these studies?

MR. BEAULIEU: Well one of the reasons this study is happening is the Yellowknives Dene Band and its Members had some very grave concerns on the quality of water and the fish because of the continuing use of the water, the water licence and the surrounding land areas.

I brought this as part of the presentation but I have to warn you that the study is not complete. It is nowhere near complete. I don't think it will be near completion for the next two years. This is just the first sample of what the study had brought out. It is a progress report for the time being. That is all we have for the Water Board at this time.

I don't think I stressed enough the community involvement in this process from the Elders that have been living directly across and with the Mine for the last 50 or 60 years, because of their harvesting of the fish and the rest of the animals. I would just like to stress that a little more. Thank you very much.

MR. NICKERSON: Thank you very much. The Board noted that you had recommended continuing studies in the Back Bay

area. Not just doing one study and walking away but really echoing what the presentations from the Department of Fisheries and Oceans and the Department of the Environment said in that you need to know how things are progressing on a progressive basis. The problem involved with that is who is to do that and who is to pay for it.

The final point I wanted to touch on was the question of animals, caribou in particular but also other animals, drinking out of tailings ponds. Wherever we have public hearings dealing with tailings ponds this question inevitably comes up. We have tried to find experts who know something about this and I don't think there are any. Wildlife toxicology is an emerging science and there is very little factual information. The Board Members have on several occasions become besieged with this question. We as much as you would like answers to it, but those answers are not really forthcoming. The best study that was done into caribou drinking out of tailings was one done on behalf of Echo Bay Mines at Lupien. That study is available should you want to see it.

MR. BEAULIEU: Okay. If I can respond to the continuing studies. I would just like to clarify that. We aren't asking for continuing studies. I don't think anybody wants to hear that in public and in the newspaper all the time. When are they going to stop studying and start doing something? If you are going to have a study that study should be a good study that has good recommendations and you get results that can be implemented. We certainly are not saying to continue studying and studying and studying at the cost of Canadian taxpayers and at the cost of other Companies etc. What we are looking for is results and answers to our questions.

On this caribou that you brought up. There has been recent sightings of caribou with loss of hair on their legs. The other thing when I am talking about loss of hair is that there was also some loss in humans. I have also noticed it on dogs. A lot of the people in Ndilo used dogs before skidoos came along and it was funny seeing dogs with no hair on their hips but I don't think it was funny for the dogs. They don't survive very long without hair in this cold climate. Thank you.

MR. NICKERSON: I am sorry if I misunderstood you on the question with regards to continuous monitoring. You do a study now and you might want to see what the changes are from year to year thereafter. I am sorry if I misunderstood you on that one.

Perhaps that Applicant for the Licence Renewal would like to make some comments with respect to Chief Beaulieu's presentation.

MR. CONNELL: There is no way I can adequately address the concerns you have brought forward. I do not have the information to address some of the things you have asked. Some of these are very valid points. There are some things that we can address.

We will start with some of the easier ones like the water balance. We file with the Water Board on a monthly basis, a balance of where our water consumption goes. It is on the Public Water Register record. It is a reading of all the water meters we have on the minesite.

The one point about 1.95 cubic metres. That is an addition of the water that is pumped from Great

Slave Lake through the pump house plus the water that is pumped out of the underground mine, the runoff water that comes into the Mine. The actual water that is pumped from Great Slave Lake is I think 1.25. Any water that we pump out of the Mine, any water that we contaminate on the facility has to go to our tailings facility for treatment before it can be released to Baker Creek. We aren't licensed to release other sources of water direct to the Creek. I think the only other exception to that, and maybe Gary can correct me, is there is one compressor that discharges, or is that even active any longer?

MR. HALVERSON: No.

MR. CONNELL: That is no longer active. So there is no other discharge from the Mine that goes to the Creek by bypassing the Effluent Treatment Facility. So everything that we have is licensed to go through those treatment facilities before it is released to the Creek and that is our practise.

The holes to Great Slave Lake. I don't know of these drill holes that are drilled into Great Slave

Lake. I don't know if Terry has any further information on it. If we had a four inch hole drilled into Great Slave Lake and hadn't been able to seal it, we would significantly know by now as we would be in severe trouble with keeping up with that pumping rate. I don't know. I wonder if it has to do with the inleakage from Supercrest where there is significant inleakage from fractures in the rock below our Northwest Tailings Dam where we have a lot of water coming into the Mine and have had to initiate systems to bring that back to surface and pump it back into the tailings pond? I am only surmising that, that may be where the large influx is you are talking about. I don't know of any four inch holes and I am not in a position to be able to answer you properly on that.

The signs I think we have covered. I don't know what happened to the signs and I am not in a position and I do not have the medical information to tell you whether it is safe to drink the water or bathe in the water. I personally have swum in that water and I know our kids at the Giant Mine Site do it. Again, I am not in a medical position to answer that question for you so it would be

improper for me to say it is safe.

The leaves on the trees that you mentioned. This bag housing - what they are talking about with the term bag housing - it isn't the correct term but your principle is right. As I described earlier this morning, the final stage in the gas cleaning plant is this bag house filter that draws off the condensed arsenic trioxide dust. It is basically an enlargement of a vacuum cleaner bag and there is multiples of these. Ultimately those bags get filled as a home vacuum cleaner does. At some point in time we have to manually deactivate that section of the bag house and then shake those. At that point, from all of our research and all the work we know, that is the point where we get our highest discharge of arsenic out the stack. We have worked very diligently over the last seven or eight years to take those out of the system when they are being shaken and to minimize that release. So we have significantly reduced the level of arsenic that goes up the stack during that system. But it is an intrinsic part of the operation and that is the single largest time when arsenic is released through these bags is when you physically

shake it. As you can well imagine, some dust will come through the bag.

There was, and I am not 100% familiar with it, but there was some work done I think by Renewable Resources who got the Forestry Department involved, on the leaves and they did do some reporting on it. I think they came to a pretty inconclusive result. They made comment to the fact that it had been an extremely dry summer and that this probably had some impact on the leaves but they didn't rule out the fact that arsenogistic effects where a dry summer along with impingement of SO_2 may have resulted in enhancing what was observed. I don't think we have a clear answer beyond that at this point.

This breaking into the arsenic stope from B-1 Pit. I know nothing about that. Can you respond to that at all Gary?

MR. HALVERSON: No, I don't have any knowledge of that.

MR. CONNELL: Between the two of us, we have a pretty long life at the Mine dating back to 1977/78. So if it

occurred, it is something we don't know about and it occurred prior to that. Because between the two of us we have been there from that time.

MR. TEED: Our understanding is that is was five years ago.

MR. CONNELL: So then we would have been at the Mine. Gary would have been here and we don't know of any such incident. The pit that is being pumped is C-1 Pit, not the B-1 Pit so that doesn't add up. Something is missing in that information. But as far as we know, we have not broken into an arsenic stope. We haven't backfilled it with waste rock.

There is a pit in that area that was backfilled. It was actually backfilled with a combination of waste and tailings at one time. Then they found new ore reserves in it and it had to be re-excavated and the ore reserves were taken out. But that was greater than five years ago, it is closer to ten or eleven years ago. That was in the vicinity of B-1 Pit, but to my knowledge we have never broken into any arsenic stope.

I think of your points that is all I can talk to with information at this point in time. We appreciate your concerns and are most willing to address them with you at any time.

MR. NICKERSON: Is there anyone else who would like to ask questions of the witnesses before us or have comments to make with respect to their submission? If not I would like to thank you gentlemen very much for an interesting presentation and invite the last gentleman on the list at this time Mr. Chris O'Brien to come forward to make his presentation. Do you have a question?

MR. BEAULIEU: Yes I just have one more thing and it is not regarding the Water Licence. I mentioned earlier about the process in which this is happening. We do have Dene speaking language people here as translators and for the information of the community I would just like to again stress that they be utilized and that information be taped in the languages.

MR. NICKERSON: I don't know if the interpreters have been listening intently to everything that is being

said. If they wanted to put together a twenty minute tape that you could take back to Dettah and Block 500 I am sure that, that would be acceptable to the Board. I don't know if the interpreters feel that they could comfortably do that. Maybe we could ascertain that or maybe yourself would like to do that? I don't know if we can rely on you to be completely objective though.

MR. BEAULIEU: You can rely on me. You will be sending out the minutes and maybe that is the process I can go through. Once it is drafted up the information could be given to the interpreters for translation.

MR. NICKERSON: The whole thing?

MR. BEAULIEU: I would imagine that you would condense it or do you do it word for word. I am not sure how the Water Board does there minutes.

MR. CONNELL: They do it word by word on the transcripts of these Hearings.

MR. BEAULIEU: That is what the interpreters do I think, word by word.

MR. NICKERSON: But to translate the whole transcript is a monumental job and a lot of the technical stuff would be extremely difficult to interpret into Dogrib I am sure. Maybe what we could do when we have the transcript maybe make a summary of it, something that would take up a 15 or 20 minute tape and make that available to you. Maybe instead of trying to resolve that here now, you or your designate could either meet with me or the Executive Assistant to the Water Board, Mrs. Pam Lemouel, and we could arrive at some solution but we probably can't do it right now.

MR. BEAULIEU: I agree you have a very good suggestion of developing that 20 minute overview of what has happened here. Thank you very much.

MR. NICKERSON: Thank you very much. Mr. O'Brien.

MR. O'BRIEN: I am afraid that I don't have a written copy of this, I had to bring my machine instead.

I am a Board Member of Ecology North. Unfortunately I did not have time to get the rest of the Board's approval for this presentation

although I suspect they would approve it. However I don't have official approval so I will be presenting this on my own behalf.

When I read the Water Register in preparation for this Hearing I was very surprised, even shocked, that at the request of the Yellowknives Dene Band, DIAND and others have undertaken a study to find out if the water, fish and sediment of Yellowknife Bay have been contaminated as a result of the operation of Giant Mine. Equally surprising is DFO, Environment Canada's recommendation that an Environmental Effects Monitoring Program should be established for Giant.

It has been known for a long time that Giant has been discharging arsenic and other toxic contaminants into Back Bay. Why is the possibility of the contamination of the water and fish in Back Bay only now being addressed? I have naively believed all these years that the effects of Giant's discharge were studied a long time ago and that as a result of such studies the discharge limits imposed on Giant by the Northwest Territories Water Board were set at levels that

would ensure that there would be no adverse impacts on either Back or Yellowknife Bay. Now I find that not only are the effects unknown, but Giant is being allowed to discharge some contaminants at high levels than another mine that also discharges waste into Yellowknife Bay.

An Environment Canada study in 1989 recommended that the sediments and benthic organisms of Back and Yellowknife Bays be monitored regularly to see what effects Giant's effluent is having on these water bodies. As far as I can tell this recommendation has not been followed. The document entitled "Proposed Yellowknife Bay Study 1992" - I think that was put out by DIAND, is that correct - this study proposal puts it well and here is a quote. "Little work has been done since the 1970's".

My question to DIAND, DFO, Environment Canada and the Water Board is this. Why has it taken a request from the Public to get a study done of this problem and why is an environmental effects monitoring program not a standard part of every water licence? Another question arises as well.

If so little is known about the impacts of a mine so close to a heavily populated area where one would expect extra care to be taken, then how much is known about the effects of mines that are far from any population centres? I now have to assume that as with Giant, there is not as much known as there should be, and licence limits have not necessarily been set at limits low enough to ensure that there will be no adverse environmental impacts.

I can only conclude that licence limits for all mines in the Northwest Territories have been set at levels that companies can afford rather than at levels that will fully protect the environment. We have obviously come a long ways since the bad old days whatsoever and companies could pollute at will. There are plenty of examples of this all over the Northwest Territories. However, the Giant situation shows us that we are still a long way from doing all we can to protect our Northern waters.

The solution to our pollution still appears to be dilution. There seems to be a belief that when

contaminants are diluted to background levels in a body of water they somehow magically disappear. I am glad to see Department of Fisheries and Oceans and Environment Canada talking about loadings. The actual amounts of contaminants entering and remaining in the environment, an acknowledgement that contaminants indeed do not disappear when diluted.

But the situation remains unchanged. We are still allowing mining companies to externalize many of their costs by using the environment as a dumping ground for their toxic waste. Companies may save a lot of money this way but the costs have to be paid somehow none the less. In every case the environment pays in one way or another but since people are an integral part of the environment whether they know it or not, they end up paying some of the costs of a degraded biosphere even though they might never be aware of it.

Sometimes however, the costs to human beings are more direct be they medical, cultural or financial. This is certainly the case with Giant Mine externalizing its costs to Yellowknife Bay. Some

of these costs may already have been paid for by the people of Dettah and Ndilo and anyone else who relies on Yellowknife Bay for water or for fish. But there is one part of Giant's externalized costs that is definitely being paid for right now. I am speaking of the cost of the joint study of Yellowknife Bay being carried out by DIAND and two other Government Departments. This to my mind, should be paid for by Giant itself, but instead it is the taxpayer that is picking up the tab yet again.

I believe that it is time for our society to begin taking full responsibility for all the consequences of our actions and to cease dumping our wastes into the environment as a means of avoiding such responsibility. I think we can learn a lot from the approach being taken by the International Joint Commission in its attempts to deal with the severe water quality problems being found in the Great Lakes.

I would like to quote from the IJC's Sixth Biennial Report which came out this past year. "As a society we can no longer afford to tolerate the

presence of persistent toxic substances in our environment. The overall strategy or aim regarding persistent toxic substances is virtual elimination and the tactic or method used to achieve that aim is through zero input or discharge of those substances created as a result of human activity. Such a strategy should recognize that all persistent toxic substances are dangerous to the environment, deleterious to the human condition and can no longer be tolerated in the eco system whether or not unassailable scientific proof of acute or chronic damage is universally accepted. Zero discharge means just that, halting all inputs from all human sources and pathways to prevent any opportunity for persistent toxic substances to enter the environment as a result of human activity. Thus zero discharge does not mean less that detectable. It also does not mean the use of controls based on best available technology, best management practises or similar means of treatment that continue to allow the release of some residual chemicals. We conclude that persistent toxic chemicals are too dangerous to the biosphere and to humans to permit their release in any quantity." That is the end of the quotation from the

International Joint Commission's Sixth Biennial Report.

Don't our own great lakes, Great Slave, Great Bear and for that matter every other body of water in the Northwest Territories deserve at least the same treatment as the Great Lakes down south? If the Provinces and States around the Great Lakes had, had a zero discharge policy in the early days when their waters were as near to pristine as Great Slave's are today, there wouldn't now be a water quality crisis in the Great Lakes. Let's make sure we don't wait for our water quality to deteriorate before establishing a zero discharge policy for all of the Northwest Territories. There is absolutely no excuse for any water body in the Northwest Territories to ever be degraded from its present quality. Now is the time to establish a zero discharge policy not one hundred or fifty or even ten years from now when the damage has already been done.

In the same Report quoted above, the IJC mentions that an American response to the problem in the Great Lakes, the US Great Lakes Water Quality

Initiative calls for prohibiting new sources of pollution from using dilution to meet water quality objectives. The IJC goes on to say that the US Initiative also would require the phase out of the use of dilution to meet objectives by existing US plants by the year 2004 and calls for new standards that require discharges of persistent toxic substances to be below detection levels when measured at the end of the pipe. I recommend that the Northwest Territories Water Board adopt such a strategy as a good first step on the way to establishing a full zero discharge regime.

I request a formal response from the Board to the idea of zero discharge and I request that the Board commission a study of how to go about introducing such a regime.

There are a few other things that I would like to comment on briefly. Giant plans to use permafrost to immobilize its underground storage of its arsenic trioxide and to stop acid generation in its waste rock piles. These ideas have yet to be proved workable and there is an extra factor to be considered that I did not see mentioned in other

submissions, global warming. Giant's plans might possible work in the short term but in the years to come if the permafrost melts we would be stuck with a serious problem. I believe that Giant's Abandonment and Restoration Plan must take into account all reasonable possibilities and given that global warming is predicted to be very much with us within the next fifty years, I think that it must be taken into serious consideration.

Apparently Giant has yet to show how it will pay for its Abandonment and Restoration Plan. I understand that there is new legislation that will soon allow the Water Board to use a Mine's security deposit to help pay these costs but security deposits are far to small to cover Abandonment and Restoration. Giant has said that money from the sale of mine buildings and equipment when the Mine closes down will be used to pay for Abandonment and Restoration. Where are the guarantees? There must be an official mechanism to deal with this problem and I am surprised that such a mechanism does not already exist. I assume that at the present there is nothing to stop a company from declaring bankruptcy and disappearing into a post office box

in the Bahamas leaving the taxpayer to foot the cleanup costs. I hope from now on and retroactively for existing mines, an airtight mechanism will be put in place to ensure that there will be ample funds set aside by companies for proper Abandonment and Restoration in every case.

Finally, I agree with the recommendations in the submissions made by DFO/Environment Canada and DIAND. I too believe that Giant should only be granted a five year renewal of its licence. Thank you.

MR. NICKERSON: Thank you very much for that interesting presentation which contains many high ideals and we wish we could all live up to but probably can't for awhile. Are there any questions or comments arising from Mr. O'Brien's presentation? No, then you got off light. Thank you very much for that presentation.

Is there anyone else who would like to make representation with respect to the renewal of the Giant Yellowknife Mines Licence, Royal Oak Mines Inc.? There not being any, I would now invite the

Applicant for the renewal to make any concluding remarks that they might like to.

MR. CONNELL: I don't think I will add any other concluding remarks. I think what we have covered has stated the position that we are asking the Board to renew in our licence. We are asking for the ten year renewal term and we are asking for a sustaining of the amount of water we currently have in the Licence. We are asking for the water quality limits to be maintained as they are right now. We have identified the studies that we believe that have been raised by others with regard to Abandonment and Restoration and we are quite agreeable to enter into those studies. We think that there is validity in gathering that information to further the competence and the technical competence of the Abandonment and Restoration Plan. I will leave it at that point.

MR. NICKERSON: Thank you very much Mr. Connell.

Now in the form of a wrap up, I will highlight some of the pertinent points that were touched on earlier. Transcripts of the Public Hearing are

forwarded to all Board Members, the Applicant and interested intervenors and Members of the Technical Advisory Committee to the Water Board. The Technical Advisory Committee then forwards to the Board its recommendations regarding any conditions to be attached to the Licence. A meeting of the Water Board is held to determine whether to recommend the Licence be approved or turned down, and if approved, the conditions to which it shall be subject.

Copies of the Draft Licence are sent to the Applicant and all interested intervenors for comment. Comments are then reviewed by the Board and the final Licence prepared and signed by the Chairman. The Licence is then forwarded to the Minister of Indian Affairs and Northern Development for his approval and signature. The Minister may reject the Licence and return it to the Board, but he does not have the authority to change it. In the history of this Board, the Minister has never refused a Licence issued by the Board.

The final concluding remarks deal with the security deposit and inspections by various people that have

been touched on before in their presentations.

With that over I would like to thank all the people who participated in this Public Hearing. It has been a very useful process and one from which the Board and everyone concerned has learned a lot. With that I call this Public Hearing to a close.

Public Hearing Adjourned 4:50 pm

ATTENDANCE LIST

Robin Aitken	Renewable Resources Government of the N.W.T. Yellowknife, NT
D'Arcy E. Arden	Vice-Chairman N.W.T. Water Board Prelude Lake, NT
Peter Atamanenko	Member of the Public Yellowknife, NT
Chief Darrell Beaulieu	Yellowknives Dene Band Dene Nation Yellowknife, NT
Craig Broome	DIAND/NAP Yellowknife, NT
T. Byberg	Royal Oak Mines Inc. Yellowknife, NT
David Coffey	Member of the Public Ottawa, Ontario
Brian Collins	Water Resources DIAND Yellowknife, NT
Ed Collins	Environment Canada Yellowknife, NT
Lawrence Connell	Royal Oak Mines Inc. Vancouver, BC
Greg Cook	DIAND Yellowknife, NT
Alan Denroche	Legal Counsel N.W.T. Water Board Yellowknife, NT
Mark Dickey	CJCD Radio Yellowknife, NT
Dr. Ian Gilchrist	Member, N.W.T. Water Board Yellowknife, NT
Laurel Gladu	Secretary N.W.T. Water Board Yellowknife, NT

Gary Halverson	Royal Oak Mines Inc. Yellowknife, NT
Frank Hamilton	Mackenzie Health Services Yellowknife, NT
Stephen Harbicht	Dept. of Fisheries & Oceans Yellowknife, NT
Gary Henry	Nerco Con Mine Yellowknife, NT
Sigfried Heinze-Milne	Environmental Protection Yellowknife, NT
David Hohnstein	Echo Bay Mines Ltd. Lupien, NT
Karen Huss	Secretary N.W.T. Water Board Yellowknife, NT
Frank Ipakohak	Member, N.W.T. Water Board Coppermine, NT
Neil Jamieson	City of Yellowknife Yellowknife, NT
David Jessiman	Water Resources DIAND/NAP Yellowknife, NT
Dale Johnston	C.A.S.A.W. Yellowknife, NT
Laura Johnston	Member, N.W.T. Water Board Yellowknife, NT
Mike Legge	Member of the Public Yellowknife, NT
Dan Levert	City of Yellowknife Yellowknife, NT
Kevin McDonnell	Water Resources INAC - NAP Yellowknife, NT
Howard Madill	DIAND Yellowknife, NT
Erik Madsen	DIAND Yellowknife, NT

M.A.J. (Fred) Matich	Consultant Royal Oak Mines Inc. Islington, Ontario
Suzanne Morples	C.B.C. Yellowknife, NT
Yvette Morin	Member of the Public Yellowknife, NT
Dave Nickerson	Chairman, N.W.T. Water Board Yellowknife, NT
David Nicklen	City of Yellowknife Yellowknife, NT
Dave Nutter	DIAND Yellowknife, NT
Chris O'Brien	Member of the Public Yellowknife, NT
Diane Paquette	C.B.C. Radio Yellowknife, NT
Kathleen Puznicki	Member of the Public Yellowknife, NT
Lee Selleck	The Press Independent Yellowknife, NT
Trevor Teed	Dene Nation Yellowknife, NT
Francis Thompson	Northern News Services Yellowknife, NT
Buddy Williams	MACA/GNWT Yellowknife, NT
John Witteman	Controller of Water Rights DIAND Yellowknife, NT